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MASS TRANSIT DEVELOPMENT FOR SMALL URBAN AREAS: A CASE STUDY TOMPKINS COUNTY, NEW YORK

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EXECUTIVE SUMMARY

This report constitutes a summary of the second-year effort in the study entitled "Mass Transit Development for Small Urban Areas: A Case Study - Tompkins County, New York." The following seven research tasks, as identified in the Work Statement and research proposal, were performed in the course of the second year:

1. Accessibility to Health Services
2. Design of Transportation Service for the Disadvantaged
3. Integration of Existing Systems
4. Alternative System Designs
5. Evaluation of Alternative Mass Transit Configurations and Ownership Options
6. Marketing of Incremental Changes in Existing Bus Systems
7. Monitoring of Public Transportation Service Improvements

In Chapters 2 through 4, methodologies are developed for planning transit services for health-care delivery, and for the handicapped and disadvantaged. Further, a methodology is presented for considering and implementing the integration of a variety of specialized public and private transit services into a single, consolidated system under various alternative operating and organizational procedures. Each strategy is developed to provide a general approach for any small urban area concerned with planning transit service for any of these special situations.

For planning health-care delivery and transit services for the handicapped and disadvantaged, the strategy involves six basic steps of inventory, demand estimation, identification of alternative systems, evaluation, design, and implementation. The inventory stage comprises both a survey of the market segment, i.e., those who need health-care services or those who are handicapped or disadvantaged, and a survey of existing services available for each market segment. In addition to these steps, a detailed inventory of the legal requirements for servicing the handicapped is required, and the current set of pertinent legislation is summarized in the report.

The integration of services is concerned with the proliferation of individual special services found in many small urban areas. These include such services as school buses, services to hospitals and clinics, services for senior citizens, volunteer services to shut-ins and other needy groups, services to handicapped employees, etc. Many of these services duplicate each other and their independent operation generates many redundancies of vehicles, maintenance facilities, and labor.

Chapters 9 and 10 provide the development of alternative transit systems designs and evaluation in a case-study context. Finally, this report addresses the issue of transit marketing and monitoring programs suitable for application in small urban areas.

The overall objective of the research performed during the second-year effort was designed to investigate and develop further various aspects of a methodology for mass transit developments in small urban areas. The culmination of the overall project is seen to be the preparation of a manual (third-year effort) for use by the transportation planner in small to medium-size urban areas faced with the task of instituting a new public transit system or evaluating the performance of an existing system with the intent of instituting transit system improvement.

PREFACE

This report constitutes the Final Report for the second-year effort on Contract DOT-OS-40003 "Mass Transit Development for Small Urban Areas: A Case Study - Tompkins County, New York." In conformance with the objectives of the "Program of University Research," a substantial number of students have been involved in the conduct of the research which underlies this report. Also, a number of students have contributed significantly to the writing phase of this report. Special thanks is due Ms. Mary Gallagher, Messrs. Arnold Bloch, John Coulter, Thomas Fletcher, and James Ryan for their contributions to the preparation of the final report.

The consulting services of Dr. Peter R. Stopher of Northwestern University are gratefully acknowledged. He was involved in the research and report preparation of this effort. His critical input is very much appreciated.

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1. INTRODUCTION

The research tasks of the second-year effort of this three-year project are designed to investigate and develop further various aspects of a methodology for mass transit developments in small urban areas. The culmination of the overall project is seen to be the preparation of a manual (third-year effort) for use by the transportation planner in small to medium-size urban areas faced with the task of instituting a new public transit system or evaluating the performance of an existing system with the intent of instituting transit system improvement.

The following seven research tasks, as identified in the Work Statement and research proposal, were performed in the course of the second year:

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2. Design of Transportation Service for the Disadvantaged
3. Integration of Existing Systems
4. Alternative System Designs
5. Evaluation of Alternative Mass Transit Configurations and Ownership Options
6. Marketing of Incremental Changes in Existing Bus Systems
7. Monitoring of Public Transportation Service Improvements

The research performed under these tasks is described in the following eleven chapters of this report.

2. ACCESSIBILITY TO HEALTH SERVICES - GENERAL GUIDELINES

2.1 Purpose

The task of providing adequate access to health services for all segments of the population in a rural and small urban area is particularly difficult. The limited number of available health service facilities are typically concentrated in a few locations, usually within or near the major population centers of the area. As a result, residents of rural areas are frequently without nearby health service facilities. Additionally, public transportation in small urban areas is usually limited or non-existent; the population is largely dependent on the automobile for access to health services.

The nature of the demand for medical care complicates the provision of public transportation for health service accessibility. The need for medical attention may occur at any time during the day, and among all segments of the population irrespective of socio-economic status and geographical location. Conventional public transit, if indeed it does exist in the area, may well prove unsuited for this type of demand.

The objectives of this research task are, first, to investigate the most feasible method(s) of providing transportation service for people in need of medical attention and who lack private transportation; and second, to implement this methodology in the case study location - Tompkins County. The remainder of this section is concerned with the development of a procedure for determining and describing the transportation-related needs of health-care delivery. As mentioned in the introduction to this report, the case study application is described in section 6 of this report, where the case study context is outlined.

2.2 The Planning Process for a Health Service Delivery System

2.2.1 Inventory of Existing Health Services

The first phase of the development of a health service delivery system involves the identification of all existing and known future health service facilities within the study area. This inventory serves as a basis for estimation of the level of demand for transportation to health services; it also gives some indication of any remote areas that are substantial distances from health care facilities.

The basic groups of health services to be inventoried are:

- a) Physicians and Dentists
- b) Hospitals
- c) Long-term Care Facilities
- d) Other Health Services

In the remainder of this subsection, each of these categories of health service is described, together with specific concerns relating to the applicability and potential of mass transit to provide the desired access to the service.

a) Physicians and Dentists

An important component of health service is the care provided in the private offices of physicians and dentists. Physicians may be classified according to the nature of the service they provide. Primary care physicians - general practitioners - provide initial treatment for most health problems. Secondary care physicians are specialists who treat patients referred to them by primary care physicians. Dentists are quite similar to primary care physicians in terms of the service they provide and are also backed up with the secondary care of orthodontists, etc.

Trips made to a physician's office vary in degree of urgency. Patients travelling to a specialist's office usually do not require immediate attention. An advance appointment has usually been made, providing ample time for the patient to plan his or her trip. Dentists and primary care physicians treat patients with a variety of needs. While most are less urgent, some may require prompt attention. The transportation requirements of a patient are clearly related to the type of attention he needs. These requirements must be identified and incorporated into the service characteristics of a transportation system designed to provide access to physicians' offices. Physical limitations of patients must be considered when vehicle designs are chosen. In addition, the locations of all physicians' offices in the study area must be determined. Areas with large numbers of offices are identified as important attractors of health-related trips. Areas with few or no offices may require special attention because of the necessity of longer trips to health services.

b) Hospitals

Because a hospital is the major health facility in a small urban area, access to its services is especially important. Hospitals are major trip generators and attractors; doctors, staff, patients, and visitors make trips to a hospital at various times for different purposes. The periods of peak travel to a hospital are often different from those of other important trip generators. Emergency care may be required throughout the entire day. Staffs work a three-shift day, causing three home-to-work peak periods daily. Visiting hours are typically in the late afternoon and early evening. Doctors and outpatients may visit the hospital throughout the day on an irregular schedule.

The service characteristics of a transportation system serving a hospital must reflect this diverse nature of travel demand. It must also reflect the physical handicaps of many of the patients traveling to the hospital.

c) Long-term Care Facilities

Another type of health service is that provided by extended-care institutions. Included among these are homes for the elderly and nursing homes. The number of residents of each facility and the type of care provided must be determined. The special transportation requirements of residents of each type of facility are then identified. These requirements might include special vehicle entrance steps, provisions for wheel-chairs, or door-to-door service.

Patients of extended-care facilities are among those likely to be transit-dependent. Trips to medical offices may represent a large part of their travel demand. However, trips for other purposes, especially recreational, social, and shopping trips, are also important. These trips may be considered a part of the health care, as they contribute to the social and psychological well-being of the residents.

d) Other Health Services

In addition to physicians' offices, hospitals, and extended-care facilities, special health service facilities must also be considered. These might include special clinics, temporary vaccination centers, and neighborhood health centers. The nature of the service required by each must be identified and included in the design of a health service delivery system.

2.2.2 Inventory of Public Transportation

This phase of the planning procedure identifies the access to health services provided by existing public transportation. Deficiencies in present service can be identified and some indication of demand levels for health service transportation is obtained. Existing transportation may be provided by three types of organizations: public transportation companies, health service institutions, and volunteer service organizations.

The service area, type of service (fixed schedule buses, taxis, etc.), and fare structure of all public transportation companies in the study area are determined. The service provided to the health care facilities identified in the health service inventory is of special importance. Any special services provided to handicapped or otherwise infirm passengers should also be identified. Ridership figures for recent years should also be obtained.

Any of the health service facilities - often the extended care facilities - may provide their own transportation service. The type of service provided, its costs and fare structure, and levels of usage for health-related trips must be determined.

Several service organizations may provide rides to those who cannot otherwise find transportation. The purpose of the organization and the nature of its transportation service are important. Past ridership levels, restrictions on eligible users of the service, and estimates of costs should also be obtained.

2.2.3 Estimation of Demand

A significant portion of the expected demand for a health delivery system would be travel by the transit-dependent. This group would include the elderly, the physically and mentally handicapped, and the poor. Aggregate data on the elderly and the poor can be obtained from the United States Census. Information on the mentally and physically handicapped is often available through local social service organizations. The location of the transit dependent in relation to the identified health service facilities gives some indication as to the probable demand. Unfortunately, this information typically is not readily available, giving rise to the need for a survey to generate the necessary data.

Additional information is available from the past ridership levels of existing health-related transportation services. From the characteristics of these services, further estimates of the demand for a new system can be obtained.

2.2.4 Evaluation of Alternative Systems

In this phase of the planning process, a set of possible health service delivery systems is first identified. A set of objectives for transportation service to health care facilities is also developed. Each of the possible systems is then evaluated in terms of these objectives and the system which fulfills the objectives is selected. In the event that no system is superior, a hybrid of the alternatives may be selected as the system able to fulfill the selected objectives.

In a small urban area, the available alternatives are usually limited to conventional bus systems, taxi service, demand-responsive systems, and chartered bus operations. The objectives of the provision of such a service might be related to some minimum degree of accessibility to health services that is desired in the study area. The criteria used to evaluate each system might include service area, frequency of service, fares, anticipated subsidization, and so forth.

2.2.5 Design of System

Once the type of system is selected, the exact parameters of the system are determined. Equipment requirements, such as the number and size of vehicles, location and number of bus stops and shelters, special provisions for the handicapped, and audio-visual aids are to be specified. Hours of operation, routing, and scheduling are determined. On the basis of cost and ridership estimates, the fare structure is set and expected subsidies are estimated. Finally, decisions are made as to the ownership and administration of the system.

It is unlikely that a health service delivery system would be operated as a separate transportation service in a small urban area. Because of anticipated low levels of demand, many such systems would serve passengers whose trips were unrelated to health service. Additionally, such a system could be operated as a subsystem of existing conventional transportation systems. Consideration of these organizational alternatives is included in research tasks 3 and 4 (sections 4 and 6 of this report).

2.2.6 Summary

The design process for providing accessibility to health services by mass transit may be summarized by means of the flow chart shown in Figure 2.1.

Figure 2.1
Health Service Accessibility Study Design

3. DESIGN OF TRANSPORTATION SERVICE AND FACILITIES FOR THE DISADVANTAGED - GENERAL GUIDELINES

3.1 Purpose

The provision of transportation for the disadvantaged requires a number of special considerations. In addition to estimates of the nature and level of demand for public transportation, the special requirements of the handicapped in terms of vehicle design, roadside facilities, and other equipment must be considered. These design considerations may be incorporated into a system intended for general use, or may require a separate system reserved exclusively for the disadvantaged.

This research task involves three phases of work, two of which are reported in this section. First, a thorough search of literature pertaining to the design of transit vehicles and service for the physically handicapped, the infirm elderly, the very young, and the economically disadvantaged is presented. The second phase is the development of a methodology for planning transportation service for the disadvantaged in a rural or small urban area, incorporating the design considerations identified in the first place. Finally, the methodology is applied in Tompkins County, New York, following the inventories described in the first part of section 5 of this report.

3.2 Literature Search

3.2.1 Legal Requirements Concerning the Provision of Public Transportation to the Disadvantaged

a) Congressional Legislation

The movement towards legislation concerning access of the handicapped to public facilities began in 1961 with the joint publication by the Easter Seal Society and ANSI (the American National Standards Institute, formerly American Standards Association) of a booklet entitled "American Standard Specifications for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped." In 1968 Congress enacted PL 90-480 (Public Law No. 480 of the 90th Congress) providing that all design, construction, or alteration of public buildings be done in accordance with minimum standards to be prescribed by GSA (the General Services Administration) which would ensure that handicapped persons have ready access to and use of the buildings. A public building was defined as any facility used by the general public and financed with federal funds, or built for or leased by the federal government.

The standards adopted by GSA were the ANSI standards of 1961. There was some suggestion that the new Washington, D.C. METRO stations were not included under this law until, in early 1970, Congress enacted PL 91-205 which specifically incorporated within the meaning of PL 90-480 all METRO structures, stations, and facilities used by the general public. Notably, and lamentably, rolling stock was excepted at that time.

By late 1970 Congress had begun to recognize the inadequacy of barrier-free terminals and stations when the transport system itself remained barrier-infested. In the enabling legislation for the National Railroad Passenger Corporation (AMTRAK), Congress "authorized" the Corporation

...to take all steps necessary to ensure that no elderly or handicapped individual is denied intercity transportation, ...including but not limited to, ...conducting special training for employees; designing and acquiring new equipment and facilities and eliminating architectural barriers in existing equipment and facilities; ...and providing special assistance while boarding and alighting and in terminal areas...

AMTRAK management announced the "voluntary" implementation of such a program throughout its system. And in separate legislation at almost the same time (PL 91-453), the true issue was finally reached.

It is hereby declared to be the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services; that special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize will be assured; and that all Federal programs offering assistance in the field of mass transportation ...should contain provisions implementing this policy.

The act further provides for special federal funds from which the Secretary of Transportation may make grants and loans

to states and local public bodies ...for the specific purpose of assisting them in providing

mass transportation services which are planned, designed, and carried out so as to meet the special needs of elderly and handicapped persons ...and ...to private nonprofit corporations ...for the specific purpose of assisting them in providing transportation services meeting the special needs ...of persons for whom [the public transportation services] are unavailable, insufficient or inappropriate.

Special funds were also made available and reserved for the financing of research, development, and demonstration projects to provide improved facilities planned and designed to meet the special needs of elderly and handicapped persons.

One further advance was made in 1973 with the enactment of PL 93-87, the Federal Highway Act of '73. This act authorized the reallocation of funds originally given to states for use on the Interstate Highway System to finance instead the federal share of costs of projects for mass transportation within urban areas including purchase of buses. These former highway funds became available to state and local public agencies beginning in FY 76. The act further provides:

The Secretary of Transportation shall assume that projects receiving [funds] shall be planned and designed so that mass transportation facilities and services [including rolling stock] can be effectively utilized by elderly and handicapped persons.

In late 1973 Congress also established the Architectural and Transportation Barriers Compliance Board. Among its many responsibilities and changes are the following:

...investigate and examine alternative approaches to transportation barriers confronting handicapped individuals particularly with respect to public transportation (including air, water, and surface transportation whether interstate, foreign, intrastate, or local).

[and]

...determine what measures are being taken by public and nonprofit agencies to eliminate barriers in public transportation systems (including vehicles used in such systems) and to prevent their incorporation in new or expanded transportation systems.

The Board was directed to prepare a final report of its activities under these two charges for transmission to the President and Congress not later than 1 January 1975.

b) Department and Agency Regulations

Pursuant to Congressional mandate, cabinet level federal departments and independent regulatory agencies promulgate rules and regulations setting federal policy. Regulations prescribing barrier-free conduct and requirements have been issued by GSA, HEW, and HUD. Further, the Secretary of Transportation has immense discretionary power in granting many millions of federal aid dollars to various transportation projects and he must list in detail the conditions under which he will allocate money and the responsibilities or limitations imposed on its recipients.

Regulations of both the FAA and CAB require commercial air carriers to accept certain handicapped persons as passengers without requiring a personal attendant to accompany them. Previously, airlines had insisted they did not have to transport handicapped persons (for safety and emergency evacuation reasons). The FAA is also distributing an "advisory" circular, "Airport Terminals and the Physically Handicapped."

c) State Legislation

Several states have recently enacted laws concerning the access of the physically handicapped to public facilities. Among these are Minnesota, Massachusetts, Illinois, and Maryland. Minnesota's White Cane Law would appear to be the strongest statement of concern and support for the handicapped. It is reproduced in part here.

The State of Minnesota shall encourage and enable the blind, the visually handicapped, and the otherwise physically disabled to participate fully in the social and economic life of the state, and to engage in remunerative employment.

The blind, the visually handicapped, and the otherwise physically disabled have the same right as the able-bodied to the full and free use of the streets, highways, walkways, public buildings, public facilities and other public places; and are entitled to full and equal accommodations, advantages, facilities, and privileges of all common carriers, airplanes, motor vehicles, railroad trains, motor buses, boats, and any other public conveyances or modes of transportation...

Other portions of Minnesota law make the expected provisions for public building construction and alteration standards, curb cuts and ramps at all crosswalks, and further provide for the display of the internationally approved symbol to indicate buildings or facilities are accessible to and usable by persons in wheelchairs.

New York seems to be conspicuously absent from this field of enlightened legislation. Only one reference was found in New York Law and that was in the state building code. The law provides that construction, alteration, or improvement of public buildings provide for access and use by the physically handicapped. Transportation terminals and stations are included, but no mention is made of rolling stock, nor is any policy declaration (like Minnesota's White Cane Law) in evidence as of yet.

3.2.2 Transportation and the Elderly

The mobility of older persons is affected by three types of constraints. Medical constraints result from sensory-motor changes, some of which are a decline in strength and agility, a decrease in the ability to correctly respond to complex stimuli, and less secure body balance. A general loss of confidence often reduces the willingness of senior citizens to embark on trips. The complexity and speed of modern transportation penalizes older persons. It is difficult for them to cope with the physical demands and the confusion and rush of a subway train or a bus.

Income constraints magnify transportation problems of older people. Senior citizens live on essentially fixed incomes. Ownership of personal vehicles is difficult (if not impossible). A low level of vehicle ownership results in low rates of trip generation. Concerning public transportation, it is unclear whether senior citizens are restricted by the lack of funds for travel or for purchasing the goods and services at destination points which attracted them in the first place.

Institutional constraints are external restrictions of senior citizen travel. Specific restrictions range from driving license regulations, inadequate safety regulations, to social habits and practices such as bus drivers who start their vehicles before an older person can find a seat. A lack of institutional assistance for the aged and the low status of retirement are perhaps more subtle forms of institutional constraints, but present not so subtle problems.

Examples of the three types of constraints are seen by considering the major transportation modes used by or available to senior citizens. Discussed here are three studies by Frances Carp on walking, driving, and riding the bus respectively.

A study of "The Older Pedestrian in San Francisco"¹ indicates some of the problems encountered by senior citizens when they walk. Carp discovered a strong dependence on walking due to limited financial resources, inadequate offers of rides from others, and situations in which senior citizens are simply forced to walk. Potential advantages are perceived by senior citizens such as: walking is good for health; it is inexpensive, it is convenient, and it allows independence and contact with other people. Difficulties encountered by older pedestrians include: long distances, poorly constructed walkways, intrusion by vehicles, confusing traffic, poor health, bad weather, hilly terrain, and the hazards of walking (senior citizens make up 25% of all pedestrian deaths). The study concludes that under favorable conditions (distance not too great, walkways safe, etc.) most older people view walking positively. The strong negative reaction is to dependence on walking as a means of getting places. Carp recommends that conditions for the older pedestrian be improved and that vehicular transportation be provided for certain trips (medical, drugs, grocery).

The automobile is the most frequent means of transportation in American society. It offers comfort, convenience, and independence which are appealing to most people. The senior citizen finds himself generally unable to meet his transportation needs through the automobile. Carp's "Automobile and Public Transportation for Retired People"² deals with retired people in San Antonio and San Francisco. The study attempts to establish who of the senior citizens drive, problems of the "older driver," and problems of the conditions of driving.

The most important factor influencing who drives is financial status. Drivers tend to have good incomes, good housing, and are retired from high-level jobs. Moreover, income is the most important reason for giving up driving. Car ownership is an associated factor, and is almost completely predictive of frequency of driving. Car owners are likely to be satisfied with their means of transportation. Lending of automobiles on a regular basis is rare.

Health is the second most frequent cause of retired persons giving up driving. Those who do not drive often rated their health unfavorably. Health restricts the ranges of driving and destinations.

Men are more likely to be drivers than women, but this is because fewer women had learned to drive. Future generations of senior citizens may have more equal proportions of men-women drivers.

A final influencing factor on being a driver is location of residence. Those living on the periphery of an urban area are more likely to be drivers than those living in the central city. Clearly residence is related to other correlates of car ownership.

Driving problems encountered are of two types -- those of the driver and those of the conditions of driving. Drivers tend to perceive many problems for the "older driver" but not for themselves. This may be a result of defense mechanisms, but in any case, the difficulties of the "older driver" include: deteriorating vision, slowness of response, nervousness, stiffness, lack of confidence, and adjustment to new conditions.

The conditions of driving itself create problems for the elderly. The idea of speed activates psychological defenses on the part of many older drivers. Older drivers do not like the crowded-in feeling; many said that there are too many cars on the road and that streets and roads are inadequate to handle traffic. Traffic signals, freeways, and interchanges are complex and confusing to the older driver. The problem of night driving is accepted in a matter-of-fact way by a large number of retired people.

This study concludes that only a small percentage of the total group of retired people were freely able to meet their transportation needs by driving an automobile. Furthermore, as the speed and complexity of traffic increase, this proportion of drivers may be expected to diminish. Because the ability to travel in this country depends largely on driving an automobile, a large proportion of retired people are confined to their own homes.

To make car driving more amenable to senior citizens, it would be necessary to make networks as simple as possible, and streets wider. At the same time, mass transit systems can and should be developed with the needs of the elderly high on the list of considerations.

Presently bus systems are designed for the general public. The special needs of senior citizens are somewhat neglected. It seems obvious that redesign of transit systems

with particular consideration of the problems of handicapped persons would alleviate many of their transportation problems. Carp's "Public Transit and Retired People"³ concerns senior citizens' problems with the San Antonio Municipal Bus System. The study comprises a static analysis of the bus system, indicating perceived advantages and disadvantages, followed by a sequential analysis of a typical bus trip.

Positive attributes of the system include: safety, convenience (location of stops, comfort of ride, no traffic and parking worries), company of other people, and the fact that it is inexpensive compared to owning a car.

However, disadvantages far outnumber advantages. The most common complaint was that the buses are too infrequent. Difficulty in getting a bus directly to the desired destination deters some from riding. Buses are now scheduled for the work force and for school children, which means that during the middle of the day, when most senior citizens travel, fewer buses are running. Some indicated that crowding and standing during rush hours make them tired and induce a fear of falling. Impatience of other passengers with older people getting on and off buses is another problem.

More specific problems were pinpointed in the sequential analysis, beginning with the wait for the bus and ending with getting off the bus.

For the most part, the wait is too long, uncomfortable (due to weather), and tiring, which results in a feeling of loneliness and fear. Entering the bus, senior citizens feel pushed around and hurried by other passengers. They fear falling and getting caught in the doors. Many feel that the steps are too steep. Riding the bus, senior citizens again feel crowded and pushed around. They find some passengers rude. Falling is a fear heightened by the crowded conditions. A few older people complained of driver recklessness. Getting off the bus, elderly persons feel that they are being hurried. They fear falling and getting caught in the doors. Another fear of getting off at the wrong stop is prevalent. Some indicated that they need help to get off. Finally, after getting off the bus some feel loneliness.

Carp concludes that the bus is not extensively used by retired people. Some senior citizens depend on the bus to get around. In the study, the greater the dependence on the bus, the higher the incidence of negative comments.

3.2.3 Hardware Design Considerations

"In the past, all aspects of our environment have been designed for a mythical average man, a concept produced by a statistical analysis of the size, strength and responses of the person with full physical powers. The average man pictured by these calculations is, of course, a fallacy... From this mistaken assumption a physical environment has been developed that is either difficult, exhausting or impossible to use for the nonaverage person."⁴

Mass transportation, specifically the hardware employed, is in many respects vulnerable to this accusation. The prevailing policies used in mass transit planning to date have searched for the largest possible market of riders as a general population. Little has been done (until very recently) in serving any particular portion of this general ridership. With increased awareness of the problems of the disadvantaged, however, considerations of the physical barriers and their consequences are needed.

The success of any specialized system aimed at the transit disadvantaged will depend integrally on the success of its planners in overcoming these physical obstacles. This section is therefore intended to survey the possible problems associated with travel accessibility.

Many of the elderly and handicapped preference charts for hardware listed in this section were taken from a study conducted by British Leyland U.K., Ltd.⁵ The study is summarized here; its abstract states:

The relevant anthropometric dimensions of one hundred elderly persons and one hundred patients with neurological and orthopaedic disabilities were recorded.

The abilities of the same subjects to negotiate steps of various heights, to pull, twist and reach with their arms were recorded together with their preferences for various seating arrangements and hand holds.

The study contains highly detailed data on technical design and is recommended for reference.

Roadside facilities are also a very important factor in a system serving the disadvantaged. Therefore, the final part of this section is devoted to the possible problems concerning physical features affecting pedestrians.

a) Vehicle Design

The material presented here has been selected because of its applicability to small urban areas. Many studies reviewed included discussions of subway, train and terminal facilities as well as buses. Attention is centered here, however, on bus design. The problems, as well as the solutions discussed and visually presented, were selected with coaches and minibuses in mind.

A list of possible impedances in bus travel is given in Table 3.1, by considering the degree of use of mobility aids which might impede a person's use of a bus.

(i) Steps and General Access: The problem of entrance is probably the barrier most widely recognized. Steps not only exclude the obviously physically handicapped, but deter many elderly persons who have weakened and/or arthritic legs.

The problem of the disadvantaged is amplified by the fact that buses often have initial steps in excess of twelve inches. Table 3.2 illustrates the extent to which certain heights can deter riders.

Three alternative solutions are possible. Steps could be engineered to extend to ground level. If steps were not altered, it would be possible to design a section of curb that would allow the bus to pull up flush with the sidewalk. As an aid to entrance, handrails could be designed to extend from the bus as the doors are opened.

For the portion of the population confined to wheelchairs, the problem is more severe. Steps are total barriers and lifts must be added to vehicles to serve these people. Two kinds of lifts have been found that would suite the two different sized buses mentioned. First, for larger coaches being redesigned, a combination step-lift can be employed. This set-up is shown in Figures 3.1 and 3.2. Second, for smaller mini-buses that would be used for more personalized service, a separate lift could be used. See Figure 3.3

(ii) Function and Width of Doors: Entering many buses is made difficult by doors of minimal width. This feature is a hindrance even to normal riders when on shopping trips and carrying packages. ASA standards specify a minimum of 32" for wheelchair access. Altering door widths on buses already in service is a substantial undertaking. Less prohibitive but still expensive is a conversion to sliding doors which retract along the side of the vehicle. New purchases should be required to meet ASA specifications prior to delivery.

Type of Aid	Percent
Use no Aid	47%
Cane	31%
Wheelchair	15%
Special Car	7%
Crutches or Walker	5%
Leg Braces	5%
Heavy Aid	3%
Artificial Limb	1%
Other	6%

Percentages do not add to 100% since a person may use more than one aid

Table 3.1
USE OF MOBILITY AIDS

With Ease

		With Handholds								Without Handholds							
		Able Adult		Disabled		Elderly		Lame/ Elderly		Able Adult		Disabled		Elderly		Lame/ Elderly	
Step Height (in.)	(cms)	No.	% of 7	No.	% of 116	No.	% of 43	No.	% of 33	No.	% of 7	No.	% of 116	No.	% of 43	No.	% of 33
3½	9	7	100	114	98	43	100	33	100	7	100	88	76	41	95	29	88
7	18	7	100	101	87	42	98	32	97	7	100	55	47	38	88	22	67
10½	27	7	100	74	64	40	93	24	73	7	100	19	16	29	67	14	42
14	36	7	100	30	26	32	65	14	42	7	100	8	7	17	40	3	9
17	43	7	100	11	10	20	47	6	18	7	100	2	2	6	14	2	6

Source: Reference [5]

Table 3.2(a)

STEP HEIGHT NEGOTIATED (ABLE, DISABLED, ELDERLY, LAME/ELDERLY)

Just Possible

		With Handholds								Without Handholds							
		Able Adult		Disabled		Elderly		Lame/ Elderly		Able Adult		Disabled		Elderly		Lame Elderly	
Step Height		No.	% of 7	No.	% of 116	No.	% of 43	No.	% of 33	No.	% of 7	No.	% of 116	No.	% of 43	No.	% of 33
(in.)	(cms)																
3½	9	7	100	116	100	43	100	33	100	7	100	106	91	43	98	30	91
7	18	7	100	115	99	43	100	33	100	7	100	78	67	41	95	28	85
10½	27	7	100	104	90	42	98	32	97	7	100	48	41	36	84	21	64
14	36	7	100	72	62	40	93	23	70	7	100	17	15	25	58	9	27
17	43	7	100	36	31	32	74	13	39	7	100	8	7	18	42	3	9

Source: Reference [5]

Table 3.2(b)

STEP HEIGHT NEGOTIATED (ABLE, DISABLED, ELDERLY, LAME/ELDERLY)

Figure 3.1

Chairlift in Boarding Position

Source: Reference [6]

Figure 3.2
Chairlift at Floor Level
Source: Reference [6]

Figure 3.3

Flexette Equipped with Chairlift

Source: Reference [7]

(iii) Aisle Widths: Negotiation of the aisle in a bus is a major feat for someone using crutches, a cane, or a walker. Wheelchairs present obvious requirements. ASA standards list 25" as a minimum acceptable width.

(iv) Seating: Proper arrangement of seats in the smaller "mini-vans" seems to be adequately considered. But the more conventional large coaches are grossly remiss in this respect. The major problems to be addressed may be stated as: (1) the fear of elderly riders that a seat will not be available or that the bus may accelerate before a seat is reached; and (2) the absence of spaces in the coach to accomodate wheelchairs. The first problem was long ago solved by the Paris Metro system where certain seats near the entrances are marked for use by disabled veterans. An ordinary rider may use one of these seats but must relinquish it when a disabled veteran requests him to. Several seats at the right front of the bus should be so marked. This will insure immediate and easy access, an unhindered view of destinations, and easy communications with the driver. The second problem is solved by providing several empty spaces near the wheelchair access door and equipping them with chocks, tie-downs, and handrails. The chocks and tie-downs should be easily operable by the wheelchair passenger. Exterior vision at these points must also be unhindered. One possible floor plan incorporating these provisions is given in Figure 3.4. Elderly passengers' preferences recorded in one field study are reproduced in Table 3.3a.

Proper construction and separation of the seats is as important as arrangement. Specific aspects are height, seatback rails, foot rests, and separation. Preferences of handicapped and elderly persons in this regard are summarized in Tables 3.4 through 3.6.

(v) Audio and Visual Signals: Recognizing and approaching a bus, recognizing and approaching the destination, and signalling one's desire to disembark are serious concerns to the handicapped and elderly. The difficulties with these functions can be alleviated by providing: (1) color-coding of vehicles and routes and large destination signs on vehicles; (2) audio announcements within the vehicle; (3) greatly improved visibility from within the vehicle and plainly marked stops; and (4) next-stop signals on seatbacks instead of high overhead (see Figure 3.5).

(vi) Vehicle Size: Many significant problems for handicapped and elderly transit riders are posed by dynamic, movement-oriented travel barriers, e.g., uneven or sudden

Figure 3.4

Special Provisions for Handicapped Passengers

Source: Reference [6]

Seat Spacing

	24" (60.9 cms)								26.8" (68 cms)							
	Able		Disabled		Elderly		Lame/Elderly		Able		Disabled		Elderly		Lame/Elderly	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Too Near	6	86	57	48	14	31	12	36	1	14	8	7	2	4	3	9
Just Right	1	14	63	53	31	69	21	64	6	86	109	91	42	93	30	91
Too Far Away	0	0	0	0	0	0	0	0	0	0	3	3	1	2	0	0

Source: Reference [5] 27

Table 3.3(a)
SEAT SPACING (ABLE, DISABLED, ELDERLY, LAME/ELDERLY)

Seat Spacing	All Subjects		Male		Female		Able		Disabled		Elderly		Lame/Edlerly	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
24" (60.9 cms)	30	15	6	10	23	17	0	0	22	19	4	9	4	13
26.8" (68 cms)	169	85	57	91	111	83	7	100	94	81	40	91	28	88

Source: Reference [5]

Table 3.3(b)
SEAT SPACING PREFERENCE

acceleration, crowds, time pressures. Definite implications as to vehicle size can be seen. Smaller vehicles handle better, can be more smoothly operated, and allow for increased driver interaction with passengers.

(vii) Fare Collection: For many elderly and handicapped persons fare collection mechanisms and procedures present significant travails to be suffered. Crowding, rushing, and confounding machines are serious complications. These problems can be easily eliminated with human engineering.

Zurich has completely removed fare deposit machines from the vehicle. Ticket sales machines are located at the bus stops (see Figure 3.6). Tickets are not collected but a transit system employee circulates among the buses randomly checking for tickets. Alternatively, tickets could be collected by the driver upon disembarkation (Boston) or by a conductor (London). If the system must be maintained within the vehicle, an acceptable solution is given in Figure 3.7.

b) Sample of Available Buses

The following subsection constitutes a brief sample of vehicles available for the transportation of people with mobility limitations. Complete listings and descriptions of the state-of-the-art in vehicle design for the elderly and handicapped can be found in references [8] and [9].

(i) The Flxette, manufactured by ROHR/FLXIBLE, Loudonville, Ohio: This intermediate sized bus is available in 19- and 23-passenger sizes. Its use has ranged from demand-responsive service to shuttle and other fixed-route use. Ithaca's Community Transit System presently operates three 19-passenger Flxettes. The Flxettes used by CTS do not, however, include special features for the disadvantaged.

Most of the specifications for the Flxette are suitable when compared to the preferences given in the previous section on vehicle design. Seat spacing of 30+" is more than adequate and seats and failing diameters are proper. Three obvious deficiencies in the Flxette's design occur in the door width, front door step height and aisle width. Door and aisle width present problems to wheelchair users. Flxette makes provisions for these two deficiencies, though. A second, rear door is available that can be fitted with a lift. Pictures showing this feature are given in Figure 3.3.

Also, open areas are provided near the front and rear doors, so wheelchair users would not have to pass through the central aisle.

	All Subjects		Male		Female		Able		Disabled		Elderly		Lame/ Elderly	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Large (4.1 cm) (1-5/8 in)	132	65	50	78	80	58	6	86	76	64	26	58	24	73
Small (3.0 cm) (1-3/16 in)	72	35	14	22	58	42	1	14	43	36	19	42	9	27
No. of Subjects	204		64		138		7		119		45		33	

Source: Reference [5]

Larger diameter is preferred overall and by both sexes. The men show a stronger preference for the larger diameter.

Table 3.4
SEAT BACK RAIL DIAMETER PREFERENCE

Seat Height			Adjust 14" - 19"							Adjust 19" - 14"								
			All Subjects	Male	Female	Able	Disabled	Elderly	Lame/ Elderly	All Subjects	Male	Female	Able	Disabled	Elderly	Lame/ Elderly	Σ of overall %	Σ overall %
in.	cms.																	
14	35.6	N %	3 2	1 2	2 1	0 0	0 0	1 2	2 6	1 1	0 0	1 1	0 0	0 0	1 2	0 0	3	1.5
15	38.1	N %	18 9	6 10	11 8	0 0	14 12	4 9	0 0	7 3	1 2	6 4	0 0	6 5	1 2	0 0	12	6
16	40.6	N %	48 23	10 16	38 27	2 29	25 21	10 22	11 33	25 12	4 6	21 15	2 29	11 9	8 18	4 12	35	17.5
17	43.2	N %	61 30	19 30	41 29	1 14	36 30	16 36	8 24	64 31	19 30	44 31	1 14	37 31	13 29	13 39	61	30.5
18	45.7	N %	37 18	9 14	28 20	0 0	20 17	8 18	9 27	81 39	26 41	54 38	0 0	48 40	21 47	12 36	57	28.5
19	48.3	N %	39 19	18 29	21 15	4 57	26 22	6 13	3 9	28 14	13 21	15 11	4 57	19 16	1 2	4 12	33	16.5
No. of Subjects			206	63	141	7	121	45	33	206	63	141	7	121	45	33		

Distribution is skew to higher values - most popular 17" - 18" high seat. When increasing height, 17" is the most popular value. When decreasing height, 18" is the most popular value. Chosen values near start of tests - results similar for men and women.

Source: Reference [5]

Table 3.5
PREFERRED SEAT HEIGHT

Foot Stool Height 20.3 cm (8") 25.4 cm (10")

Subjects			
All Subjects	No.	178	24
	%	88	12
Male	No.	56	8
	%	88	13
Female	No.	120	16
	%	88	12
Able	No.	6	1
	%	86	14
Disabled	No.	107	12
	%	90	10
Elderly	No.	37	7
	%	84	16
Lame/Elderly	No.	28	4
	%	88	13

Source: Reference [5]

All subjects show a strong preference for the lower foot stool

Table 3.6
FOOT STOOL PREFERENCE

Figure 3.5

Aids to Bus Passengers

Source: Reference [6]

Figure 3.6

Bus-Stop Improvements

Source: Reference [6]

Figure 3.7
Improved Coin or Token Receiver
Source: Reference [4]

The entrance step height of 14" is a definite problem. From charts in the previous section, 42% of the elderly and 83% of the disabled were not able to negotiate such a step (without handholds). This problem has been expressed by many persons in Ithaca, with respect to the buses owned by CTS.

(ii) Special Buses Manufactured by Twin Coach, Highway Products, Inc.: Twin Coach manufactures two buses with special provisions. One vehicle is designed for the elderly while a second provides a rear entrance lift for use by the handicapped. The special feature of the bus for the elderly is the initial front step, which extends to the ground.

For use in a small urban area, the division of the elderly and handicapped between two different vehicles would be unrealistic. However, the bus for the elderly would satisfy the needs of many of the elderly in a typical small urban area who have expressed concern regarding the present buses having a high step.

(iii) The Fortivan Commuter, Coach and Equipment Sales Corp., Penn Yan, New York: This is the smallest of the vehicles reviewed here. Basically, it is a van that has been remodelled to include added headroom, a bus-like front entrance and a lift-equipped side door. Use of the Fortivan has been primarily in demand-responsive systems.

(iv) Mercedes-Benz Mini-Bus: Mercedes-Benz produces a diesel-powered vehicle available in models seating 13, 16, or 19 passengers. Several problems in using this vehicle for transportation of the disadvantaged are apparent. The height of the first step is 15.1" above the ground, a difficult step for elderly or handicapped riders. The entrance to the vehicle is only 19.5" wide at the bottom. Aisles are also very narrow. Buses can be ordered without seats so that special seating arrangements can be installed. Buses can be equipped with a wheelchair lift, as was done for example in the Call-A-Bus operation of CENTRO. However, because no special entrance features are available, possible modification of this vehicle for handicapped riders is limited.

c) Roadside Facilities Design

As discussed above, transportation extends beyond vehicles and vehicle movement. In any complete design of a transit system for the elderly and handicapped, roadside and pedestrian barriers must be examined. Louis E. Gelwicks, writing on "The Older Person's Relation with the Environment: The Influences of Transportation" poses an appropriate question to planners of mass transit:

What use is there in bringing an elderly person, via public transportation, to the corner of a shopping center if there is no internal transportation system to assist him in transversing several acres of parked cars or in moving from place to place within the center itself?

Eliminating pedestrian barriers not only benefits the disadvantaged, but has definite effects on the success of a mass transit system. Pleasant roadside facilities and ease in movement can substantially increase ridership. Safety of the system would also increase, benefiting the whole population.

Presented below is a summary of possible solutions that should be considered in planning the physical environment to supplement a barrier-free transit system.

d) Bus Stop Related

(i) Good lighting to assure safe conditions and to alleviate fears of assault.

(ii) Appropriate crossings with signs to aid movement of the disadvantaged from stops to any nearby destinations.

(iii) Shelters with benches. Figure 3.8 gives an example of a well-designed shelter. It includes schedule and routes, bench, handrails, clock, heating unit, and adequate space for maneuvering of wheelchairs. Costs of shelters can be found in the references.

(iv) Coordinated color-coding on buses, at stops and in brochures.

(v) Specially-designed sidewalks enabling vehicles to pull up flush with curb.

(vi) Clearly posted signs at each stop naming the stop as a location-destination.

e) General

(i) Curb cuts and ramps located at intersections and building entrances, respectively.

(ii) Sidewalks with smooth, but no-slip surfaces along pedestrian routes frequented by the elderly and handicapped.

(iii) Marked unloading zones, reserved in public parking lots, allowing wheelchair users easy exit and entrance to automobiles.

Figure 3.8
Waiting Shelter at Bus Stop
Source: Reference [4]

(iv) Well-planned pedestrian routes with places to rest (benches, water fountains, etc.) located at appropriate intervals.

With the creation of barrier-free facilities and pedestrian routes, making the locations of these changes known to the disadvantaged is essential. This "information system" concept in planning transportation for the disadvantaged is presented in Access to Cambridge 10, a study compiled by students at MIT. The project confronts the problem that the disadvantaged have in terms of travel information as explained above. This lack of knowledge can often lead to apprehension on the part of the handicapped and elderly about venturing to travel and leave their own local environment.

Students visited a large number of stores, public buildings and private organizations and recorded the presence and/or lack of physical barriers with respect to each of these locales. The result is a "guide to barrier-free movement" for the disadvantaged population. The study also contains maps of selected areas, showing positions of curb cuts, ramps, and other aids to movement.

The same type of undertaking could be included in a transportation system. Along with a presentation of routes and schedules, pamphlets giving routes of vehicles that have special provisions (with a list of these provisions) could be distributed to the elderly and handicapped. Possible results of such a provision would be:

- (i) Increased participation in all aspects of the community by the disadvantaged population.
- (ii) Increased ridership and utilization of special systems created to aid the disadvantaged.

3.3 Planning Methodology for the Provision of Transportation for the Disadvantaged

3.3.1 Identification of Target Populations

The first phase of the development of a system designed to serve the disadvantaged is the identification of the numbers and location of these population segments. The United States Census provides information on the elderly, the young, the disabled, and the unemployed. Aggregation at the Census Enumeration District level gives sufficiently accurate indications of residential patterns. Social service agencies may provide more recent data on the people with whom they work.

Long-term care facilities identified in section 2 are important because of the large numbers of elderly and physically handicapped in residence. Service desired by these residents constitutes a significant part of the demand for transportation by the handicapped.

Finally, daily trips to and from rehabilitation centers for the mentally and physically handicapped represent a large portion of the travel demand of the handicapped. The nature of each of these facilities, its location in the study area, and the transportation needs of its clients must be established.

3.3.2 Inventory of Existing Transportation Service

This phase of the planning procedure identifies the level of service to the disadvantaged provided by existing public transportation. Deficiencies in present service can be identified and some indication of demand levels for transportation may be obtained. Existing transportation may be provided by four types of organizations: public transportation companies, extended care facilities, volunteer service organizations, and rehabilitation training centers.

The service area, type of service (fixed-schedule buses, taxis, etc.), and fare structure of all public transportation companies in the study area should be determined. The service provided to extended-care facilities and training centers identified above is of special importance. Any special services provided to handicapped or otherwise infirm passengers should also be identified. Ridership figures for recent years might also be obtained.

Many of the extended-care facilities and training centers may provide their own transportation service. The type of service provided, its costs and fare structure, and levels of usage must be determined.

Several service organizations may provide rides to those who cannot otherwise find transportation. The purpose of the organization and the nature of its transportation service are important. Past ridership levels, restrictions on eligible users of the service, and estimates of costs should also be obtained.

3.3.3 Estimation of Demand

Conclusions about the nature and level of demand can be drawn from the location of the disadvantaged in the study area. The density of the disadvantaged population and its location relative to shopping and employment areas may indicate expected demand. Ridership of existing transportation services is another indicator of demand for public transportation.

3.3.4 Evaluation of Alternative Systems

In this phase of the planning process, a number of new systems or modifications of the existing system are identified. A set of objectives for transportation service to health care facilities is also developed. Each of the possible systems is then evaluated in terms of these objectives and the system which fulfills the objectives is then selected. In the event that no system is superior, a hybrid of the alternatives may be selected as the system able to fulfill the selected objectives.

In a small urban area, the available alternatives are usually limited to conventional bus systems, taxi service, demand-responsive systems, and chartered bus operations. The objectives of the provision of such a service might be related to some minimum degree of service to the disadvantaged that is desired in the study area. The criteria used to evaluate each system might include service area, frequency of service, fares, anticipated subsidization, and so forth.

3.3.5 Design of System

Once the type of system is selected, the exact parameters of the system are determined. Equipment requirements, such as the number and size of vehicles, location and number of bus stops and shelters, special provisions for the handicapped, and audio-visual aids are to be specified. Hours of operation, routing, and scheduling are determined. ON the basis of cost and ridership estimates, the fare structure is set and expected subsidies are estimated. Finally, decisions are made as to the ownership and administration of the system.

Many similarities exist between the design considerations for service to the disadvantaged and for health care delivery. Demand levels for each service are comparatively low. Vehicle design requirements are also similar. The

provision of these two services may best be considered together. In addition, such services could be provided as part of a larger conventional transit system. These system configurations are developed and evaluated in research task 4 (section 6 of this report). Again, the planning process can be presented in a flow diagram, as shown in Figure 3.9.

Figure 3.9
TRANSPORTATION FOR THE DISADVANTAGED - STUDY DESIGN

4. INTEGRATION OF EXISTING TRANSPORTATION SYSTEMS

4.1 Objectives

In many small urban areas, existing public transportation is typically organized as a number of independent, fragmentary, special-purpose systems. There is a consequent duplication of routes, schedules, rolling stock, labor forces, maintenance and storage facilities. Furthermore, the fragmentary nature of the services tends to preclude effective marketing and advertising of the systems, thus leading to a less effective service level in the area.

It is the purpose of this task to investigate the extent to which these several independent services might be integrated into a single coordinated system. The emphasis of this study is on the legal, political, and financial feasibility of integration, rather than on the problems of merging routes, schedules, rolling stock, and fixed facilities into a unified transportation system. These problems are dealt with in task 4 (section 6 of this report).

The objectives of this research task are: first, to investigate the possible ways in which an integrated transportation system can be organized; second, to inventory the existing services and note their shortcomings; and third, to evaluate the possible organizational models in the case study context. Since the latter two tasks relate specifically to the case study, they are dealt with in section 5. The organizational models are specifically a function of state legislation. Therefore, the first objective is conducted within the specific case of New York State, since this relates directly to the subsequent case study application. However, the types of organizational structures and the specific forms of legislation that affect them may well be found to be similar in other states. Thus, this section of the report should form an effective model for subsequent studies in other states.

4.2 Organizational Models for an Integrated Public Transit System

A number of candidate organizational models exist for public transit in a small urban area. Several of these options depend specifically on the initial status of public transit service. If it is non-existent (except in the form of special purpose services such as school buses, vehicles

for the elderly, handicapped, etc.), or if it is privately owned, a specific subset of options is pertinent. In the case study context, there is an existing municipally-owned bus system. In the interests of simplicity for this report, only those organizational options that are pertinent for the case study scenario are discussed. Four possible alternatives are reviewed in this section: a public authority, a special district, intermunicipal agreements (based on the municipality that currently owns the bus system), and a county department.

4.2.1 The Public Authority

a) Creation of a Public Authority

The first form of government that is analyzed as a possible means of ownership for an area-wide transit system in a small urban area is the public authority. In New York State, a public authority is legally classified as a "public benefit corporation," which is a corporation established by law to construct or operate a public improvement wholly or partly within the state, the profits from which go to the benefit of the state, or to the people thereof.¹¹ Authorities, as public benefit corporations, are created by special acts of the Legislature. In fact, the State Constitution requires that it be done this way:

"No public corporation (other than a county, city, town, village, school district or fire district...) possessing both the power to contract indebtedness and the power to collect charges, rates or fees for the services or facilities furnished or supplied by it shall hereafter be created except by special act of the legislature." ¹²

b) General and Special Powers

Even though the method of establishing public authorities is clear and consistent, the powers that the Legislature grants to the specific corporations differ widely. However, a fairly uniform set of general powers have been issued to all of the upstate transportation authorities. These general powers include the legal right to sue and be sued, to have a seal, to borrow money and issue negotiable notes, bonds, or other obligations, to invest any funds held in reserve or any monies not required for immediate use in state and/or Federal obligations, to make and alter by-laws for its organization and internal management, to enter into contracts and leases, to acquire, hold, and dispose of real or personal property, to appoint a general manager and other

employees, and to employ private consultants on a contract basis. An authority is also given the power to enter into collective bargaining agreements with labor representatives of its employees, to provide for the insurance of the authority's property, to make plans, surveys, and studies for its own purposes, to enter lands or premises to conduct surveys and examinations with the authority being liable for damages, to conduct investigations and hearings, to participate in the State employees' retirement system, and "to do all things convenient, necessary, or desirable to carry out its purposes."¹³

In addition to this extensive set of general powers, the transportation authorities have usually been granted a secondary set of rules, termed "special powers," which are drafted to facilitate the operations of these corporate bodies. Contained in all of the Special Powers sections of the laws that have enacted recent transit authorities are the powers to fix rates and collect charges for the use of facilities, to establish schedules and rules governing the use of its facilities, to acquire any transportation facility within its district by purchase, contract, or condemnation, to apply for and accept public and private appropriations, funds, or grants, to form wholly-owned subsidiary corporations, and to construct, operate and/or maintain any desired transportation facility within its district.

Although the powers of an authority are somewhat similar to those of a private corporation, there is much more governmental involvement in the affairs of a public benefit corporation. Authorities are required by law to file annual financial reports and budgets to the State Commissioner of Transportation and the legislative bodies of the counties they encompass. An authority can establish and/or change its user charges only after public hearings are held, and all applications of the authority for state aid must be approved by the legislative bodies of the concerned counties. However, authorities are exempt from local property taxes and are eligible for any state and/or Federal transit assistance funds. At the same time, an authority is given much discretion and freedom for its internal management and can continue its existence indefinitely, because there are no general termination laws. If termination is at all referred to in the law creating an authority, it is effected either by special statutes and/or whenever all outstanding bonds and liabilities of the authority have been repaid. After an authority ceases to exist, all of its rights and properties shall pass to the State. Consequently, authorities can perform their functions for extended time periods by continually borrowing money.

c) Organization -- The Authority Board

The crucial element of an authority's organizational structure is the nature of the governing board, in which all of the authority's powers are vested. Characteristics such as the size of the board, representation, terms of board members or officers, methods of selection of officers, political affiliations, requirements for quorums, compensations, and methods of removing board members vary widely between authorities and are prescribed in each special act that creates an authority. For example, Tottle (16) II-C, which created the Capital District Transportation Authority, specifies that initially there should be nine members of the board (three from Albany County and two each from Schenectady, Rensselaer, and Saratoga Counties) with five-year terms, appointed by the Governor with the advice and consent of the State Senate, with names submitted by the respective county legislatures. C.D.T.A. members cannot simultaneously hold elective offices, can be removed by the governor after a hearing is conducted, and receive \$100 per day when rendering services to the Authority.¹⁴

Once a board is formed (according to the legislative provisions), it often becomes a body of policy-formation and review, leaving day-to-day management problems and extensive powers to a general manager, whom it chooses. The board then meets periodically. In some large authorities, the boards meet frequently and are thoroughly involved in the daily operations of the organization. However, for smaller authorities, it is usually preferable to employ a part-time board and a full-time salaried general manager. In addition, most of the small and/or single-purpose authorities that function effectively have limited the size of the board to ten members, whose terms are usually staggered and are from three to five years in length. There are no general rules for methods of selecting board members and for specification of their qualifications.

d) Acquisition of Labor and Property

After the board of an authority is established, and after the nature of its role has been decided upon (usually the decision spells out a role of policy-determination), the authority proceeds to build a staff and hire employees. Staff size is dependent on the authority's functions: public benefit corporations that operate transit systems, toll bridges, etc., might have several hundred employees, whereas those organizations that manage facilities like parking garages or that hire consultants and contractors to do most of the work might have no more than twenty permanent positions. As a

result, wide variation exists in labor force size among public authorities in the State. Another area of difference is employment hiring procedure -- some authorities are exempt from state civil service regulations and have complete control over the hiring and firing of their employees. For others, either the local or the State Civil Service Commission has direct jurisdiction over such matters as compensation, insurance, benefits, union negotiations, and retirement provisions. Authorities, under these circumstances, follow guidelines of the State Civil Service Law in creating their labor forces.

Transportation authorities almost always begin their operations by buying the assets of private transit companies, and since most authorities are deeply involved in the management and ownership of capital investments, a separate section of each New York public authority law, dealing with the acquisition and disposition of real property, is often included in the legislative act.

Although specific provisions of this section differ between public benefit corporations, there are a few measures that have been granted to all of the recently created transportation authorities. Such measures allow the authorities to acquire transportation equipment and facilities, and to hold real property, the titles to which are vested in the authority. The organization is also allowed to purchase property by condemnation, and detailed condemnation procedures that conform to state law are described in the special section. Eminent domain, as it is exercised through condemnation, is an important power because it allows the state to take any property for a public purpose as long as the owner is justly compensated. Consequently, when the state delegates this power to public corporations, it also provides for safeguards against the abuse of this power. For transportation authorities, the state requires the consent and approval of the local governing body of the municipality in which condemnation is requested before the procedure can occur. This requirement is part of the special section on property acquisition. In addition, the legal right of the authority to rent, lease, or sell its own property is included within the property section of the law. Armed with all of these powers, the transportation authority is thereby in a legally sanctioned position to acquire private transit companies. However, the process is by no means instantaneous, requiring detailed appraisals and often legal suites, long delays, and a great deal of the authority's money.

e) Revenue Bond Financing

Various sources of revenue are available to transportation authorities in acquiring, operating, and/or constructing facilities and equipment. One such source that authorities have traditionally used is the issuing of bonds (borrowing money).

Since it is difficult for a public authority to undertake the construction of new facilities by the utilization of its immediately-available resources, the funds for major expenditures must be borrowed and repaid over a period of years, so that the facility may be created to fill a present need and its cost can be apportioned during its use. However, states, their municipalities, and their agencies today are borrowing money at a rate of over ten billion dollars a year and must compete with business enterprises, home buyers, and a host of other potential borrowers for the available supply of lendable money. The rate which the competing borrowers are willing to pay has had increasing significance to the municipal bond market during recent periods of "tight money." The conflicting desires for low interest costs and attractive yields must be reconciled between the issuer and the ultimate purchaser in order to provide the bonds with the required degree of ready salability so necessary in a highly-competitive market. As a public benefit corporation, the transit authority is given the power to issue municipal bonds, after it files official statements, and must thus compete in an already competitive bond market.

A municipal bond official statement may be defined as a document which includes all of the information relating to the bond issue that a prospective purchaser should have upon which to base his decision of whether to buy the bond. The statement is prepared by or under the direction of the public body issuing the bonds, and representations made therein are taken as written by those contemplating purchase. Basically, the official statement must accomplish two tasks. First, as defined above, it must be expected to provide the prospective purchaser with all of the information he needs to know. Second, the statement is expected to arouse the reader to the investment opportunity.

The two basic types of municipal bonds are the general obligation bond and the revenue bond. The issuance of a general obligation bond customarily involves the pledge of the full faith and credit of the community and the agreement to levy general taxes against all taxable property within the

boundaries of the issuer in such amounts that, each year, there will be enough funds to meet the obligations of maturity interest, principal, and any other requirements of the issuer.

In the case of revenue bonds, the issuer agrees to meet debt service from specific funds, and has no obligation beyond that of managing the property wisely and conserving the earnings for the creditors.

The form and content of an official statement offering either type of bond for sale are developed from the advice of bond counselors, with respect to the presentation of the legal aspects of the issue, and the judgement of financial advisors on the economic and financial data that are needed to properly inform the prospective retail purchasers and potential underwriters of the merits of the bond. The form and content of the usual corporate stock or bond prospectus are basically determined by acts of congress and regulations on the Securities and Exchange Commission. In the case of municipal bond official statements, the review is by the S.E.C. Moreover, other regulations on the procedures of revenue-bond financing, such as limitation on total bonds outstanding, fixed maturity dates of bonds, rights to sell bonds privately without bidding, ceilings on the interest rates issues may pay to bondholders, rights to issue bonds to refund outstanding bonds (borrowing to pay back previous lenders), and fixed dates for bond redemption are less stringent and often nonexistent for public authorities. Authorities do not need the state comptroller's prior approval to issue bonds, can use available funds to purchase their own outstanding bonds, and can engage in short-term borrowing.

Furthermore, the laws that create public authorities contain specific procedures for bondholders to follow in the event of default, allow banks and the state to purchase authority bonds with tax exemptions, grant authorities some freedom in making legal and financial arrangements to cope with any unforeseen problems of issuing bonds, and declare the State of New York not liable for the bonds and notes of the authority. Although revenue bond financing is an involved process, public authorities have used it extensively. Authority bonds have been sold on the market through public or negotiated sale and to governmental purchasers, in varying lot sizes, and with varying interest rates and maturity dates.

f) Alternative Revenue Sources

In addition to issuing bonds, transportation authorities also collect funds by borrowing money at low

interest rates from the state and by receiving state appropriations. New York established a statewide Operating Assistance Program on April 1, 1974 to aid localities in financing mass transit. Under the provisions of this act, the five larger transportation authorities in the state (the Metropolitan Transportation Authority, Capital District Transportation Authority, Central New York Regional Transportation Authority, Rochester-Genesee Regional Transportation Authority, and Niagara Frontier Transportation Authority) receive annual amounts, as specified by the Legislature. However, other public or semi-public mass transit corporations receive grants according to a formula based upon the local population, revenue¹⁵ passengers carried, and the number of vehicle-miles in service. One important feature, though, is that authorities, other than the five mentioned above, are reimbursed according to the three previously mentioned parameters, whereas any county or city transit company that contracts for service is not entitled to grants based on the local population but only on passengers and vehicle-miles. In terms of state aid, authorities have a decided advantage over other governmental units of mass transit. Furthermore, transportation authorities, like public transportation corporations, are eligible for U.M.T.A. grants. Since the mid-1960's, the Urban Mass Transportation Administration has provided up to eighty percent of the cost of capital projects for municipal transit systems, selecting programs to be subsidized through a grants-application process.¹⁶ Because U.M.T.A. prefers to aid systems that have planning capabilities, authorities with in-house transportation planning staffs enjoy a partial advantage in this area of funding too. Lastly, authorities receive funds by obtaining local subsidies (a standard procedure with all of the existing transit authorities) and tax credits, and of course, by charging fees for the use of their facilities. The percentage of an authority's income attributable to each source naturally is unique to each organization but it might be noted that many of the present authorities rely almost exclusively on operating revenues and outside subsidies, rarely resorting to bonding.

Concomitant with this flexibility of choosing different revenue sources, transportation authorities are also relatively free to establish their own price policies, and to adopt their own budgeting and accounting procedures. In these areas, however, there are a few state requirements, spelled out in the authority laws: first, transportation authorities must hold public hearings before raising fares and rates; and second, recent bills of the state legislature have compelled authorities to present their accounts, audits, and other financial reports to the state comptroller on a periodic basis.

g) Government Intervention

A summation of the ways in which state or local officials may exercise some control over the activities of public authorities would comprise the following:

1. Appointment and removal of authority board members.
2. Affiliation of authorities with regular government agencies.
3. Civil Service regulation of authority personnel practice (not standard).
4. Authorization of new authority projects.
5. Approval of authority contracts or leases.
6. Specific statutory controls over authority finances (taxes, etc.).
7. Appropriation of funds to authorities.
8. Regulation of authority rates.
9. Auditing of authority finances.
10. Submission of annual reports by authorities.

h) Brief History of New York State Authorities

Despite these limitations, authorities have proliferated in New York State ever since the Port Authority of New York was created in 1921, as the first such public benefit corporation in the country.¹⁷ Devised in order to coordinate the port area's terminal, transportation, and commercial facilities, the Authority spent its early years attempting to reorganize the region's railroad terminals without much success and did not become self-supporting until the late 1930's when tolls on its bridges and tunnels started producing sizeable revenues. Having achieved financial stability, the Port Authority floated several bond issues, constructed many capital projects, and received certain works, like LaGuardia Airport and the Holland Tunnel, from the state. Moreover, the Port Authority became the model for other public benefit corporations. A few years after its enactment, the state created the Lake Champlain and Niagara Frontier Bridge Commissions (which really function as public authorities) in 1927 to construct and operate bridges for those respective regions.¹⁸

Although the early authorities were created for transportation-related purposes, with a heavy orientation towards the automobile, some were formed in the 1930's for more diverse functions, including the development of hydro-electric power, agricultural produce markets, municipal sewage treatment plants, and metropolitan park systems. Another change

introduced in the 1930's was federal aid to authorities. The Public Works Administration, set up during the Depression by the federal government to stimulate construction and provide employment, proceeded to make loans to and buy the bonds of ten separate authorities in New York. However, had the federal government not subsidized these improvement programs, authorities would still have flourished in the 1930's because the state, with its tax resources depleted and borrowing capacity limited, created many authorities to finance certain capital projects through user charges. Moreover, capital projects were undertaken in this decade to alleviate the problems of the state's urban areas, whereas most of the previous programs addressed rural and/or regional needs. In 1935, the first housing authorities were created in New York State under the Municipal Housing Authority Law to encourage the construction of housing and coordinate state and federal aid programs.¹⁹

A second type of public authority was formed in several cities to handle a strictly urban problem, downtown parking shortages, beginning in the late 1940's. After the end of World War II, urban traffic problems, which had been serious before the War, reached critical levels, and many cities were forced to build off-street facilities to meet parking demands, especially in downtown areas. Since considerable revenues could be generated from on-street parking meters to finance land acquisition and construction of garages, authorities did not have to float bonds but were created primarily to remove parking operations from direct political control. Since the formation of the White Plains Parking Authority in 1947, more than twenty-five such authorities have been established in New York.²⁰

The application of the public authority model to urban mass transit is a relatively recent step. In 1953, the state created the New York City Transit Authority to operate the city's massive transit system, which had previously been municipally-owned but was confronted with rapidly-mounting operating deficits, public opposition to fare increases, and a number of necessary capital projects to be built.²¹ The City Transit Authority was unique among other public authorities in that it did not have the power to issue bonds, it leased (rather than purchased) the capital assets of the transit system over a ten-year period, and received money for all of its capital expenditures from the city. However, the Transit Authority had full control over rate determination and discretion to alter service, and even had full control over the planning of capital projects, despite total city funding for those projects. At the same time, the Authority

was required by the legislature to make operating revenues meet operating costs through fare changes and to notify the City Board of Estimate in advance of any significant service changes.

A second public transportation authority came into existence in 1965 when the Metropolitan Commuter Transportation Authority was established to operate the bankrupt Long Island Railroad with initial appropriations from the state in order to acquire the property from its owner, the Pennsylvania Railroad.²² Three years later, the M.C.T.A. was transformed into the Metropolitan Transportation Authority, to become an "umbrella agency" for transit. Through statutorily imposed interlocking directorships, the M.T.A. controls the New York City Transit Authority (and its subsidiary, the Manhattan and Bronx Surface Transit Operating Authority, which runs the buses of the system), the Triborough Bridge and Tunnel Authority, and the Long Island Railroad. The M.T.A. is also able to transfer funds from one division to another as long as the funds are used for the construction of capital projects.

Within the past seven years, transit authorities have been established in many of the upstate cities: Buffalo (the Niagara Frontier Transportation Authority in 1967), Rochester (the Rochester-Genessee Regional Transportation Authority in 1969), Syracuse (Central New York R.T.A. in 1970), Albany (Capital District T.A. in 1970) and Utica (also in 1970).²³ The steps leading to creation in these cases are all very similar: a private transit company, caught in an increasing-cost-decreasing-ridership spiral, approached bankruptcy; the city and county in which it operated did not have the funds or desires to acquire the system; and so, the county legislature recommended that an authority be created. For these cities, the options of governmental ownership of transit were exceedingly limited because of the reluctance of the affected municipal corporations to operate the systems. As a result, the authority unit was almost chosen by default in the upstate urban areas. But in addition, transportation authorities have been, and still are, created to:

1. Finance public improvements without resort to additional taxes.
2. Finance improvements through charges upon the users instead of upon the general taxpaying public.
3. Finance improvements without conflict with constitutional debt limitations.
4. Secure additional revenues and greater financial autonomy for certain activities of regular state agencies.

5. Take advantage of federal loans and grants.
6. Finance improvements through revenue bonds without earmarking of taxes.
7. Facilitate financing of enterprises taken over from private ownership.
8. Facilitate the transition from private to public operation of enterprises.
9. Remove the administration of enterprises from direct control by politically responsible officers.
10. Provide a more flexible administrative instrument to manage a commercial-type public enterprise.²⁴

Although there has been some recent criticism of authorities, the disadvantages usually cited relate to the lack of uniformity in State Authority Laws, the inadequacy of accounting procedures, procedures for transferring financial information on authorities to the State, the exact nature of state subsidies to authorities and the necessity for such aids, and whether authorities are too independent. Nevertheless, the transportation authority certainly remains a viable option of governmental ownership of transit.

i) Implementation

To create such a public benefit corporation in a county with minimum delay, the Board of Representatives would first pass a resolution calling for a transportation authority, the resolution to contain the details of the authority's organization, after which the assemblymen from the area could then introduce a similarly-phrased bill to the state legislature. Then, hopefully, the measure would be passed, and the new organization could initiate its operations. Since the legislature usually passes measures that are of strictly local importance, the most significant impedances would be local political conflicts, which are beyond the realms of quantification and prediction.

4.2.2 The Special District

A second form of government ownership of a transit system is a special transportation district, the boundaries of which would be aligned to include only the participating towns and cities. Although many people consider special districts and public authorities to be identical, in New York State they are quite distinct. As mentioned previously, authorities are legally classified as public benefit corporations, whereas special districts are district corporations. (There is also a third type of public corporation, the municipal corporation, which includes counties, cities, towns,

villages, and school districts.) As the General Corporation Law states:

A 'district corporation' includes any territorial division of the state, other than a municipal corporation, heretofore or hereafter established by law which possesses the power to contract indebtedness and levy taxes or benefit assessments upon real estate or to require the levy of such taxes or assessments... 25

Thus, units such as water districts, fire districts, etc., are all considered to be special districts, and the term can be, and is, interchanged with "district corporation" and "improvement district." This substitutability of the terms often leads to confusion.

a) Legal Formation

Another characteristic of a district that causes confusion is the method by which one is created. Unlike authorities, district corporations can be created not only by the state legislature, but also by county boards of supervisors (or representatives) and by town boards of supervisors. Indeed, the majority of districts are authorized by either town or county boards, since the legislature is involved only when a proposed district intends into more than one county or in special cases. Otherwise, a town board establishes districts or parts of districts that lie within its boundaries and county boards act in the same manner for districts that extend over several municipalities. However, county boards are only empowered to create certain types of districts, specifically, water, sewer, refuse, and drainage districts. Consequently, one can further differentiate special districts as being either town districts, county districts, or legislatively-enacted districts. In each instance the basic procedures of creation are similar: a petition is submitted to the appropriate authorizing agency; the agency then provides a public hearing, at which time all interested citizens can participate in and recommend revisions in the petition; after the form of the petition is finalized, the agency resolves to establish the district or deny the proposal; if approval is given, the agency's clerk files the resolution with the State Department of Audit and Control.

These same steps are followed if an already-existing district wishes to alter its boundaries and/or construct a new facility, and if two or more districts performing the same functions are to be consolidated. Variations in the

procedure occur because different participants and agencies can be involved. When the authorizing agency is the town board, the petition is usually filed by a group of citizens and it must identify the boundaries of the district, the affected properties, and the maximum amount of money to be spent. The petition often contains maps and plans of the proposed improvement and those signing it must own more than fifty percent of the assessed valuation of taxable real property in the proposed district.

Upon receiving a petition, the town board is, of course, obliged to schedule a public hearing, and the town clerk must publish a notice of the hearing in the official town newspaper. During the hearing, interested citizens frequently request changes in the proposed boundaries of the district, often requiring further hearings to be conducted until all, or almost all, of the property owners in the district benefit by the improvement. Once the board passes the resolution, the town clerk files a certified copy in the county clerk's office. In addition, if the cost of the improvement and establishing the district is to be financed by issuing notes or bonds, the approval of the state comptroller must be obtained by the town, after it adopts the resolution. The town board is also empowered to create a special district without first receiving a petition. In such a case, the board passes a resolution to appropriate money to have maps, plans, and reports prepared about the proposed district and improvement. The board then conducts a hearing, at which these documents can be examined by the public. A resolution is then passed to establish the district by a permissive referendum.

The county proceeds to create a district in the same manner, the difference being that the petition is generally filed by a group of municipalities, instead of citizens. Similarly, the state legislature acts upon the requests of county boards. Thus, the levels of government involved in creating a district increase with the scale of the proposed unit.

b) Types of Districts

As can be discerned from the preceding discussion, the establishment of an improvement district is a complicated, difficult task. Nonetheless, town boards have frequently employed this method but within functional limits, being legally able to create only the following types of districts:

water	park
water supply	sidewalk
water storage and distribution	snow removal
sewer	public dock
sewage disposal	beach erosion
drainage	harbor improvement
refuse and garbage	aquatic plant control
lighting	fallout shelter
public parking	districts 26

Because this list does not include mass transit service, or even general transportation, the establishment of such a district in a small urban area would entail the involvement of the state legislature, because a special exemption to the Town Law would have to be given. Therefore, the procedure for creation would require that one or more of the municipalities of the county submit a petition to the Board of Representatives, who would then hold hearings on the matter and hopefully adopt the resolution, after which the state assemblymen of the region could introduce the measure to the state legislature. The legislature would probably pass the bill because of its local character and because no state money would be required (at least to set up the administrative structure).

The powers granted to improvement districts depend upon the functions performed by the unit and the authorizing agency. For example, New York Town Law gives a town public parking district the powers to obtain property through condemnation, leasing, or buying (as long as the acquisitions have been included in the proposals of the petition), to buy necessary equipment, engage needed personnel, and to sell its property above the original cost and then buy other property. Parking districts are also allowed to fix reasonable charges on the use of, set rules for the operation of, and improve their facilities.²⁷ Most of the other types of districts, whether created by town or county, are granted these general powers, but also have special powers that deal with the particular problems of the respective functions. Since no improvement district has ever been created in New York State for mass transit, there are no records on the special powers granted to such districts. However, were a mass transit district to be formed, it would almost certainly be endowed with the above-mentioned general powers.

c) Administrative Structure

The organization of a district is just as important as its power of operation. Unlike authorities, improvement districts do not necessarily have separate administrative boards but are frequently run by the authorizing agencies, particularly the town and county boards. In fact, for town

districts, separate boards of commissioners have been abolished by Town Law. ²⁸ Consequently, the county and town boards are the policy-making bodies for most special districts, and daily management decisions are the responsibility of the county and town engineers (or occasionally, a general manager is hired). Although labor requirements for many improvement districts are relatively low, the employees are subject to county and town civil service regulations. A further degree of involvement in district affairs by local government is the process of constructing physical facilities: the plans for such facilities must first be approved by the authorizing agency; next, the agency's engineer and attorney must prepare specifications and contracts for the work to be done; and then, the board selects a contractor by means of competitive bidding. Thus, town and county boards are thoroughly involved in district management.

d) Financial Provisions

Improvement districts can finance themselves through a variety of revenue-producing measures, including user charges, notes and bonds, intergovernmental transfers, and special assessments. Although a district thereby has more financial options than an authority, there are also more outside controls on their sources of funds. First, user charges and assessments are determined by the authorizing agency. Also, any rate changes must be properly advertised and be discussed in public hearings. In addition, the Town and County Laws contain a detailed set of steps that officials must follow, if assessments are to be valid. ²⁹ Furthermore, districts can contract indebtedness by issuing serial bonds, bond, tax, and revenue anticipation notes, capital notes, and budget notes, all of which are executed by the authorizing agency's fiscal officer. However, all of these notes and bonds must be issued in accordance with an intricate set of regulations prescribed in the Local Finance Law. Moreover, a mass transit district, as a public corporation, would also be eligible for operating assistance funds from the state, grants from the Urban Mass Transportation Administration, and local subsidies.

e) Reasons for Creation

The selection of a special district (as opposed to other governmental units) to implement a public improvement program is affected by several factors. Special districts, like authorities, have been created so that state constitutional debt limits on municipal corporations would not be exceeded

(i.e., districts can incur larger sums of indebtedness). Another important reason was, and is, the state's restrictions on differential taxing -- local governments are unable to establish areas with different tax rates within their boundaries. Thus, an improvement with benefits limited to a neighborhood has little chance of being financed by other areas of the municipality, and so the neighborhood resorts to the district.

Although in other states special districts have been formed to provide administrators with greater fiscal autonomy and to remove the functions being performed from political influences, these reasons do not apply in New York State, especially because the administrators are often board officials (however, political accountability is somewhat reduced for county districts, which often have separate administrative boards and a manager). Despite the involvement of politics and outside governmental units, over 5340 district corporations have been formed in New York although none perform functions of public transportation. ³⁰

f) Implementation

In order to apply the special district model to mass transit in a small urban area, three basic plans are possible from at least a legal viewpoint. First, the principal city and any of the surrounding interested towns could jointly submit a petition to the County Board of Representatives requesting the formation of a county district, the boundaries of which would cover only those of the petitioners. Two immediate problems arise, though, with this plan: not only must the County Board adopt the resolution, but then the state legislature has to grant the county the power to create a special district for mass transit. Also, the district, once established, would possibly want to purchase the rolling stock of the city-run bus system, and the city would have to arrange the purchase agreements so that it wouldn't be buying the buses a second time (assuming that the district is partially financed by subsidies or taxes on the participating municipalities). The next plan is very similar, except that in addition to the county district, the town boards of the participating towns would also create town transit districts which would contract for service with the main district. The supplementary town districts are formed to increase the political responsiveness of the system, if so desired, but it must be noted that to do so, the state legislature would also have to grant each town the power to create such a district.

The third plan calls for the participating towns to create their transit districts (with or without petitions), the city to retain ownership of all bus facilities and equipment, and for the town districts to contract for service with the city. However, this scheme furnishes the towns with unnecessary legal difficulties, because the towns can contract out for transit service without having to create special districts to do so, as is discussed in more detail under intermunicipal agreements. At the same time, the third plan might be of value to neighborhoods within the surrounding towns which want mass transit service but cannot get it because the parts of the towns outside of the neighborhoods are not dense enough.

Although these three plans have substantial differences, all still incorporate the essential characteristics of special districts, particularly the high degree of political accountability and the flexibility in funding. Thus, the adoption of a special district will depend on how much importance the local politicians will place on those two factors.

4.2.3 Intermunicipal Agreements

A third form of governmental ownership of mass transit is an agreement between two or more municipal corporations. A municipal corporation is a public corporation created by government for political purposes, and having subordinate and local powers of legislation. Article VIII, Sections 1 and 2-a of the New York State Constitution provides additional authority for municipalities to engage in cooperative activities.³¹ Also, Sections 119-m through 119-o of the General Municipal Law empower municipalities to enter into agreement to carry out the following joint activities:

1. Provision of joint service, meaning the joint provision of any municipal facility service, activity, or undertaking or the joint performance or exercise of any function of power which each municipal corporation or district has the power by any other general or special law to provide, perform or exercise separately.
2. Provision of the joint water, sewage or drainage project, meaning a joint project to provide for a common supply of water, the common conveyance, treatment and disposal of sewage or common drainage system, as described in Section 2-a of Article VIII of the New York State Constitution.
3. Performance by municipal corporations among themselves of their respective functions, powers,

and duties, meaning a situation (a) where one municipality provides a service to another, (b) where the parties agree as to how each is to perform a given service jointly or separately.³²

a) Types of Legal Agreements

Municipal officials who wish to deal cooperatively with a common problem have to consider certain procedures. Outlined here are the principal procedural aspects of the two most common types of agreements.

(i) One Municipality Contracts for a Service

In this procedure, one unit of local government enters into a contractual agreement with another unit for the provision of a service. While each contract presents a different set of facts and conditions, there are certain basic elements common to all contractual arrangements and these should be adequately covered in the interest of both parties:

1. Quality and standards of service.
2. Schedule of charges.
3. Duration of the contract.
4. Liabilities of contracting parties.

There are two advantages of this type of agreement. First, the contracting municipality can shape the contractual agreement to accurately suit its needs. Second, a municipality can make use of the resources of the other communities and thereby provide more services to its citizens.³³

(ii) Two or More Municipalities Provide a Service Jointly

In this case, two or more municipalities enter into an agreement for a joint service for a joint water, sewage or drainage project, or for the performance among themselves of their respective functions, powers and duties. Under Sections 119-m through 119-o of the General Municipal Law noted above, municipalities are empowered to enter into agreements to carry out joint activities. These provisions are in addition to and are not in substitution or limitation of any other authority for contractual arrangements among municipalities.

b) Financial Considerations

The Local Finance Law authorizes municipalities to incur debt to carry out agreements for joint activities. Special provisions covering the incurrence of joint or

several debts for the purpose of an agreement appear in the Local Finance Law, Sections 15.00-15.40.

c) Structure of Agreement

Officials of municipalities negotiating an agreement involving joint indebtedness should have the advice of a Bond Counsel. This agreement must cover at least the following eight points.

(i) The agreement should specify the following as a matter of course: (a) identify and list all parties; (b) define the areas where services are to be rendered; (c) define the services to be applied, their scope, and the general standard to be met; (d) define the general obligations of the parties; (e) state the duration of the agreement; and (f) specify a method of finance.

(ii) It must have a joint governing body which is created to administer the service. Designated elected officials of participating municipalities may compose the governing body of the joint activity. The agreement should, in any case, specify how the governing body is to be composed, what officers it should have, and how they are to be chosen. The responsibility of the governing body must be spelled out in the agreement.

(iii) When a joint activity is to be administered, the status of the employees engaged in the activity must be considered, specifically, basis for retirement, social security, and other benefits.

(iv) A variety of methods may be used to cover the costs of providing a joint activity. The methods selected must be spelled out in the agreement. Section 119-o of the General Municipal Law provides generally that a method or formula for allocating costs shall be established between the municipalities involved.

(v) An agreement should designate a fiscal officer who will have custody of any or all of the money allocated for the joint activity and have the authority to make payments. As for the joint budget, the agreement should state the time and method of adapting the proposed annual budget for the joint activity.

(vi) Indebtedness for the purpose of a joint activity may be contracted by the participating parties. The agreement must indicate this fact.

(vii) A joint agreement should make specific provision for the holding of the title to any property acquired or used in the joint activity and should set forth clearly its tax exemption status, if any.

(viii) As a rule, the joint agreement should provide an amending procedure provision for periodic review desirable in the interest of any possible revision.³⁴

Two important features of a joint agreement are its extreme flexibility and its similarity to bargaining sessions. This flexibility allows those municipalities participating in the agreement to shape the transportation service according to their desires. And since the agreement is reached in political bargaining sessions, the larger communities have more influence upon the negotiations. The fact that agreements must be reached through political bargaining may be a disadvantage, depending on the particular politicians involved. In some cases, an agreement would never be reached because of differing political views and philosophies between politicians of neighboring municipalities.

d) Implementation

To apply this model to a small urban area, inter-municipal agreements would be used in what is commonly known as the incremental approach to mass transit. This implies that the municipality that currently owns the bus system would make agreements with surrounding municipalities to provide transit through an expansion of the existing system. The city would maintain the title to all property and equipment, but would be assisted by the participating towns in meeting operating costs. The participating governments would negotiate to enter the intermunicipal agreement only when they believe it to be in their interest and when they feel that transit service is necessary for their towns. However, there would be no external agency attempting to provide a truly regional service or master plan.

4.2.4 The County Department

The final transit option proposed for a small urban area is one in which the county government assumes the responsibility of providing transit services for the area. The county, the Board of Representatives in this case, could either create a department of transportation under its executive wing or contract the service out to a private operator or to a municipality contained within its jurisdiction. In the latter instance, the operations would be overseen by a standing committee for transportation.

a) Legal Precedents

Both of these options are well established in New York State Law as reasonable alternatives. The state addresses itself to this issue in the General Municipal Law 119-r. Citing Section One of the act:

1. To assure the provision of mass transportation services at adequate levels and at reasonable cost, every ... county ... shall have the power to adopt local laws to authorize:
 - a. The acquisition, construction, reconstruction, improvement, equipment, maintenance, or operation of one or more transportation projects.

* * *

- c. The making of a contract or contracts with any person, firm, or corporation, ..., for the equipment, maintenance or operation of a mass transportation facility...³⁵

At least two examples of this model exist in New York State, where Broome and Chemung Counties have opted for the county approach to transit.³⁶ At present, in Broome a department of transit operates a bus system for the cities of Binghamton, Johnson City and Endicott, and in Chemung a private operator, under the supervision of a transit committee, contracts with the county for an operation that serves seventy-five percent of the constituents. In both regions changes are in process, but not away from county control of transit. Broome County is merging its airport and transit departments to hopefully provide a more efficient and comprehensive approach to transportation. Chemung, on the other hand, although well served, is losing the private operator, and will probably assume the ownership, maintenance, and operation of the system. In both cases, the impetus for creation lay in the imminent bankruptcy of the local private bus operators. Where such crisis conditions do not exist, progress towards this particular option may be precluded.

b) Department Creation

The creation of a new department or the establishment of a contract agreement with another municipality is frequently provided for in the County Charter and Code.³⁷

To form a department of transportation, the Board of Representatives would enact a local law which would be subject to a permissive referendum if any change in the office or powers of any elected county officials were involved.³⁸ Reference should be made to Special Districts for details concerning the process of local law enactment. The act would establish an appointed post for a qualified individual to manage the system.

Contract agreements are arranged by negotiations between each participating government through special transit committees and subsequent referral to the respective municipalities for authorization. In either case, the difficulty lies not in the process, for these are long-standing functions of local government, but in the desire of local officials to move in this direction.

c) Financial Provisions

As a constituent part of the county government, any system controlled by the county would be funded in part by the county budget. Federal and state capital funds and the state-wide operating assistance would be potential sources of funds.³⁹ It is significant to note at this point that a county department would receive more assistance from the state than a contracted service.⁴⁰

In being part of the county budget, although perhaps a constraint, a county department would either directly or indirectly have taxation as a revenue source. A county in New York State has the power to levy taxes on real property, retail sales, amusements, alcohol and motor vehicles, but is not necessarily limited to these items.⁴¹ The largest revenue producer of those listed is the property tax, though it is not without restrictions. The New York State Constitution limits taxation from 1/2 to 2 percent of the full valuation of taxable real estate in the county.⁴² As an example of the use of this tax, Tompkins County recently proposed to raise the county tax in order to offset a deficit of 3.4 million dollars for the next five years. This tax is in response to the recent approval of a 20.6 million hospital plan.⁴³

The advantage of this method is that the costs can be diffused over a larger number of people, thereby lessening the burden. The "everybody should pay for the general good" philosophy has one serious weakness - when one pays for something, one expects to receive something in return.

Many of the towns in a rural county would be unlikely to exhibit a significant enough need to warrant the provision of public transit services. They most probably would not perceive or receive the benefits; therefore, it would be difficult to convince them to support a county transit department in the legislative stage and in operation.

Both Broome and Chemung Counties' transit services, although serving most of their constituents, do not provide service to every municipality, yet the county transit agencies exist. It is apparent, however, that the municipalities served must exert a controlling influence over the county government. The determination of this "taxation without representation" issue lies in the political arena.

As another means of obtaining funds, counties are also able to contract a debt for county purposes which would be financed by the issue of bonds or notes.⁴⁴ Again, the New York State Constitution imposes limits (7 percent of the full valuation of taxable real estate of the county) that restrict the capacity of municipalities to fund in this manner.⁴⁵

d) Civil Service Requirements

County functions are also subject to the Civil Service Codes of the state. Any agency of county government is therefore faced with the possible inefficiencies of a Civil Service bureaucracy. These are in large measure due to lack of economic incentives and the structure of the promotion system. They also lead to difficulties in personnel management. In addition, the wages and benefits required by Civil Service Law increase the costs of labor. Union benefits are closing the gap between private industry's labor costs and those of the government.

e) Planning

Another important aspect of a mass transit system is the planning function, which a county approach could deal with quite easily. Most counties already have a planning department and could place transportation planning under its umbrella. In general no governmental unit at or below the county level could afford to have a separate transportation planning agency. Also, the county planning agency could integrate the transit plans into the overall planning picture for the region. Hence, this option has much to commend it.

Broome County Transit presents a situation that seemingly dissolves the above comprehensive logic. The Transit Department, being separate from the Planning Department, has become an autonomous unit and cooperates little if at all with the planning agency. This particular difficulty must be guarded against but is not insurmountable. Provision could be made in the enabling act calling for cooperation between the agencies and requiring the planning department to make transit plans on a yearly basis. The other alternative is, of course, to place transit planning directly under the transit department. In terms of expertise, this is probably the best solution; but in terms of economics and overall planning, it may not be the best alternative.

5. INVENTORY OF EXISTING TRANSPORTATION SERVICES

Tompkins County is a growing area in the middle of New York State. Its population is approximately 80,000 with about one-third of the population living in the urbanized area of the City of Ithaca. In analyzing past population trends and future projections for this area, one immediately notices a drop in the percentage of people living in the central urbanized area. However, land use projections show that the majority of commercial and public services will remain in the city. This alone shows the need for increased public transportation from the county into the city.

5.1 Community Transit System

The Community Transit System (CTS) is owned and operated by the City of Ithaca and its service area, with minor exceptions, is confined to the city. CTS provides fixed-route fixed-schedule bus service, almost exclusively during the daylight hours. The routes and scheduling are presented in Figure 5.1 from which it may be seen that the service comprises five routes which operate with a one-hour headway six days a week. These routes connect Ithaca College, West Hill and Cornell University, the Elmira Road commercial area, Titus Towers (a senior citizen housing development), two recreation centers, and the high school to Ithaca's central business district (CBD). These routes run from 6:00 a.m. to 7:00 p.m. The route that connects Ithaca College with Cornell University is maintained until 11:00 p.m. on Friday and Saturday nights.

The income CTS takes in is approximately 60% from fares, 30% from tax revenues, and 10% from a subsidy provided by Ithaca College and Cornell University. The fare is 25¢ with reduced rates for senior citizens (8 trips for one dollar). The use of these senior citizen tickets has grown tremendously, from 8,442 in 1972, the first full year they were available, to 33,673 in 1974. Concomitantly, sales receipts from these tickets have risen from \$150 in 1971 (the year of introduction) to \$3,600 in 1973.. This is probably due to increased awareness of cost reduction on the part of the elderly population as well as increased distribution efforts by the Senior Citizens Council. This trend of increased ridership should continue with additional advertisement and increased number of distributional locations.

With the present system, the City of Ithaca is well-served. This area contains a high percentage of the county

Figure 5.1 Community Transit System Bus Routes

population (approximately 26,000 of 77,000 total) and numerous health facilities, as described above. However, conventional bus service is, for many well-documented reasons, unsuited for many handicapped and elderly people. Because of the many barriers present - high entrances to buses, long walks to bus stops, long waiting times, few shelters, etc. - the service provided by CTS is clearly not ideal for a large number of the transit-dependent for medical trips.

CTS has all of its maintenance work done by the Department of Public Works at their garage. At this time, the garage is underspaced and overworked. The city is in the process of building a new garage.

An important facility not presently served by CTS is Tompkins County Hospital. From December 15, 1969 to April 15, 1971, the Community Transit System operated a route serving the hospital and the adjacent professional building. This corridor was served by two different routes, one used during the day and a different one at night. These routes and schedules are presented in Table 5.1.

The operation of this route was subsidized by Tompkins County as part of its operation of the hospital. Under the contract agreement between the City of Ithaca and Tompkins County, the bus operated hourly, with the first run in the morning early enough to accommodate hospital employees. The hospital required that service continue until 11:00 p.m. The bus stopped at the professional building, the Briggs Memorial Building of the hospital, and at the Lakeside Nursing Home. The cost of the service was computed at \$5.32 per trip. The fare was 50¢ for those who rode to the hospital grounds; free transfers to all other routes were available. The county contribution was computed as \$5.32 per trip for 17 trips per day, less farebox income. This agreement was initiated by the hospital as a result of the numerous requests for such service received from city residents. When the service was first initiated, a good number of passengers were served, but during the course of the service the number of regular passengers diminished. At no time were any publicity or marketing efforts made to support the service. After 16 months, the contract was terminated by the county due to the size of the deficit.

In order to determine the amount of the hospital subsidy it was required that ridership records be kept by the bus drivers for the hospital run. Table 5.2 derived from a sample of the trip sheets for the first two weeks of

ROUTE 4: DAYLIGHT HOURS

State and Aurora (South)	6:25 A.M.
Coddington and Hudson	6:30
Coddington and Aurora	6:35
State and Aurora (West)	6:40
State and Cayuga	6:42
Greyhound Terminal (North)	6:46
Lakeside	6:51
Professional Building	6:53
Hospital	7:10
Greyhound Terminal (East)	7:20
State and Aurora (South)	7:25

First bus leaves the principal stops at the times shown and every hour thereafter Monday thru Saturday. Last scheduled trip at 5:25 P.M. SEE ROUTE 5 FOR EVENING SERVICE.

ROUTE 5: EVENING

State and Aurora (East)	6:25 P.M.
Collegetown	6:28
Day Hall	6:31
East Ave. and University Ave.	6:33
Baker Dorms (West Ave.)	6:35
Collegetown	6:37
State and Tioga (West)	6:40
Greyhound Terminal (North)	6:46
Lakeside	6:51
Professional Building	6:53
Hospital	7:10
Greyhound Terminal (East)	7:20
State and Aurora (East)	7:25

First bus leaves the principal stops at the times shown and every hour thereafter Monday thru Saturday. Last scheduled trip at 10:25 P.M. SEE ROUTE 4 FOR DAYTIME SERVICE TO THE HOSPITAL.

TABLE 5.1 - SCHEDULES FOR COMMUNITY TRANSIT HOSPITAL BUS ROUTES

February 1971 gives the average ridership for the hourly runs to the hospital during this period. No record was kept of directional travel. It is assumed that the averages for this period are representative of the averages during the entire period of operation of the hospital run, although ridership may have been generally higher during the initial period of service.

The figures in Table 5.2 show very low ridership overall, plus other significant details. Ridership peaks only in the early afternoon hours, and then only slightly. This indicates that the most significant use of the service was for hospital visiting plus, perhaps, visits to doctors' offices. Lack of a morning peak indicates either total disinterest, lack of awareness, or both by hospital employees. The nearly total lack of passengers during the evening and the low levels on Saturdays indicate that much of the deficit accrued at these times. Even so, the overall ridership was too low to justify a fixed-route service such as this. A lower density system might be considered. In any case, most likely subsidization of such service would be necessary.

In summary, the Community Transit System is owned and operated by the City of Ithaca, and the city provides garage and maintenance services for its own vehicle fleet. Current facilities are inadequate. The CTS provides reasonably good coverage of the City of Ithaca, but offers little or no service outside the city. Both vehicles and routes are poorly designed to serve health care delivery, the elderly, and the handicapped.

5.2 The North-East Transit System

Instituted in September 1974, the North-East Transit System (NET) is a peak-hour commuter bus service connecting the residential areas northeast of Ithaca and Cornell University. Service is provided between 7:30 a.m. and 10:00 a.m. and again between 4:00 p.m. and 5:30 p.m. Monday through Friday. Fare is 30¢ or 20 rides for \$5.00

The system is as present not suited to provide any service other than to commuters to Cornell. While residents of the northeast suburbs could ride NET to Cornell and transfer to CTS for the trip downtown, it is unlikely that this trip would be made. The long wait for a return trip would prohibit any trip to downtown for business requiring only a short period of time. This system is clearly unsuited for health service trips, even for those living in the residential areas it serves.

HOUR	WEEKDAY	SATURDAY	WEEKDAY AND SATURDAY
6:25 A.M.	4.6	3.0	4.3
7:25	4.0	3.0	3.9
8:25	3.4	1.0	3.0
9:25	3.0	1.0	2.6
10:25	3.1	2.0	2.9
11:25	3.8	2.0	3.4
12:25 P.M.	3.5	5.0	3.8
1:25	10.0	5.0	9.0
2:25	8.1	4.0	7.3
3:25	11.9	3.0	10.1
4:25	6.0	3.0	5.4
5:25	3.1	3.0	3.1
6:25	1.8	0.0	1.5
7:25	1.0	0.0	1.4
8:25	1.7	0.0	1.4
9:25	1.6	0.0	1.3
10:25	0.1	0.0	0.1
11:25	0.2	0.0	0.2

TABLE 5.2 - HOSPITAL-BUS RUN, AVERAGE HOURLY RIDERSHIP

5.3 The Cornell Campus Bus Service

The Cornell Campus bus service is provided for the purpose of transporting employees from the University's two peripheral parking lots to their places of employment on campus. The service is free and runs from 6:30 a.m. to 7:00 with varying headways. All of the maintenance work for the Cornell buses is performed at Cornell's bus garage. The garage is only four years old and is situated on the campus.

Like the North-East Transit System, the Cornell Campus bus service is a commuter- (and student, in this case) oriented service. Hence, it has little applicability to serving the elderly and handicapped, or in providing accessibility to health services within the county.

5.4 Ithaca School District Bus System

The Ithaca School District bus system is the largest bus operator in Tompkins County. It employs fifty-three drivers and six maintenance workers and it owns and operates sixty-four buses and other vehicles. The network of bus routes throughout the district is both extensive and intensive, but as is the case with most school bus systems, it is used only in the morning and mid-afternoon hours. Their garage is presently underutilized. In addition, the location of the garage forces all of the buses to pass through the most congested and dangerous intersection in the area on their way to and from their assigned routes.

5.5 Other School Districts

The other school districts in the county - Dryden, Groton, Lansing, Newfield and Trumansburg - also provide bus service, though not at the level of the Ithaca school district. It is interesting to note that each of these has a maintenance garage and a maintenance crew. Trumansburg's garage is located at the school. It was built in 1934 and is capable of handling one bus at a time. It has two employees on its maintenance staff. Groton's garage has had additions made to it in 1958 and 1969. They employ one full-time and one part-time mechanic. Newfield's garage was built at the school in 1940. They do all work except for body work. Only one mechanic is employed there. Lansing's bus garage is thirteen years old. They employ one full-time and one part-time mechanic. Like most of the garages, hardly any work is contracted out. Dryden also has its own garage.

5.6 Airport Limousine

One essential need of any public transportation system is to try to coordinate its routes with other transportation services. The airport limousine service provides this coordination by meeting every arrival flight, and, by appointment, departing passengers will be transported to the airport. They use three mini-buses to provide this service.

5.7 Automobile Dealer's Courtesy Cars

Eight of the car dealers in Tompkins County provide transportation service for their service customers. The routes covered by the dealers usually have Cornell as a destination, though some do go to downtown Ithaca and Ithaca College. It should be noted that the vehicles used for this service are utilized for other business-related purposes throughout the day.

5.8 Taxi Service

The City of Ithaca is served by three taxi-cab operators, varying in size from three to nine vehicles with a total of 97 seats. The operators handle approximately 800 calls per day and travel over one million miles per year. No data are available on trip purposes, however; the percentage of these trips that are health-related is unknown. The fare structure is set by the City of Ithaca. There is a 75¢ base fare, plus 25¢ for every zone-line crossed. Zone-lines are Meadow Street, Buffalo Street, and Stewart Avenue. An additional 60¢ charge is assessed for every mile travelled beyond the city limits.

Taxi service eliminates many of the problems of conventional bus service. Service is door-to-door, private, and comfortable. However, because typical fares are two to three dollars for a round trip - and as much as five dollars to the hospital from the City of Ithaca - costs are much higher. This presents a problem to those with limited incomes and may be a serious limitation of taxi use.

5.9 Alpha House

Alpha House, a drug rehabilitation center, provides regular transportation service for its residents to Tompkins Cortland Community College, Ithaca High School, and Cornell University. It also supplies service on demand for necessary

trips for legal and medical purposes. This amounts to approximately five regular riders per day. They own a van, a station wagon, and a car. The condition of these vehicles was described as old but good. The vehicles are driven by staff.

Although Alpha House is already operating at full capacity and is therefore not limited by the present inadequacies of bus service, they felt that their clientele should be getting better service. This would allow staff to devote more time to necessary responsibilities. Alpha House residents were described as requiring no special equipment for public transportation.

5.10 Day Care and Child Development Council

Through the outreach program of the Day Care and Child Development Council, various transportation services are provided for bringing people from Dryden and Groton into Ithaca. This amounts to about seventy people per week. Private cars are used and the drivers are reimbursed accordingly. However, even those involved realize how inadequate the present services are in comparison to the needs of parents with pre-school children. Specifically noted were preventive child health care conferences held by the Health Department. Unfortunately, many cannot take advantage of these programs because of inadequate transportation. Providing the present level of service is a major problem. Their money comes from the UNITED Way. They do not feel it would be appropriate to use this money to subsidize public service which would replace the service they are presently giving.

5.11 FISH

FISH is a volunteer social service organization whose major activity is the provision of rides for those with no other means of transportation. Its primary financing is a subsidy from the United Giver's Fund; private donations are also received. Only the telephone service expenses are financed through the above services. The drivers are unpaid volunteers who use their own personal vehicles and gasoline.

A prospective user calls the FISH phone and makes his request, giving origin, destination, and date and time he wishes to be transported. The FISH volunteer who is at the phone will then look for a volunteer to fill the request. The requests are usually made a day or more in advance of the time of the ride, but many are received on the same day. The requests cannot always be met -- volunteers may not be available on the particular day.

FISH will not provide regular daily service. For example, a person may receive a ride from FISH to Meadow House if he visits there occasionally, but he will not be driven there daily if he is a regular patient.

For this research, the records of FISH transportation requests for the entire year of 1973 were obtained. For that year, there are records of 663 ride requests made by 288 individuals. This is not an absolutely complete record, but is believed to contain at least 90% of all such requests. Of the total number of requests, 318 were for health purposes; rides to the hospital, doctors' offices, mental health and other health clinics. Nearly all of the non-health requests were concerned with other social services (legal aid, for instance), or shopping trips. In addition, one of the most frequently occurring trip ends was Storefront, a general service organization for low income people. This, together with the nature of the FISH organization, would indicate that the major users of the ride services are the transit-dependent poor and infirm.

The greatest concentration of both productions and attraction for health trips is, as expected, in the downtown Ithaca area. Additionally, the hospital zone and the zone encompassing the Trumansburg Road are the largest single attractors of health trips. The number of health trip productions from the downtown area, where public transit service exists, leads to two conclusions:

- a) there are many transit dependents for whom conventional bus service is unsuitable;
- b) there is a necessity for public transportation to serve the Trumansburg Road corridor.

The records indicate a small number of productions from outlying zones. The demand from these areas is quite small. It must be noted, however, that the users of the FISH service do not represent the entire transit-dependent population. There are, undoubtedly, many who are unaware of the existence of the service or who will not use the service because of its "charity organization" nature.

5.12 Greater Ithaca Activity Center

Transportation is a big part of the Greater Ithaca Activity Center's functions. With their van they provide flexible service depending upon the activity schedule. On

the average twenty people use the service every day. Their source of income is the UNITED Way and the City of Ithaca.

5.13 Lakeside Nursing Home

The Lakeside Nursing Home provides service on demand to its clientele. They use their employee's cars. Therefore, their service is limited by staff availability and the capacity of their cars. Their revenue is from fees collected and monies received through Medicaid. This money can be used to subsidize necessary transportation services. One explicit advantage to Lakeside if public transportation is provided is that it would help them in their efforts to normalize the lives of their clientele by forcing them to interact directly with the rest of the community.

5.14 Oak Hill Nursing Home

The Oak Hill Nursing Home provides transportation to doctors' offices. (Ambulances are used when necessary. This is paid for by Medicare and Medicaid.) They use staff members' cars which are driven by six volunteers. In addition, they use the Red Cross cars when they are available and the facilities of FISH. Like Lakeside, they felt that if their transit needs were provided by a full-time operator they could concentrate on their primary functions.

5.15 Transportation Service Provided by the Red Cross

The Red Cross of Ithaca provides free transportation to those who have special needs. People can call the Red Cross office and request transportation for a specific trip. No regular service is provided, however. Because of financial and equipment constraints (a single station wagon is available), the Red Cross limits use of this service to people in need of medical attention or other necessary services. Transportation for social or recreational trips is not provided.

The Red Cross has not actively promoted this transit service among the disadvantaged, as it is something of a secondary concern to them. Red Cross officials strongly advocate the use of station wagons rather than vans or mini-buses with special equipment for the less mobile passengers. They believe that the physically handicapped feel more comfortable with the personalized service made possible with an automobile. In addition, more vehicles can be purchased on a fixed budget if automobiles are used in place of vans.

5.16 Reconstruction Home Van Service

Table 5.3 contains a record of the van ridership for January to October 1974. Most trips occur between 9:00 a.m. and 11:00 a.m. and in the early afternoon.

The Reconstruction Home is a private non-profit extended-care facility offering rehabilitative services for the handicapped. Patients are of all ages with the elderly representing a majority. The Home has a passenger van available for the personal transport of its residents on their demand. The bus is only to be used for medical necessity and essential activities; however, the superintendent of the Home defines essential services as "those activities as close to normal as their (patients') physical conditions will permit." Thus, shopping and recreation trips are included.

The van is driven by a full-time maintenance man at the Home. Approximately 3 trips per day are made. For medical or dental purpose trips usually only one passenger is carried; two or three are often carried on shopping trips. The Home estimates the van expense to be \$12 per trip which must be met by the passengers on a shared basis. That is, if one passenger makes a trip it will cost him \$12, if two make a trip it will cost \$6 each, etc. If a trip is made for medical purposes, the patient's Medicare covers the cost. This coverage is, of course, not available for other trip types and the high fare is often prohibitive. In such cases a patient may call on friends or relatives for a ride or may simply not go.

5.17 Southside Community Center

The Southside Community Center owns one Volkswagon bus that is used to serve about sixty people per week. The service is totally random because it depends on the activities provided during that week. The money for this transportation service comes from the United Fund. Though more buses would allow more children to participate in activities, they are happier with the status quo. The reason given for this was the relative independence from outside agencies in scheduling activities.

5.18 Challenge Industries

Challenge Industries is involved in operating a "thrift store" that sells miscellaneous items at discount prices. Employment for the handicapped operating this store and also in gathering the items sold is the major purpose of this agency. Challenge Industries provides transportation to these employees for work purposes. Vehicles used include a 50-passenger coach, a 15-passenger van and a station wagon.

Reconstruction Home Van Service
Ridership Between January and October 1974

Medical Trips

8-9 AM	9-10 AM	10-11 AM	11-12 AM	12-1 PM	1-2 PM	2-3 PM	3-5 PM
1	23	14	7	4	42	9	5

81

Other Trips

Shopping: 8

Recreational: 44

Group activity at other homes: 26

Other: 9

Table 5.3

As in the case of the Reconstruction Home van, Challenge Industries' vehicles are often under-utilized. Again, the possibility of including these in an organized system arises.

5.19 Special Children's Center

The Special Children's Center serves the mentally and physically retarded and handicapped of all ages in Tompkins, Cortland, Tioga, Schuyler and Seneca Counties. They have four twenty-passenger buses that run four routes in the morning and evening. Their money comes from the United Way, Mental Health Association and two Appalachia Regional Commission Funds. It would be legal for their funds to be transferred to other operators for providing transportation service. Though its present transportation service is adequate, they would prefer not having this responsibility due to the necessary time commitment and strain on the Special Children's Center budget.

5.20 Tompkins County Social Service Department

The Tompkins County Social Service Department has fifteen staff automobiles which are occasionally used for transportation in emergency situations.

5.21 Charter Services

Many of the organizations interviewed made mention of activities that required bus chartering. Basically, there are three services offering buses for this purpose. They are:

- a) Crispell Charter Service;
- b) Swarthout and Ferris;
- c) Charter Service available from the Snyder Hill Baptist Church.

5.22 Summary

In an effort to concisely present all the relevant information about these services the following matrix was prepared. For each of the operators, the following information is given:

- a) The name of the system.
- b) The physical property owned or presently being used by the operator. This includes rolling stock and garages where it is relevant.

- c) The objectives of the system, an evaluation of why the service is presently being provided.
- d) The means of fulfilling the objectives - a description of the present service in relation to the objectives listed above.
- e) An evaluation of the means of fulfilling the objectives. This is done with respect to the objectives of the system and the attitudes of the operators of the system.

The complete matrix follows on the next pages. (Table 5.4)

TABLE 5.4 - TRANSPORTATION SERVICE INVENTORY

Name of System	COMMUNITY TRANSIT SYSTEM (City of Ithaca)	CORNELL CAMPUS BUS SERVICE	ITHACA SCHOOL DISTRICT BUS SYSTEM	NORTHEAST TRANSIT SYSTEM	LANSING SCHOOL DISTRICT BUS SYSTEM
Physical Property	1 Garage (New one being requested) 7 Buses Shelters (More being requested)	15 buses 1 Garage Shelters	1 Garage 55 Buses 2 Station Wagons	3 Buses (additional available from Swarthout and Ferris) 1 Garage (owned by Swarthout and Ferris)	1 Garage 18 Buses
Objectives of the System	To supply public transportation to the people of the City of Ithaca To bring County people to business and services in the City To eliminate congestion from Downtown Ithaca	Bring University employees from Parking Lots to Day Hall Provide Charter buses for field trips Provide on-campus transportation to students and employees	Provide the legally required transportation for school children to and from the public schools Provide buses for public school charters To run special services for federally sponsored programs	Connect residential areas in South Lansing to the Cornell Campus as shown in the O-D survey. Provide housing alternatives for Cornell students	(See Ithaca School District Objectives)
Means of Fulfilling Objectives	Operates five routes 6 days a week in and around the City of Ithaca and into Cayuga Heights, Forest Home and Ithaca College	One route through campus with 15 stops; Runs Monday to Friday - 6:30AM to 7:00 PM. Connects parking lots A and B to Day Hall. Provides buses for charter	Runs 55 routes plus additional routes for special programs in the morning and afternoon to all sectors of the School District	Runs 3 routes in the morning and afternoon and one at midday Stops at 10 different residential areas and can be flagged down along the route	18 routes to serve the school district (like the Ithaca School System)
Evaluation of Means	No facilities for elderly or handicapped No evening service Increasing losses (even with increasing ridership) Service is not as well known as it should be Does a limited job of bringing people to the city from outlying townships Runs too infrequently to be considered convenient	System overloaded with students Places further administrative demands on the University to operate a bus system Runs are overcrowded No night service causes a parking problem on campus at night	Could be more cost efficient - sharing administrative costs - increased purchasing power - improved maintenance performance Poor location of garage	(Probably to soon to evaluate) Rolling stock should be of better quality	(See Ithaca School District Bus System)

Name of System	Dryden School District Bus System	Groton School District Bus System	Newfield School District Bus System	Trumansburg School District Bus System	Automobile Dealership Courtesy Buses
Physical Property	1 Garage 33 Buses	1 Garage 18 Buses	1 Garage 19 Buses	1 Garage 23 Buses	Vans and cars available from the dealers Garage facilities of the dealer
Objectives of the System	Provide the legally required transportation for school children to and from the public schools. Provide buses for public schools charters				Service for customers Advertising of business Public relations Increased service business
Means of Fulfilling Objectives	Operate 24 routes throughout the district Provide buses for charter	Operates 18 routes throughout the district Provides buses for charter	Operates 17 routes throughout the district Provide buses for charter	Operates 20 routes throughout the district Provides buses for charter	Provide individual morning and afternoon runs from the garage to Cornell and/or downtown Ithaca or Ithaca College and back
Evaluation of Means	Could be more cost efficient as in the case of the School District of Ithaca.				Service is limited in area served and frequency of service Not coordinated with other modes of transportation Further responsibility for the dealership

Name of System	Airport Limousine	Alpha House	Day Care and Child Development	FISH	GIAC
Physical Property	3 mini-buses	1 Van 1 Station Wagon 1 Automobile	Use private cars of staff and volunteers	Use private cars of volunteers	1 Van
Objectives of the System	To provide transportation to and from the airport and areas in the urbanized area of Ithaca	To provide regular transportation for residents to and from TC3, Ithaca HS, and Cornell. Also service on demand for court hearings and medical examinations	In their Outreach Program provide means for parents to attend meetings and day care access Transportation to GIAC twice a week	Provide service on demand for the transportationally disadvantaged - elderly, welfare recipients	Service for special field trips and other general services related to the center
Means of Fulfilling Objectives	Meet every flight that comes into the airport Takes reservations to take passengers to airport	Staff drives the vehicles for the required trips	Staff and volunteers drive cars and are reimbursed latter	Volunteers are contacted by a central dispatcher who takes phone calls	Staff and others drive vehicles when needed
Evaluation of Means	(no information available as to quality of service)	It is a drain on the time and energy resources of the staff Takes away from service they need to provide	Major hassle Limits demand for their services - especially for mothers without cars who want to attend meetings.	Successful in providing a personal touch to the service Supply of drivers varies considerably as does the demand for service	Provides flexibility in providing activities Like status quo - gives them freedom to plan program

Name of System	Lakeside Nursing Home	Oak Hill Nursing Home	Reconstruction Home	Tompkins Co. Red Cross	Senior Citizens Service
Physical Property	Employees' cars	Employees' cars	2 Vans	1 Station wagon volunteer's private cars (In the process of applying for funds for more station wagons)	No service provided at this time
Objectives of the System	To provide service on demand for clientele	Service for residents to downtown and medical facilities	Service for clientele for medical purposes and for group activities	Fill in the gaps in transportation left by other ser- vices in the County	(Not applicable)
Means of Fulfilling Objectives	Try to match demand and staff availab- ility and car capacity	Use volunteers to drive vehicles when needed	Have 2 full time staff to drive vans	Have an on call service system	(Not applicable)
Evaluation of Means	Service is inadequate Would prefer if residents could use public services because it would help to normalize their lives if they are in contact with the rest of society	Service inadequate Hassle to get the needed volunteers	No major complaints	Takes time from other services	(Not applicable)

Name of System	Southside Community Center	Special Children's Center	Tompkins County Social Service Department	Challenge Industries	Taxi
Physical Property	1 VW Bus	4 Buses (20 passenger)	15 automobiles - also used for other staff purposes	(rent all buses)	18 Automobiles
Objectives of the System	Emergency Service To transport children from the Center to activities	Brings mentally retarded and multiple handicapped from the 5 County area to BOCES, Challenge Industries, Meadow House	Emergency only transportation for clients	Transportation of Handicapped	To provide demand-responsive transportation in and around Ithaca
Means of Fulfilling Objectives	Director or Assistant Director drives bus for all activities	Four routes in the morning and afternoon through the five County area	When an emergency happens they respond	Run routes in the Ithaca area	Operates 7 days/week ∞ ∞
Evaluation of Means	Like the flexibility Level of service is inadequate	Many children are not presently served Budget constraints on present service Would prefer that a professional full-time transit operator provided the service	Limited service Demonstrates need for more public transportation service	Would rather not have the responsibility	A very flexible mode of transportation, but very expensive.

6. ACCESSIBILITY TO HEALTH SERVICES: APPLICATION OF THE PLANNING PROCESS

6.1 Inventory of Existing Health Services

6.1.1 Physicians and Dentists

In Tompkins County, there are 20 primary care physicians (general practitioners), 67 secondary physicians (specialists), and 45 dentists. The locations of these physicians are summarized in Table 6.1. The Speech and Hearing Clinic at Ithaca College is considered a secondary care center. The concentration of physicians in the Ithaca area is clear. All of the specialists, 40 of the 45 dentists, and 9 of the 20 primary care physicians are located within the Town and City of Ithaca. Twenty-three doctors are located in the professional building adjacent to Tompkins County Hospital on the Trumansburg Road.

A recent survey by ALPHA (Areawide and Local Planning for Health Action, Inc.) is of interest. The survey was conducted among residents of the Towns of Caroline, Danby, and Newfield. Table 6.1 indicates that one primary care physician practices in Newfield, while Danby and Caroline have no practicing physicians or dentists. The survey results indicate that 44.7% of the respondents must travel 21 to 40 minutes to receive medical care, and 5.5% more than 40 minutes. However, only 2 of the 255 respondents indicated that the travel time involved has prevented them from receiving more medical care. (Residents of these outlying towns are required to travel long distances for many services and possibly are accustomed to long travel times.) Finally, a cross-tabulation of total physician contacts and travel time indicates no correlation; the frequency distribution of visits to physicians' offices is similar for each travel-time interval.

The medical services provided by physicians are typically not of an emergency nature. Specialists usually treat patients who have been referred to them by a primary care physician and normally require advance appointments. Primary care physicians and dentists also see the majority of their patients by appointments; however, some patients may require more urgent attention and are treated without appointments.

Because of the nature of the health services provided, the demand for transportation to physicians' and dentists' offices is typically known well in advance. Individuals with appointments have ample opportunity to plan their trip to the office. The travel time involved is usually not critical. Therefore, conventional public transit (fixed-route bus service,

PRIMARY CARE PHYSICIANS (20)

Ithaca		9
Downtown	7	
Community Corners	1	
Professional Building	1	
Brooktondale		1
Dryden		3
Groton		2
Ludlowville		1
McLean		1
Newfield		1
Trumansburg		2

SECONDARY CARE PHYSICIANS (67)

Ithaca		67
Downtown	29	
Professional Building	22	
821 Cliff Street	5	
Hospital	6	
Cayuga Heights	5	

DENTISTS (45)

Ithaca		40
Downtown	31	
Professional Building	4	
Community Corners	3	
Rest of Cayuga Heights	2	
Dryden	1	
Groton	1	
Spencer	1	
Trumansburg	2	

TABLE 6.1 - LOCATIONS OF TOMPKINS COUNTY PHYSICIANS AND DENTISTS

for example) may prove adequate. However, several problems are apparent. The routes of the transit system must be located within reasonable proximity of both the patient's home and the physician's office. The schedule of the transit service must prevent long waiting times, especially waiting times at bus stops. Finally, the physical design of the transit vehicles must be convenient for the patients, including the elderly and handicapped who constitute a significant portion of the demand for health services.

6.1.2 Tompkins County Hospital

Tompkins County Hospital is a general hospital providing care for every kind of general medical need. Patients are of all ages, infancy through old age. The hospital, located on the Trumansburg Road approximately 4 miles from downtown Ithaca, is part of a campus of health facilities. The location of the hospital and all major health service facilities is presented in Figure 6.1.

Patients may be classified according to the nature of the service they receive: patients who are admitted by previous arrangement, out-patients who visit the hospital regularly, and emergency patients. Outpatients and those whose admittance has been previously arranged could be served by public transit, providing the nature and seriousness of their illness does not require highly specialized care. Tompkins County Hospital maintains 211 beds and has an average occupancy rate of 70%. Some 25 to 30 outpatients travel to the hospital daily, as do approximately 150 hospital visitors. Emergency patients are best served by ambulances; public transit is clearly inappropriate.

The hospital employs between 600 and 700 people. Among these are 400 nurses who work in 3 shifts (7:00 a.m. to 3:00 p.m., 3:00 p.m. to 11:00 p.m., and 11:00 p.m. to 7:00 a.m.) and other technical and administrative staff. Many of the nurses are housed in a dormitory on the hospital grounds. Approximately 400 employees arrive for work at the hospital between 7:00 a.m. and 9:00 a.m. These employees come from many origins, including several outside the county. Additionally, most of the county's physicians visit the hospital daily.

Thus, the hospital is a major trip generator and attractor throughout the day. There are, in general, three peak hospital travel periods according to a 1969 Highway Research Board study. These are 7:00 to 9:00 a.m., 2:00 to 4:00 p.m., and 7:00 to 8:00 p.m. The same patterns hold for Tompkins County Hospital. The early afternoon and early evening peak visiting hours account for the early start of the afternoon peak and the 7:00 to 8:00 p.m. peak. Virtually all hospital trips are made by automobile as there is no public

Figure 6-1. Long-Term Care Facilities

1. Ithacare	7. Hospital (C-2)
2. McGraw House	8. County Home (Trumansburg)
3. Reconstruction Home	9. BOCES
4. Oak Hill Manor	10. Challenge Industries
5. Lakeside	11. Meadow House
6. Odd Fellows	

transit available for the hospital trip (past service will be discussed subsequently). In addition, the hospital is located in an area of low population density. The HRB report found that taxis account for less than 2% of all hospital tripmaking nationally.

6.1.3 Long-Term Health Care Facilities

There are eight long-term health care facilities in Tompkins County, all located within the Town of Ithaca (Figure 1). The services provided by these facilities are of three types. First, nursing homes provide extended health care to those in need of continued professional medical attention, but whose illnesses do not require hospitalization. Residents are often bed-ridden and therefore constitute a low travel demand group. Secondly, rehabilitation centers provide specialized therapy for those recovering from debilitating illnesses or injuries. Patients in these facilities may be bed-ridden, confined to wheelchairs, or may be relatively mobile. Finally, adult homes provide care for the elderly who can no longer easily care for themselves. Residents of these homes typically have no serious physical limitations; they often have minor handicaps, however. Table 6.2 presents the size and type of care provided by each of the long-term health care facilities within Tompkins County.

The residents of all extended care facilities have a common problem in their dependence on others for their transportation needs. Rides from friends and relatives are the usual means of travel. These rides are not always available and the residents are dependent upon public transportation which may be unsuited for their needs. Because of these limitations, a great number of potential trips by the residents are simply not made.

6.1.4 Other Health Services

Two family health care centers have been opened in the past year. One is located on the grounds of Tompkins County Hospital, the other adjacent to the Triphammer Shopping Center. Both are intended to serve as primary care facilities with the purpose of diverting unnecessary trips to the hospital emergency room by persons with no family doctor. The center at Triphammer serves the health care needs of the rural areas in the east and northeast sections of the county. It consists of four examination and two consulting rooms as well as a laboratory and X-ray facility. Two teams, each consisting of a physician, a physician's associate, a licensed practical nurse, and a secretary

FACILITY	TYPE	NUMBER OF BEDS
Hospital C-2 Wing	NH	25
Lakeside	NH	160
	HR	100
Oak Hill Manor	NH	60
	AH	14
Reconstruction Home	HR	72
Odd Fellows	NH	31
	HR	36
County Home	AH	91
Ithacare	AH	81
McGraw House	AH	10

Type Code: NH Nursing Home
 HR Health Related (Rehabilitation)
 AH Adult Home

TABLE 6.2 - TOMPKINS COUNTY LONG-TERM CARE FACILITIES

staff each center. These facilities have the capacity to serve approximately 50 patients daily.

The transportation required by patients of the family health care centers varies with the nature of their problem. Emergency patients are best served by ambulance. Patients with less critical problems could be served by public transportation.

6.2 Estimation of Demand for Public Transportation to Health Services

The United States Census provides data that are helpful in estimating demand for public transportation to health services. Two segments of the population that typically need more medical attention than other groups are the handicapped and the elderly. These groups are also less likely to have easy access to an automobile and therefore are potential users of a public transit service.

Table 6.3 presents a tabulation of data from the 1970 U.S. Census. The largest concentration of elderly persons is found in the City of Ithaca. The City and Town of Ithaca together have more than half (56%) of the elderly population of the county. Other towns with large numbers of elderly residents are Groton and Dryden. Table 6.4 shows the distribution of the handicapped population in the county. Again, the City and Town of Ithaca show large numbers of the handicapped; Groton and Dryden also have significant numbers.

Residents of towns other than Ithaca (including approximately 44% of the elderly and 53% of the handicapped) are without any public transportation service. The level of demand for transportation service in these areas is undoubtedly quite low. Indeed, the total demand for transportation for all purposes is quite small because of the low population densities. However, because of the vital nature of health-service delivery, the transportation-disadvantaged in outlying areas are of special concern.

Two of the extended-care facilities, Ithacare and Oak Hill Manor Nursing Home, keep records of their residents' travel patterns. Table 6.5 presents the Ithacare travel records for the period between September 26 and October 28, 1974. The high levels of tripmaking suggest that residents of this adult home continue to enjoy relatively active lives. Ithacare, together with the other adult homes in the county, represents an important source of travel demand in a low-demand density area.

MCD or Village	No. of Elderly	% of Eld. Population	Total Pop.	% of Total Pop.
Caroline Town	193	3.39	2,536	7.61
Danby Town	117	2.06	2,141	5.46
Dryden Town	613	10.77	9,770	6.27
Dryden Village	149*	2.62	1,490*	10.00
Freeville Village	51*	.90	664*	7.68
Enfield Town	138	2.42	2,028	6.80
Groton Town	486	8.54	4,881	9.96
Groton Village	278*	4.88	2,112*	13.16
Ithaca City	2,298	40.37	26,226	8.76
Ithaca Town	886	15.56	15,620	5.67
Cayuga Hgts.	261*	4.58	3,130*	8.34
E. Cayuga Hgts.	63*	1.11	2,611*	2.41
Lansing Town	325	5.71	5,972	5.44
Newfield Town	236	4.15	3,390	6.96
Ulysses Town	401	7.04	4,315	9.29
Trumansburg Vill.	164*	2.88	1,618*	10.14
TOTALS	5,693	100.00	76,879	7.41

* Population Included in MCD

Table 6.3
ELDERLY POPULATION, 65 AND OVER

Town	Total No. Handicapped	% of Hand. Pop.	% of Total Pop.	Handicapped or Disabled	
				Employed	Unemployed
Caroline	61	1.89	2.41	39	0
Danby	94	2.91	4.39	60	0
Dryden	476	14.76	4.87	220	21
Enfield	191	5.92	9.42	110	0
Groton	392	12.15	8.03	196	0
Ithaca City	1,029	31.90	3.92	546	53
Ithaca Town	488	15.13	3.12	304	0
Lansing	132	4.09	2.21	94	0
Newfield	236	7.32	6.96	129	0
Ulysses	127	3.94	2.94	67	0
TOTALS	3,226	100.00	4.20	1,765	74

Table 6.4
HANDICAPPED POPULATION, AGE 16 - 64

Ithacare Residents -
Trips During the Period Between
September 26 and October 28, 1974

Day Destination	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Weekday Total	Weekend Total
Medical	7	2	7	4	9	0	0	29	0
Shopping	3	19	14	5	9	1	3	50	4
Social	7	10	19	13	8	1	35	57	36
Personal Business	0	0	2	3	1	2	1	6	3
Unspecified	21	9	8	29	35	27	20	<u>102</u>	<u>47</u>
								244	90

Table 6.5
DAY OF WEEK VS. DESTINATION PURPOSE

Table 6.6 presents travel records of Oak Hill Manor residents for the 5-month period between July and November 1974. The few trips recorded reflect the predominance of nursing home residents at Oak Hill Manor (60 nursing home residents and 14 adult home residents). The less mobile residents do not represent an important travel demand. It would appear, because of the low numbers of trips made by residents of the Reconstruction Home and Oak Hill Manor, that the adult homes (Ithacare, the County Home and McGraw House) constitute the largest trip origins among the extended care facilities. Because of its size (260 total beds) Lakeside Nursing Home may also be an important origin.

Three characteristics of the demand for health service transportation in Tompkins County are evident. First, the level of demand is quite low; second, the origins of this demand are diffused throughout the county with few, if any, concentrations; finally, little peaking occurs, as health service trips are distributed throughout the day. These characteristics are most important in the design of an appropriate health-care delivery system.

6.3 Evaluation of Alternative Systems

Three alternative systems would appear most appropriate in a small urban area application. The first is conventional fixed route, fixed schedule bus service. This type of system is presently found within the City of Ithaca and in many other small communities. However, the use of conventional bus service as a health-service delivery system has several drawbacks. Such a system cannot operate without heavy financial losses because of the extreme low density of health-related travel demand in Tompkins County. Because the service area of such a system is limited to a narrow zone around each bus route, the provision of area-wide service would be extremely costly. In areas where such a system is feasible because of a higher demand for non-health trips, the system is unsuited for use by the infirm elderly, the handicapped, and other groups likely to require public transportation.

A second possible system is fixed-route charter operation, providing service at specific times and in specific areas only. Such a system is potentially appropriate in serving large groups of people from the long-term care facilities in the county. Trips between facilities and to various group activities would be served. Such a system would not serve a large part of the health-related trips in the county. Low density areas and time periods would not

Oak Hill Manor
Trips by Residents Between
July and November 1974

Day Departure Time	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Weekday Total	Weekend Total
Before 10:00 AM	0	0	0	1	1	2	0	2	2
10 - 12 AM	2	4	2	1	5	7	11	14	18
12 - 2 PM	2	7	10	0	2	10	11	21	21
2 - 4 PM	2	4	5	6	5	4	7	22	11
4 - 6 PM	1	0	1	1	8	3	2	11	5
6 - 8 PM	0	0	0	0	0	0	0	0	0
After 8:00 PM	0	0	0	0	2	0	0	<u>2</u>	<u>0</u>
								72	57

Table 6.6
DAY OF WEEK VS. TIME OF DEPARTURE

be included. As a result, rural areas in the county would receive no service, and all areas would enjoy service during very limited periods of the day.

Finally, some type of demand-responsive system is considered. Such a system eliminates many of the undesirable service characteristics of conventional or charter bus operations. The system responds to individual demands within a specified service area. The extreme flexibility of such a system makes it an attractive alternative. Small buses, vans, or automobiles can be used, depending on expected demand levels. Modifications of the vehicles to accommodate the physically handicapped are possible. The existing taxi systems in Ithaca provide essentially demand-responsive service. Their fares are comparatively high, however, and are not typical of public transportation fares.

A more detailed consideration of the alternative systems is presented in Task 4 of this project. Analysis of operating costs, service characteristics, and operational experience is presented.

6.4 Design of System

A system designed exclusively for health care delivery in Tompkins County is likely to experience a very low level of ridership. The small and widely-scattered demand for such a system would result in inefficiencies in operation. However, it is anticipated that the service characteristics required for a transportation system for the handicapped will be similar to those required here. Therefore, a single system intended to serve both types of demand is discussed in Sections 7 and 9.

7. DESIGN OF TRANSPORTATION SERVICE AND FACILITIES FOR
THE DISADVANTAGED: APPLICATION OF THE PLANNING PROCESS

7.1 Identification of Target Populations

7.1.1 Residential Patterns

The United States Census provides data that are helpful in locating target populations within the county. Table 6.3 presents a tabulation of data from the 1970 Census. The largest concentration of elderly persons is found in the City of Ithaca. The City and Town of Ithaca together have more than half (56%) of the elderly residents of the county. Other towns with large numbers of elderly residents are Groton and Dryden. Table 6.4 shows the distribution of the handicapped population in the county. The City and Town of Ithaca again dominate, while Groton and Dryden also have significant numbers.

Unemployment data obtained from the Census are presented in Table 7.1. A list of major employers in Tompkins County, provided by the County Chamber of Commerce, is presented in Table 7.2. The unemployment data obtained from the Census are now several years out of date; the overall unemployment rate is presently substantially higher than the 3.11% in 1970. However, it is assumed that the distribution of the unemployment remains similar.

7.1.2 Special Facilities for the Training of the Physically
and Mentally Handicapped

There are several special centers in Tompkins County for the physically and mentally handicapped. The clients of these centers generally live at home and are transported to and from the centers daily. However, not all of the patients are treated on a regular basis, but are occasional visitors.

The Special Children's Center trains children from Tompkins, Cortland, Schuyler and Tioga counties who are handicapped by cerebral palsy, brain injury, physical disabilities, or mental retardation. The Center operates during regular school hours.

Challenge Industries, Inc. is a vocational rehabilitation workshop which serves adolescents and adults having physical, mental, or social handicaps, and who have potential for employment in the competitive labor market or within the workshop. Challenge Industries is located on East State Street in Ithaca.

Town	Total in Labor Force	Total Unemployed	% of Unemp. Pop.	% of Labor Force
Caroline	1,070	9	.91	.84
Danby	886	26	2.62	2.93
Dryden	4,301	133	13.38	3.09
Enfield	868	35	3.52	4.03
Groton	1,943	61	6.14	3.14
Ithaca City	10,821	430	43.26	3.97
Ithaca Town	6,387	117	11.77	1.83
Lansing	2,548	101	10.16	3.96
Newfield	1,403	64	6.44	4.56
Ulysses	<u>1,750</u>	<u>18</u>	<u>1.81</u>	<u>1.03</u>
TOTAL	31,977	994	100.00	29.48

Table 7.1 - Unemployed Population 16 Years and Older

* These figures taken from the 1970 census may have changed substantially over the last four years, but present distribution is assumed similar.

Employer (over 100)	Number Employed
Babcock Industries	220
T.C. Hospital Area	743
Ithaca School District *	600
Ithaca Gun *	500
Ithaco *	165
Downtown (detailed below)	1,145
Morse Chain *	1,540
NCR *	1,285
Cornell *	7,300
Therm *	150
Ithaca College *	970
NYSE & G	500
T.C. Community College	114
Smith-Corona	1,000

* Given on map as "Ithaca"

Downtown Employers in Detail	
First Nat'l. of Ithaca	119
Tompkins County Trust	130
New York Telephone	220
Rothschild's	135
Woolworths	106
City of Ithaca	30
Tompkins County	405

Table 7.2 - List of Major Employers in Tompkins County (1974)

Meadow House is a rehabilitation center for emotionally disturbed, mentally retarded, and physically handicapped adults and is primarily concerned with the individuals motivation and social adjustment. A work activities program is conducted in cooperation with Challenge Industries; many individuals are clients of both facilities. Meadow House is located on the west side of the City of Ithaca.

The Board of Cooperative Educational Services of Tompkins-Seneca-Tioga Counties (BOCES) provides, among other services, special education for emotionally disturbed and mentally or physically handicapped children. BOCES is located on Warren Road in the Town of Ithaca, northeast of the City of Ithaca.

7.2 The Nature and Level of Demand for Public Transportation

Two distinct types of demand for transportation by the disadvantaged may be clearly identified. First, many trips are made on a regular basis to rehabilitation centers. These trips typically occur at the same times every day and are easily scheduled in advance. A second type of demand is the travel of the disadvantaged to other destinations. These trips may occur at any time of the day between numerous origins and destinations and are less easily scheduled in advance.⁴⁵

Existing transportation to BOCES and the Special Children's Center serves regularly made trips with essentially fixed-route, fixed-schedule systems. Any service for the unemployed to employment centers might also be of this nature. Other trips by residents of rural areas or of the several rehabilitation homes are not so easily served. These trips - shopping, social, recreational, etc. - occur irregularly and less frequently.

The total demand for public transportation by the disadvantaged is relatively low. The demand by all segments of the population in rural areas is small because of the low residential densities. In the City of Ithaca, demand by the disadvantaged is higher because of the large number of disadvantaged residents. However, this demand is less significant in comparison with the total demand for public transportation within the city.

7.3 Evaluation of Alternative Systems

Several efforts to improve transportation service to the disadvantaged are summarized here. The results of these efforts provide valuable input into the evaluation process in terms of ridership, service quality, and costs.

7.3.1 YMCA Senior Citizens Mobile Service: Chicago, Illinois

This demonstration and research project was conducted in Chicago from September, 1966 through November, 1969. Two thousand, five hundred sixty-five different senior citizens benefited from transportation provided by the project. The primary transport vehicle was a seven-passenger mini-bus selected for ease of entry and exit, compared to station wagons, etc. The first unit travelled 59,400 miles during the project period. The second van travelled 2,250 miles from February 1969 to November 1969. A citizens band two-way radio linked the office with the two mobile units. Scheduling was done during the preceding 24-hour period by telephone, although emergencies were handled. Service was later expanded to include home delivered meals and emergency deliveries.

As the program grew, augmentation of the Mobile service was necessary. Staff cars, taxi cabs and charter buses were used when the van was unable to provide service for all those requesting it, or while being repaired. Taxis proved to be too expensive. Chartered buses were used to transport large groups from senior centers to shopping districts weekly. However, when the second unit was purchased the need for chartered buses was eliminated. A cost analysis for a single mobile unit from September 1966 to June 1969 showed a total operation expense of \$7,013.99, including purchase of the van for \$2,442.00. The administrative and driving expenses totaled \$24,166. The operating cost per mile was \$.1320. The total operating, driver and dispatcher expense per mile was \$.5868. Since this service was run free of charge, no income was reported. Thus, 30,403 trips were made at a cost of \$32,000.

A major result of the project was the therapeutic effect it had upon a large number of older people. It had given a number of dejected, withdrawn, immobile senior citizens a new lease on life. The socialization necessary in traveling from place to place opened up new lines of communication between senior citizens themselves, and between the staff and the senior citizens. Finally, it allowed the clients a new feeling of independence.

Specific recommendations resulting from this experiment were put forth:

a) The service be continued and expended with additional staff and facilities.

b) Similar projects for the elderly be initiated in other metropolitan and rural areas.

c) Involve other agencies serving the elderly during the planning and development stage.

d) Encourage those who benefit from the service to take part in program decision-making.

e) Select a mobile vehicle that is mechanically reliable and one with a design adaptable for easy access by older people.

7.3.2 The Los Angeles Multi-Service Transportation (MUST) Program

The Los Angeles area is served by 170 bus routes including thirty-five routes through South Central Los Angeles and thirty through East Los Angeles, the two areas in Los Angeles where the major concentration of elderly is located. In 1965, there were 14,100 senior citizens in East Los Angeles, and 24,660 in South Central Los Angeles.

Most travel needs of senior citizens are provided for by the public transportation system. In addition, a 10¢ discount is provided during off-peak hours. The existence of this extensive system does not mean that all mobility needs of senior citizens are being met. Several reasons explain this:

a) Even with discount fares, the cost can be a barrier, especially on long trips.

b) Even short walks to bus stops, boarding, and alighting from buses can be extremely difficult.

c) The climate creates discomfort.

d) Many senior citizens are reluctant to wait at night due to fear of crime.

e) The two-to-three bus rides needed to reach most destinations makes travel in groups very difficult.

Many senior citizens, particularly those who belong to clubs or organizations desire to travel in groups. During a home interview survey two years earlier, it was made very clear that the only service that would be considered acceptable to the elder minority would be service designed and operated expressly for senior citizens.

The following recommendations resulted from the Los Angeles Program:

a) Whenever possible and practical, make modifications or adjustments in conventional service so that it can meet the needs of senior citizens and other special groups.

b) Charter Service can meet many of the long trip special needs of senior citizens. It is limited, however, by the passenger's ability to pay, and thus requires subsidy.

c) Other special needs must be met by special buses such as the dial-a-bus or mini-bus programs.

7.3.3 The Kansas City Multi-Service Transportation (MUST) Program

This program is an attempt to modify the existing system to adapt to the special needs of senior citizens. It is significant that when the fare was raised from 35¢ to 50¢, the revenue increased 14% while ridership dropped 16%. The greatest drop occurred in poverty areas. This indicated that the people could just not get around, especially the aged who rely on fixed retirement incomes.

About 12% of the population in Kansas City is older than 65, or 16,900 people. Most are in the low income bracket. The specific proposals for dealing with the special transportation needs of this group include:

a) Modifying existing routes, or establishing new routes to serve a greater number of senior citizens.

b) Initiate a specialized transportation system to accommodate the needs of those physically unable to use other systems, or those isolated from reaches of existing systems.

c) Charge a nominal fee, but not zero; the elderly want to pay for their service (but they obviously cannot afford to wholly support it).

7.3.4. Cape May Demonstration Transportation Project

Cape May is a small community of 5,000 located on the southernmost tip of the New Jersey coast. Until implementation of a mini-bus project, the only means of intra-city transportation was a costly taxi cab service. This system was designed to serve the needs of 4,000 people 60 years old or older, located in a 9 square mile area. Social Security benefits provided the main source of income for this segment of the population.

The vehicle chosen was a nine-passenger Volkswagen van. It operated six days a week between 8:00 a.m. and 5:45 p.m. The routes were arranged to transport people from the areas in which there was the greatest concentration of the aged population, to downtown shops, doctor's offices, business offices, and entertainment facilities. Fares of 25¢ locally and 75¢ to the hospital and clinic are charged for senior citizens, and 30¢ and 75¢ for the general public. The ridership is not segregated by age. A commutation booklet of five trips for \$1.00 was available. During Senior Citizen Week in May 1969, fares were reduced to 10¢. There was no significant increase in ridership.

From August 15, 1968 to March 30, 1970 there was a total of 8,264 passengers, one-third of whom were senior citizens. Attempts to increase usage through additional publicity, evening and Sunday trips, and schedule adjustments have been to no avail. Project income for this period was \$2,004, while costs were \$20,463, including the purchase of the bus, insurance, registration fees, salaries, upkeep, maintenance and administrative costs. Repair costs were high.

The economics of this project was the major problem. It operated at over an \$18,000 deficit, which would have been higher if it had been designated specifically for senior citizens. The vehicle used was an unfortunate choice. It was not designed for constant use; consequently repair costs sky-rocketed. Thus, such a project cannot function unless subsidized by a state or federal agency.

7.3.5 Provisions for the Elderly and Handicapped on the San Francisco Bay Area Rapid Transit System

The facilities for the elderly and handicapped surpass those of any mass transportation system in the world, providing for 100% ridership within its service area. These facilities were acquired primarily due to the efforts of the Architectural Barrier Committee of the Easter Seal Society for the Crippled Children and Adults of Alameda and Contra Costa Counties.

The objective of this group was to change the original plan which would prevent access for approximately 4% of the population who were elderly and handicapped with severe mobility limitations to a more suitable one. This required obtaining endorsements from special interest groups and organizations, informing the administrators of the BART system that it was insufficient for all people, obtaining authority

and funding from the State Legislature to effect the necessary changes. This process required eight years to achieve its objectives. On February 29, 1968 the BART Board of Directors noted that the additional facilities would require \$10 million in excess of the original estimate. A year later, the State Legislature approved the additional \$10 million for the elderly and handicapped facilities.

The specific facilities provided included:

- a) Elevators which move the non-ambulatory person vertically from street to train platform.
- b) Restroom facilities with special provisions for wheelchairs.
- c) Stairs with extended handrails.
- d) The BART car can be easily accessed by a wheelchair occupant. A combination of loudspeaker systems and easy to read signs, as well as a station attendant, are provided to aid someone with impaired sight or hearing.
- e) Other facilities include special service gates and fare collection machinery in stations, closed circuit television communications, special directional signs, and the low placement of telephones and elevator buttons.

Resulting from this program, Willson recommends that a federal law be enacted, making it mandatory for all newly-built buses to be equipped to accommodate wheelchair and other elderly and handicapped passengers, and that federal funds be made available to the bus systems for the purchase of mini-buses, etc. during an orderly and planned conversion to newly-equipped buses and complete service to all the public.

7.3.6 Transportation and the Rural Elderly: Raleigh County, West Virginia

Thirty percent of the population was classified at the poverty level in 1968. Thirty percent of the population had no car; 55% of the poor had no car. The average income of the people served by this demonstration project was \$150 per month, with 4.3 persons per family. Each trip amounted to 3% of their monthly income. The elderly can be considered a large portion of the poor.

The OEO in a demonstration project provided free bus service for the poor. Operations started in September 1967 lasting for 19 months for \$150,000. Eight-passenger

Chevrolet carryalls were used. The average round-trip lasted three hours and covered forty-five miles. Costs were 36¢ per vehicle mile, \$1.80 per round-trip passenger, or \$4,100 monthly.

Results of the demonstration project were:

- a) Trip distribution by purpose changed indicating that participation in different kinds of activities was very cost sensitive.
- b) Forty-three percent made more trips than before; 28% just as frequently, 27% less often.
- c) 6.5 trips per month before, 6.8 after, but a 25% increase in multipurpose trips.
- d) The free bus was used for 91% of all travel by its riders.
- e) Use of transit to regional shopping centers increased from 53% to 75%.

Thus, it was shown that transportation programs for rural areas can benefit the poor living there in the following ways: (i) by stimulating economic development of the region; (ii) by translating the benefits of economic development into improvements in the economic conditions of the poor; (iii) by providing job access; (iv) by increasing real income of the poor by giving them goods and services; (v) by significantly affecting social awareness, political effectiveness, aims, aspirations, and life styles of the poor.

7.3.7 Menlo Park, California

Little House is a multipurpose center for senior citizens in Menlo Park, California sponsored by the Peninsula Volunteers, a philanthropic organization of civic-minded women on the San Francisco peninsula. There are currently 1,800 Little House members. In 1969, the volunteers leased, and later purchased, a twelve-passenger Ford Econoline bus, for transporting Little House members to and from daily center activities. This vehicle operates in a kind of "dial-a-bus" system operating in corridors that run through areas where Little House members live. Members arrange for regular pick-up by making a standing reservation, or call the center by noon of the preceding day before they wish to ride.

The mini-bus is driven by members. Insurance coverage has been a problem, and the possibility of being cut off is omnipresent. Currently, about 500 riders a month use the mini-bus, plus others for special events. Including gas, insurance, and amortization of the vehicle, the cost amounts to 60¢ per person per ride (\$1.20 round-trip). The Volunteer group absorbs these costs and provide free parking nearby.

7.3.8 New York City, Off-Peak Reduced Fare Program

A reduced fare program involving buses and subways during certain hours showed an increase in ridership during reduced fare (non-peak) hours. In a follow-up survey it was noted that 70% said they planned or rearranged their day in some fashion around those reduced fare hours. Seventy percent felt these hours were convenient, 33% said they travel more now, but it was still too expensive. One-third felt that reduced fare made a real positive difference in their budgets. Most indicated a fear of personal violence as a major deterrent to use.

7.3.9 Ithaca, New York Mini-Bus Project

The following report was prepared by Malcolm Freeborn, Executive Director of the Tompkins County Senior Citizens Council, Inc.:

TOMPKINS COUNTY SENIOR CITIZENS COUNCIL, INC. MINI-BUS PROJECT

1972 Report

The fourth year (1972-1973) for Project 71 was officially approved September 8, 1972 by supplemental agreement #3 and Comptroller Contract No. C-34907 has provided the Senior Citizens Council a total sum of \$14,013 - with the federal share \$7,006 and the local share \$7,006.

Our Project for a period of three years has been "a selective use of part-time paid workers and volunteers - combined to perform specific tasks and support with a transportation program."

The transportation project began September 1, 1968 with a volunteer driver, using an E.O.C. surplus reconditioned bus. This was unsatisfactory. From September 1, 1969 to September 1, 1970, 720 people were transported in a private vehicle - total mileage was 2,716. Data available for January 1, 1975 to January 1, 1971, 753 people were carried for a total mileage of 2,295 miles.

The decision to obtain an 8-passenger, leased vehicle was initiated in March 1970, after a mini-White House Conference at Cornell University. At this Conference the top priority, as a need, was transportation.

A transportation committee was organized to supervise the project. Harry Kerr, Chairman, Michael Leary, George Ruggles, Mollie Hile, Thomas Patton, Fred Morris, Thomas Devlin, Harry Crispell, were ex-officio and technical advisors; Rev. Edward Miller and John Lowery, drivers. Malcolm J. Freeborn, Executive Director, and Helen Vandervort have attended committee meetings.

An 8-passenger leased vehicle was used February, March, April, May, June and July. This vehicle was operated by retired persons over 65 years of age and compensated by Project 71. Note the structure, side door entrance and seating arrangement were found inadequate to carry older persons. In July 1972 a third type of vehicle was approved. A 12-passenger mini-bus, with front door entrance and middle aisle, was contracted for. On August 1, 1972 the 12-passenger began service. It continues to be operated after a review of data for September and October.

The following report covers an eleven-month period:

1)	<u>Monthly Use</u>	<u>Persons Carried</u>	<u>Total Trips</u>
	February	14	31
	March	19	50
	April	18	43
	May	26	64
	June	15	29
	July	21	50
	August	31	74
	September	28	106
	October	49	154
	November	64	171
	December	50	175
2)	Total number persons (individual) who use minibus:		120

3) Number of times used - 44 weeks:

1 person	44 times	
1 person	37 "	
2 persons	36 "	
2 persons	35 "	
1 person	31 "	
2 persons	28 "	
3 persons	20 "	etc.

Summary -

6 persons	31 to 40 times
17 persons	10 to 18 times
20 persons	9 to 5 times
59 persons	<u>less than 5 times</u>

4) Total Trips: 1667

44 weeks - average 38 per week

41 persons - used 38% of trips

70 persons - used 62% of trips

5) Total Mileage

8-passenger bus	1545 miles
12-passenger bus	1546 miles

6) Cost data - 40 weeks

1st year (1969-1970)	\$1,525.00
2nd year (1970-1971)	1,474.00
3rd year (1971-1972)	1,825.00
4th year (1972-10 months)	5,241.03

Summary of Contributions:

Presbyterian Church	\$1,500.00
Eagles	1,000.00
Anonymous	250.00
Private Gifts by Riders	308.00
Reimbursement for Insurance	29.15
New York State Office for Aging	<u>1,663.00</u>
TOTAL	\$4,750.15
Possible Loss	\$ 490.88

Note: Estimated Cost Bus	
Use Mile	\$ 1.52
Estimates Rider Cost	
Per Mile	.23

Recommendations - (M.J.F.)

- 1) Continue use of vehicles for specialized transportation service for senior citizens (persons 60 years of age and over).
- 2) Integrate the current data and future plans of the Senior Citizens Transportation Committee with the area transportation committee of the County.
- 3) Seek for 1973 a County subsidy for 1/2 of budget for a minibus service, or establish a rate of mileage subsidy, for older persons use of bus.
- 4) Prepare details and analysis of service requirements which will meet needs of older persons.
- 5) Consider local revenue sharing funds - for city, county, regional use.

The report implies a need for locating sources of funding for the project. During discussions with Mr. Freeborn, he stressed the need of the senior citizens of Tompkins County for such a service. The figures cannot possibly represent the satisfaction of those served from the freedom brought by increased mobility. The figures do show clearly an increase in demand for services during the eleven-month period.

Freeborn projected that the needs of senior citizens in Tompkins County could be adequately satisfied by a fleet of four or five such vehicles with a two-way radio communication system. He seemed skeptical, however, that adequate funding for such a system could ever be obtained.

In summary, prior attempts or experiments designed to fulfill the transportation needs of the elderly have included either a reduced fare system for public transportation, a modification of routes and schedules, or a mini-bus or dial-a-bus operation specifically for senior citizens, or a combination of the above. One pertinent aspect of all of the

case studies is that any attempt to relieve the transportation problem of the poor, handicapped, or elderly is destined to be a profitless venture. This strongly suggests the need for federal, state and local subsidization of any social program.

Two distinct types of demand have been identified in Tompkins County: regular daily trips and trips made periodically during off-peak hours. Two types of systems might be used to serve regular trips made in hours that develop sufficiently high demand to warrant this service. Because of the low densities in the county, this service would probably operate only in the peak hours - before and after school or work. The routes and schedules could be periodically adjusted to meet changes in demand. Completely demand-responsive service could be used in the off-peak hours. The vehicles for either service must include appropriate design considerations of the special needs of the expected riders.

A more detailed consideration of the alternative system and vehicle designs is presented in Task 4 of this project. Analysis of operating costs, service characteristics, and designs is presented.

7.4 Design of System

Chapters 6 and 7 of this report have identified design considerations that must be included in a public transportation system if it is to serve special segments of the population. Chapter 6, Accessibility to Health Services, supplies inputs primarily to the design of routes and schedules. However, many of the transit dependent who might require health care are also considered in Chapter 7. These tasks place similar requirements upon the design of the system and of equipment. Therefore, they are included as design requirements in Chapter 9 where specific system designs are proposed and evaluated.

8. INTEGRATION OF EXISTING TRANSPORTATION SYSTEMS:
APPLICATION OF THE PLANNING PROCESS

8.1 Transportation System Deficiencies and Methods of
Improvement

The following represents a list of significant general deficiencies in the public transportation system of Tompkins County resulting from the existing transit ownership structure.

8.1.1 Deficiencies with Respect to Coordination

There are no communication linkages between the municipalities in the area with regard to public transportation issues. This fact was made clear in an interview with a member of the Tompkins County Board of Representatives. It was explained that at this time public transportation is given a very low priority by all of the municipalities except the City of Ithaca. The other representatives do not yet see the importance of the government role in providing transportation. For this reason, the issues are rarely discussed on an inter-municipal level up to the fairly recent past. The City and Town of Ithaca recently reached an agreement on expansion of public transportation services.

a) Scheduling-Routing

The service provided by the existing systems is limited in both depth and breadth. The former is shown in the limited night and weekend service and the low frequency of service where it is provided. The latter refers to the small geographic area that is served by the various systems.

There appear to be many difficulties in getting new routes and services established for financial and political reasons. The financial problems arise from the inadequate funding base for all of the systems. Operators are reluctant to experiment as a result of the financial uncertainties. The political problems involve communication linkages between municipalities. This fact was evidenced by the friction involved in trying to get the City of Ithaca to support the new North-East Transit System (NET).

There is no coordination between the various modes and systems that exist in the area. This is demonstrated by the lack of an attempt to coordinate the schedules of the buses that arrive from South Lansing (NET system) on the Cornell campus with the buses of the Community Transit System

leaving the campus. Such a situation exists because there is no administrative mechanism for coordinating the transportation systems.

b) Maintenance-Financing-Equipment Purchasing-Garage Facilities

Little coordination exists between the operators with respect to funding arrangements. One clear demonstration of this was the difficulty that the Tompkins County Red Cross experienced in attempting to organize a specialized transit service for all of the existing health-care groups in the area because of the varying financial arrangements and regulations.

There is duplication with respect to maintenance operations and facilities. The latter is shown by the existence of a school bus garage with excess capacity at the same time that the City of Ithaca Public Works Department has insufficient space and is building a new garage. The duplication in maintenance operations is evident in the duplication of specialized equipment, i.e., glass-repairing and wheel-balancing equipment, and in the duplication of effort in procuring parts and materials and in keeping administrative records and accounts.

There are economies of scale for the existing maintenance operations which are not being achieved. In the procurement of rolling stock, repair parts, and equipment, large bus systems, as reported in Study Recommendations for Participation in the Municipal Cooperative Maintenance Center 46, can pay lower prices because of their higher volume orders and can make more efficient use of their inventories.

Bus storage is inefficient. For example, there are numerous Ithaca School District buses with routes on West Hill. Since the garage is located in the southwest corner of the Town of Ithaca, a significant amount of time and fuel is consumed simply traveling between the garage and passenger pick-up points.

8.1.2 Transportation Planning Deficiencies

Transportation planning in Tompkins County has been dominated by highway planning. In terms of long-range planning, little attempt has been made to coordinate future needs with the projections and plans of the County Planning Department.

That office envisions a future land use pattern in which Ithaca will be the central area but will be surrounded by many satellite communities. Necessary for any such development is a transportation network to connect those communities with the center city. There exists, at present, no plan for providing or establishing such a network.

There is a lack of multi-modal orientation in what little transportation planning is carried on. The planning office of the City of Ithaca explained that it was because of time constraints, a lack of resources to explore other modes, and the existence of their present expertise in fixed-route bus operations. Also, if one looks at any organization providing transportation services within Tompkins County, not one service is oriented towards more than one mode.

There is no staff within the entire County whose major responsibility is comprehensive transportation planning. The planning office of the City of Ithaca does deal with transportation problems, but only on a small geographic scale and mostly with a concern for fixed-route systems.

There are high-demand travel corridors that have not been tapped by the transit system. These corridors are between areas of concentrated employment and major residential areas that supply employees. Supplying transit to these corridors would not require complex forecasting models.

8.2 Improvements to the Transportation System

As has been demonstrated in the preceding sections, the transportation system of the Greater Ithaca Urban Area has numerous components and exhibits some deficiencies. Several suggestions have been generated about how to improve the existing transit services. This section briefly reviews the proposals that are oriented towards the physical characteristics of the system and towards the composition of the principle transit operation in the county, the Community Transit System. The following section discusses various plans for revising the structure of the local government units that deal with mass transit.

Throughout the United States, public transit companies, in efforts to attract riders, have adopted many innovations in the fields of marketing, service extensions, rolling stock, and stations and terminals. Also, in a few cities, feasibility studies have been conducted on joint utilization

of maintenance and garage facilities, labor pools, and vehicles between the public transit systems and other transportation units operating in the same areas. Some of these ideas have to be modified to suit the special features of Tompkins County. Nonetheless, there are several schemes possible to enhance the local public transit system.

8.2.1 Marketing of System

The amount of advertising for CTS should be increased through the use of public service announcements on radio stations and in newspapers. A separate telephone exchange should be set up to handle citizen requests for information about CTS and about the existence of specialized transit services. Clearer and more informative bus schedules for CTS should be used and these bus schedules should be made more available to citizens.

8.2.2 Scheduling and Routing

A bus route could be established that would originate in Varna, proceed to Ithaca's central business district via the southeast portion of the city (around State and Cornell Streets), and then up Route #96 to the hospital and nearby health care centers. The CTS bus route #4 could be extended from Weston's along Elmira Road to Spencer Road with stops for the southwest portion of the city. Night service could be reinstated during the week for selected bus routes on an experimental basis. CTS bus routes #3 and #4 should also be extended so that larger sections of Cayuga Heights and South Lansing have service. A demand-actuated service might be established for the towns of Lansing, Groton and Dryden to allow the transportation-disadvantaged people living in those towns to get to health care and/or employment centers. This service should be initiated on an experimental basis, using CTS's 19-passenger bus or renting school district vans. A demand-actuated service and/or a fixed-route system should be set-up for the Ithaca urban area, utilizing and coordinating the rolling stock of the various local health groups to serve the elderly, infirm, and handicapped in the area.

8.2.3 Passenger Comfort

Bus shelters should be constructed at more stops. Some of the CTS buses should be equipped with special features, such as handrails on doors, lower steps, and hydraulic lifts to aid the handicapped and infirm riders.

8.2.4 Consolidation of Maintenance and Purchasing

Some of the Ithaca School District buses and CTS buses could be garaged at Cornell University's bus garage on the West Hill. One unified staff of full-time, part-time and substitute drivers should be formed for at least the CTS, the Ithaca School District and the Cornell Campus bus service. Specialized maintenance and repair jobs should be allocated among the local bus garages and the various maintenance staffs unified. (For example, all wheel alignments could be done at the garage of the Department of Public Works.) One organization should be created to serve all independent bus systems as a central equipment purchaser and as an information exchange, so that operators can be quickly notified whenever there is a shortage or excess of rolling stock on any given day (members of the exchange should include the local charter bus companies and taxi companies).

8.2.5 Planning

An office should be created that will be responsible for comprehensive county-wide transportation planning. This office would be responsible for developing long-range as well as short-range plans for a coordinated transportation system.

Obviously, this list does not mention every refinement or reform, but covers some of the most basic suggestions. Whether or not any are adopted into present transit operations depends largely upon the nature of the ownership arrangements, the degree of the distribution of costs and benefits of each measure, and their relative amounts of costs and benefits. Until recently, only economic criteria were employed to determine those costs and benefits, and thereby evaluate any plan, but now social factors are also important. Transit services, and proposed additions to those services, can and should be judged not only by their profitability (for the above physical improvement proposals, profitability would be determined by amount of revenue each one brings into the system minus its costs) but also by their dependability, comfort, safety, convenience, flexibility, environmental impact, and their benefits to special groups, such as the handicapped and the unemployed.

8.3 Local Consideration - Implementation

Before proceeding further with the details of a county option, a particular aspect of the transit picture in this area must be considered. The Community Transit System (CTS) is well established and presently applying

for UMTA funds to improve the system. In light of this fact, any transit agency proposed for this area must include CTS as one of its component parts at least in the initial stages. This factor effectively eliminates the sub-option of a contract with a private operator as a reasonable alternative. In taking on the transit responsibilities in Tompkins County, the county could either contract with the City of Ithaca for its present service or take over CTS. In the event of the latter, it is inconceivable that the county would then transfer the operation of a public system to a private corporation. The trend in the United States away from privately owned and operated bus systems, and the failure of the private operator in Chemung County, lend support to this conclusion, but perhaps a more reinforcing justification is that the county would not have direct control over transit operations that are operated privately.

8.4 Evaluation of Alternative Organizations

8.4.1 Evaluation Criteria

Judgement of the ownership forms for a county-wide transit system must be based on a set of evaluation criteria. Listed below are a set of criteria for the evaluation of the alternative organizations.

a) Adequate Funding Base

An adequate funding base necessary to sustain transit operations must be provided by the owning agency. An adequate base is one which: (i) produces sufficient revenue to cover operating deficits; (ii) provides the local share to match federal aid for purchase of CTS and for capital outlays; (iii) provides permanent and continuing funding to avoid frequent changes in mechanism or rates.

b) Coordination

The organization should be able to coordinate the needs of the community with the operation of the transit system. Provisions must exist for administrative and communications linkages between the transit operator and the federal, state and local transportation agencies, transit industry, and town, city and county governments.

c) Federal and State Requirements

The owning agency must have the capacity to satisfy U.S. Department of Transportation (UMTA, FHWA) requirements in order to qualify for financial assistance. A policy

board, an officially established public organization involved in extensive transportation planning, is a major consideration in fulfilling federal requirements.

d) Modal Orientation

The organization that will be in control of the transportation system must be capable of integrating the city transit system with the other independent modes of transportation that exist in the county. There must be a balance among all the modes when it comes to transportation planning.

e) Social and Environmental Objectives

Transit planning and operation should reflect and be responsive to social and environmental objectives of the population as well as the economic objective. Equity considerations should also be accounted for in the analysis. Changes in the transportation system may have a large effect on the income distribution of some groups of people.

f) Long-Run Development

Transit planning should be a part of long-range comprehensive transportation, economic, and land use planning within the county. The organization must have the capability to accomplish this type of planning. The long-run objective should be an integration of the many independent transportation systems that now exist in Tompkins County.

8.4.2 Evaluation of Organizations

It is the purpose of this section to evaluate the four options - Special Districts, Intermunicipal Agreements, County Department and Transit Authority - as viewed by present research in order to determine which option warrants further research for Tompkins County. The criteria used for evaluation will be based on the procedure for creating the agency, as well as funding capacity, political accountability, planning ability, administrative cost, ability to integrate the system, and ease of implementation with the political viewpoint in mind.

a) Special Districts

The possibility of this option was suggested because of its taxation ability. As already pointed out, this factor, coupled with a limited bonding capacity, affords special districts considerable financial freedom to carry out desired ends. Yet, because of the restrictions on these

funding potentials, a special district remains politically responsive to those subject to its jurisdiction.

Despite these positive points, there are serious drawbacks to this approach. State law limits the establishment of special districts to water, sewer, drainage, and refuse agencies. The Board of Supervisors (Board of Representatives) are not granted the power to create mass transit districts⁴⁷. The law, of course, can be changed, but in this case, it is not justified. The state already has laws specifically governing avenues by which governmental organs can create organizations to provide transit. The six major transit authorities in the state, and the county departments in Broome and Chemung counties are living products of presently existing legislation. Furthermore, as stated in Governor Rockefeller's annual message in 1967, and later in General Municipal Law 119-t, the state intends to continue its present approach⁴⁸. Citing from this act:

The commissioner of transportation shall prepare or cause to be prepared for submission to the next regular session of the legislature such measures as may be appropriate to facilitate the creation of public authorities or other public benefit corporations to provide transportation services to any city, town, village or county not wholly contained within a city or two or more of the same acting jointly.⁴⁹

Educating the local officials in the need for an area-wide transit is a task in itself. To propose that they explore a new route contrary to present state practices and trends only serves to complicate the matter. Before discarding this option as a possibility, for it does have its advantages, consultation with state officials and politicians would be advisable.

b) Intermunicipal Agreements

Intermunicipal agreements are a well-established means for providing public services. Ithaca and the surrounding municipalities resort to this device quite frequently. In fact, as has already been pointed out, there were negotiations between Ithaca and Lansing concerning the formation of what is now the Northeast Transit System. However, the necessity of providing the route by September 1974 did not allow sufficient time for the required procedural steps and the attempts failed. In 1975, an agreement was reached between the City and Town of Ithaca allowing for the expansion of public transit service into one part of town.

One present intermunicipal agreement between Ithaca and Lansing - the water contract - serves as an excellent example in assessing this option. On December 4, 1974, the Ithaca Common Council voted 9 to 3 in favor of renegotiating the water contract in order to exclude a new shopping center proposed for the Town of Lansing⁵⁰. This action immediately points to the political responsiveness of such agreements. They are easily altered, changed, or eliminated. Perhaps this is a rather unstable proposition for a transit system. However, political weapons are not the only or usual results of intermunicipal agreement alterability. Constructive change can also follow.

The shopping center vs. Ithaca water contract issue could have serious political repercussions in this area. It could preclude any attempt for transit agreements between Ithaca and Lansing or for that matter a transit authority, county department, or a special district.

Prior to the above mentioned controversy, the intermunicipal agreement approach was considered by several local officials as the most likely path that the county would follow given their present knowledge of transit ownership. They felt this "incremental approach" of expanding transit to be the most acceptable to the largest number of people. This is in direct opposition to authorities and county departments which were considered too large and clumsy to fit the local need.

There exist, however, inherent faults in the incremental intermunicipal approach. First, in the long-run, although the terms of the agreements would prevent economic collapse, the administrative capacities would be overtaxed. CTS represents only one-third of the Public Works Department of the City of Ithaca, and the system receives inadequate attention now. The expansion capabilities of the system are severely limited. Secondly, financially an intermunicipal agreement is limited to the funding capabilities of its constituent parts. Thirdly, and most importantly, the intermunicipal agreements would not represent overall regional planning since the agreements would only take the interests of the agreeing party into consideration. In view of the fact that area-wide transit service and planning is one of our major objectives, this is a serious shortcoming.

c) Transit Authorities and County Departments

Both the transit authority and county department options have been independently discussed at length. Since they both represent area-wide and well-established organizations, it is appropriate to compare them with each other.

An authority is usually granted an advantage in the funding area because of its ability to bond up to the limits of the market and not up to state restrictions. However, the power of taxation granted to counties should not be disregarded as evidence by Tompkins County's 20 million dollar commitment to a new county hospital. Taxation, it must be remembered, is subject to the political process, a restraint from which an authority is free. Yet, as in the present state of affairs of the New York Port Authority, an authority must deal with the ups and downs of the economy while taxation revenues are relatively stable.⁵¹

In the area of federal and state financial assistance, an authority again appears to have an edge. The statewide Mass Transit Assistance Program grants larger sums to the existing New York authorities than to county departments.⁵² It has also been hinted that the Federal government looks more favorably on authorities than other forms of transit operations. Further economic considerations juxtapose the apparent high administrative costs of an authority against the high costs of civil service required for county functions.

Both systems also satisfy the planning function criteria and are granted the right of eminent domain. In short, each of these options is capable of providing adequate transit service to Tompkins County. At this stage of investigation, no further determination can be made. A public authority is basically a private corporation granted many of the powers of a governmental agency, but lacks many of its restraints. A county department could most accurately be referred to as a bureaucracy. In this lies the fundamental controversy of private industry vs. government bureaucracy. The former is noted for its speed and efficiency of operation while the latter is often characterized by lethargy. The private industry, however, is also known for its unresponsiveness to the will of the people whereas government agencies act as their voice. The difference is largely subjective and the determination of one's preference is based on one's values. Or in more practical terms, the choice would depend on the political leanings in Tompkins County.

Even among the biased group interviewed, not one thought a transit authority would fit the needs of Tompkins County and only a few saw much hope for a county agency. The present lack of education on transit needs and of the possible ownership alternatives accounts for this response. Providing this background education is the function of this study, but there is a fundamental part missing. The ownership options cannot be effectively evaluated without a concurrent investigation of management options and costs. Then, and only then, can the best possible ownership option be determined.

8.5 Requirements for an Integrated System

a) Efficient Organization

Any agency that is given control of the transit system in Tompkins County must be able to efficiently organize an integrated system based on the many independent transportation systems described at the beginning of the task.

b) Equivalent or Better Levels of Service

The integrated system must provide an equal or better level of service than is provided presently by all the independent services combined. Special provisions should be made in the integrated transit system for the segment of transit users who require special facilities, such as the infirm elderly and the handicapped.

c) Economies of Scale

The use of economies of scale should be anticipated in the area of maintenance facilities, purchasing, labor, storage facilities, and administration as a result of integrating the transit systems into a single system.

d) Efficient Use of Hardware

Efficient use of the hardware will result from the elimination of duplication of services. The vehicles used for the transport of school children could be used in a demand-responsive system during their hours of nonuse.

The actual design of the integrated county-wide transit system is described in Chapters 8 and 9.

9. ALTERNATIVE SYSTEM DESIGNS

9.1. Introduction

On the surface, it may seem much simpler to design a transit system for a small urban area than for a large urban area because of the reduced size of the region which must be served, both in terms of population size and the number of origin-destination pairs which it contains. However, it should be realized that transit has historically been oriented towards serving large volumes of passengers in heavily populated areas. Hence, in designing a transit system for a small urban area, it is necessary to re-design this volume-oriented system so that it can provide an area with relatively low demands for transit services with a quality service in an economical and efficient manner. In effect, a compromise is needed between the high-volume transit systems of large urban areas and the automobile.

There are several reasons why transit systems are needed in small urban areas. First of all, those persons without access to cars in a small urban area have a very limited effective mobility without a transit system because of the spread-out nature of commercial and residential development in small urban areas. Thus, special consideration must be given in transit system design to the needs of the disadvantaged rider. Secondly, even in small urban areas, there are often problems of traffic congestion and parking availability which transit can alleviate. Thirdly, transit is more efficient in the use of energy and materials resources on a passenger-mile basis than the automobile in almost all cases. Fourth, transit systems, when properly operated, can provide a desirable alternative to the automobile for non-disadvantaged riders.

9.2. Objectives of this Task

In this task a number of relevant transit alternatives which might be suitable for use in rural and small urban areas will be investigated. Areas which will be explored are alternative short-range changes in existing fixed-route, fixed-schedule transit systems, administration and ownership alternatives for transit systems, and the different types of transit systems. For each alternative in each area of investigation, a preliminary evaluation of its cost, service characteristics, and flexibility will be given. In addition, each of the alternatives will be discussed and evaluated with respect to its suitability for use in Tompkins County, New York.

9.3. Relationship with Preceding Chapters

Chapters 3 through 7 have provided information on the special transportation needs of the handicapped, the infirm elderly, the very young and the economically disadvantaged and alternative means of satisfying these needs. Special consideration has been given to the role of transit in making health services accessible to these groups. Included in the overall evaluation of each alternative transit system will be an evaluation of its ability to serve these special needs. In the transit system recommendations for the Tompkins County area, the institution of transit systems which satisfy these special needs has been emphasized.

Chapter 4 identified the transit cost and service improvements which would result from an integrated transit system in a small urban area such as Tompkins County. In this chapter, when the administrative and ownership options for each alternative transit system were discussed, the potential for that system's integration with other transit systems will be considered. Chapters 4 and 8 also described and evaluated the alternative government organizations which could operate an integrated transit service. Chapter 8's evaluations of these alternative organizations will be referred to throughout this task.

9.4. Planning Considerations for Transit Systems in Rural and Small Urban Areas

9.4.1. Alternative Transit Systems

In this section each of the alternative transit systems which might be suitable for use in small urban areas is briefly described.

i. Fixed-Route, Fixed-Schedule

Until recently this was the only form of transit which was available in small urban areas. It involves the operation of buses along predetermined routes in the urban area. Thus, the buses do not deviate from these routes to pick up passengers. Rather, the buses pick up passengers at stops along the routes. This means that passengers must walk, what are often substantial distances, between their origins and destinations and the bus stops. The buses usually run along the routes at predetermined times according to their schedules.

When catching the bus, the passenger frequently has to wait at the bus stop until the bus arrives. To reduce the inconvenience of this wait, some fixed-route, fixed-schedule bus systems have installed shelters with seats at the major bus stops.

ii. Demand-Responsive Transit Systems

This service has replaced fixed-route, fixed-schedule services in some urban and rural areas recently. To the passenger, a demand-responsive service functions like a taxi in that it offers door-to-door service in response to a telephoned request for service to its dispatching center. Demand-responsive systems usually use vans or mini-buses as vehicles and function like a standard taxi service, except for the fact that attempts are made to group different passenger trips which are similar in terms of time and direction together, so as to obtain greater vehicle utilization. There are a number of types of demand-responsive services. The simplest type is the route-deviation service in which the demand-responsive vehicle deviates somewhat (usually by no more than three blocks) from a fixed route to pick up passengers who have called in to the central dispatching office to request service. The vehicle always returns to the fixed-route at certain specified points where it picks up and discharges passengers in the same manner as a regular fixed-route, fixed-schedule bus. Other demand-responsive services are many-to-one, many-to-few, and many-to-many. In a Department of Transportation report entitled Demand-Responsive Transportation the following definitions were given:⁵⁴

Many-to-one: providing transport from several origins to a common destination, such as a shopping center or bus terminal.

Many-to-few: providing transport from multiple origins to a few destinations, such as major activity centers or points on a downtown loop.

Many-to-many: providing transport between any origin-destination pair in the service area without limitation.

Demand-responsive services also vary as to when the passenger is required to make the request for service. In some cases the passenger must telephone in a request at least 24 to 48 hours in advance of when he or she wants a ride. In other cases

the request can be made at the time when the ride is needed (dynamic scheduling). Demand-responsive operations are usually operated by local governments (town, city, or county).

Demand-responsive systems can also be differentiated by the population groups which they serve. Some systems serve only disadvantaged persons such as the elderly or the handicapped. Other systems are intended for use by the general public.

iii. Shared Taxis

The major difference between a shared taxi and a many-to-many demand-responsive transit system with dynamic scheduling is that the former is operated by a private taxi firm and the latter is operated by a government organization. Also, shared taxis tend to use automobiles as their vehicles, whereas demand-responsive systems tend to use vans or minibuses. In addition, demand-responsive systems tend to have lower fares because they are subsidized by the government. Otherwise, the two services are basically identical and their principle of operation is the same.

iv. Subscription Services, Vanpools, Carpools

Each of these services is used to carry people between their homes and work in groups.

In a subscription service a bus with a paid driver picks up a group of workers at their individual doorsteps at a pre-scheduled time every working day. The bus then takes them to their common place of work and then reverses the process in the evening. The only known subscription services to date were operated by private bus firms (in Peoria and Decatur, Illinois) under contract to the Department of Transportation in a demonstration project.^{55,56}

A vanpool functions like a subscription service, except that the driver is chosen from among the van's passengers (as in a carpool).⁵⁷ In return for driving the van, the driver doesn't have to pay for his ride. To date, vanpools seem to have been organized and operated by the employers of the vanpools' riders. The employer charges the vanpool riders a fee which covers the costs of operating the vans.

A carpool is a more informal arrangement than a vanpool, with the vehicle being provided by one of the members of the pool (often on a rotating basis). Many employers and government agencies have encouraged such efforts.

v. Social Service Agency Vehicle-Pools

In many small urban areas there are a significant number of under-utilized vehicles which are owned by social service agencies. It is possible that in some cases a vehicle-pooling effort could be organized which would make possible a reduction in the total number of vehicles which are owned by the social service agencies. In addition, such a pooling effort would make the vehicles available to social service agencies which could not justify owning their own vehicles, but which occasionally have a need for one or more vehicles. Because of the fact that social service agency vehicle-pools are somewhat peripheral to the general scope of this study, they will not be discussed further herein.

9.4.2. Typical Changes in Fixed-Route, Fixed-Schedule Transit Systems

Until recently, most public transit systems have been operated on a fixed-route, fixed-schedule basis. As a result of the historical nature of these systems, a number of typical changes and improvements which can be made in fixed-route, fixed-schedule transit systems have been developed. Included in these changes are the acquisition of new vehicles, new vehicle color schemes, passenger shelters along the bus routes, new bus stop signs, new routing and scheduling information (schedules, advertisements), route changes and additions, schedule changes and additions, and fare changes (reduced fares for special groups, general fare increases or decreases).

These changes can all be implemented in a short time span and do not usually necessitate any changes in the existing transit system's organizational framework. While not as dramatic as some of the long-range changes which will be discussed later in this task, short-range changes can be effective in improving transit service quality and in stimulating transit ridership. Many of these changes are normal year-to-year events in a non-moribund transit system. The aforementioned typical changes will be discussed together with two non-typical changes in the next section of this task.

9.4.3. Short-Range Changes

i. Vehicles

Vehicle replacement is a normal process in a stable transit system. When replacing old vehicles consideration should be given to whether vehicle designs which are different from those in current use might be more suitable for present and future transit applications. For example, it may be desirable to replace large buses with smaller buses which are more flexible in their routing, because of their greater maneuverability and reduced obtrusiveness in residential neighborhoods.

There are a number of factors which should be considered in choosing a vehicle. Some of the more important factors are:

- a. Suitability of the vehicle for use by the disadvantaged. Chapter 3 should be consulted for information on vehicle designs which are suitable for use by the disadvantaged.
- b. Vehicle size. The operating cost per seat mile is lower for large than for small buses. However, the operating cost per vehicle mile is higher for large than for small buses. Large buses are also less maneuverable than small buses and may create objections as the result of their use in residential neighborhoods. Empty large buses during non-peak periods may also create a bad public image for the bus system, and passengers on nearly empty large vehicles may have a somewhat "lost" feeling.
- c. Operating Costs. With the greater availability of federal and state funds for capital than for day-to-day operating costs, it may be desirable to place a greater emphasis than would otherwise be the case on the vehicles' operating costs (fuel, maintenance) as opposed to its capital costs.
- d. Vehicle reliability and ease of maintenance.

- e. Ease with which the vehicle can be kept clean. Easily cleanable materials should be used in the vehicle and dirt collecting recesses should be avoided.
- f. The vehicle's attractiveness, exterior and interior.
- g. The vehicle's noise levels, exterior and interior.
- h. Parcel storage facilities.
- i. Heating, air conditioning, and ventilating systems.
- j. Driver audio capabilities on large buses.
- k. Durability and resistance to vandalism of vehicle interiors.

For a more complete list of vehicle criteria, an exhaustive study by the Highway Research Board should be consulted.⁵⁸ Two useful reports have been published by the Department of Transportation which provide individual descriptions of a number of presently available transit vehicles.^{59,60}

ii. Bus Shelters

As waiting for buses during inclement weather or without a seat can be extremely bothersome to passengers, the additions of shelters at major stops, if they do not already exist, can be an important change. Studies have shown that riders are more sensitive to time spent waiting for a transit vehicle than to the time spent in the vehicle.⁶¹ A large part of the reason for this is probably the better environmental conditions in the vehicle. By improving the environment outside of the vehicle (through the use of shelters), the passengers' sensitivity to waiting time will be reduced.

Bus shelters can also be useful as a means of distributing bus system information such as schedules. In addition, they provide a highly visible indication of where the bus stops are for passengers who are unfamiliar with the bus system.

A number of factors should be considered in purchasing shelters, including the shelter's ability to stand up to strong winds, the ability of the shelter roofs to handle snow in the northern areas, and its general structural soundness. The shelter's attractiveness and lack of obtrusiveness (ability to blend into the general surroundings), the shelter's resistance to vandalism and its need for cleaning and maintenance should also be considered. It may be desirable to include provisions for heating the shelter during the winter and lighting it during the night (if night bus service exists) in heavily used shelters. Chapter 3 should be consulted for further information on shelter designs and other bus stop facilities for the disadvantaged.

iii. Fares

Fare charges can be of three types:

- a. Reduced fares for special groups. Reduced fares are usually used to allow disadvantaged groups (particularly the elderly) greater mobility. These fare reductions may be in effect for the entire day or just during the off-peak hours. In systems with heavy peak loads it would seem to be desirable that fare decreases for special groups occur only during the off-peak hours. In this manner, the reduced fares will also help to even out the utilization of the transit system. Such a fare reduction in a large urban area is described in a study by Carstens.⁶²
- b. Non-peak period general fare reductions. Non-peak period fare reductions may be useful, both in reducing peak-period ridership and in increasing overall transit ridership. For example, Boston has implemented reduced 10¢ fare between 10 a.m. and 2 p.m. on subways and buses, as opposed to the normal 25¢ fare on subways and 20¢ fare on buses.
- c. General fare increases and decreases. General fare decreases are usually used to stimulate transit system ridership while general fare increases are used to increase

transit system revenues. The generally accepted figure for fare elasticity is -0.33 (loss of patronage of .33% for each 1% increase in fare.)⁶³ However, the actual fare elasticities in individual areas may vary significantly from this value.⁶⁴

The accumulated evidence shows, however, that ridership is significantly more sensitive to changes in the level of service (particularly door-to-door journey times) than to changes in fare, although service elasticities also are usually numerically less than unity. In other words, the prospects for stimulating ridership through improved service are much better than the prospect for gains through the farebox.

iv. Route and Schedule Changes and Additions

Route and schedule changes and additions can be effective means of improving transit service quality and stimulating ridership.^{65,66} It may be possible to make route improvements without adding to a transit system's vehicle fleet by analyzing the existing route structure to determine whether it is geared to past and not present demands for transit service. If this is the case, route improvements can often be achieved by re-routing existing physical equipment. However, this type of route change may be complicated by protests from those individuals who are adversely affected by it.

Route and schedule improvements are also possible as the result of an increase in fleet size. Three types of improvements are possible: an extension of bus service to new areas, more complete coverage of the present service area (bus routes closer to the average residential and commercial establishment), and greater bus frequency on each route. What combination of these alternatives will be chosen will vary with the individual case.

Schedule changes may also take the form of increased or decreased service hours, such as the addition of night or Sunday service. If transit ridership has shown an uptrend in an area, such schedule additions should be considered.

v. Transit Priority

Of the different transit priority schemes, only one seems to be applicable to small urban areas. This is the activation of traffic signals by buses, or signal preemption, as it is sometimes referred to. Signal preemption can be accomplished through two basic approaches. One involves the use of a computer-controlled traffic system. This version will only change lights or hold a green signal when queues are manageable or when "downstream" capacity exists. Under this system the approach of a bus is sensed electrically and the green light is held for the bus or activated as soon as possible. The second approach involves direct override of the local signal controller on an intersection by intersection basis. It has been estimated that eleven percent of total bus running time is spent waiting at intersections in large urban areas.⁶⁷ This percentage is obviously somewhat lower in small urban areas. Yet, preferential treatment of transit vehicles also has an important psychological and status impact.

vi. Bus-Stop Signs and Route and Schedule Information

Changes in bus stop signs and route and schedule information will be discussed in Chapter 11.

vii. Surveys

Surveys can be conducted for two purposes: to monitor the feelings of transit system users (and sometimes non-users) about the transit system, and to obtain information for use in long-range transit planning. Long range transit planning surveys are generally extensive and include information on individuals' present travel patterns, their socio-economic status, transit preferences, and satisfaction with present transit systems. These surveys, when coupled with land use and population projections, can be used in predicting future transit needs. Monitoring surveys, on the other hand, are usually less extensive than long range planning surveys. They are designed to obtain some quick feedback on user and sometimes non-user reactions to the transit system's operation. Reactions to recent transit system changes may be sought. Also, questions may be asked regarding the satisfaction, or lack thereof, with specific aspects of the transit system.

9.4.4. Administrative and Ownership Considerations

i. Integrated Transit Systems

Chapters 4 and 8 have dealt extensively with integrated transit systems. Thus, those chapters should be consulted for a detailed discussion of integrated transit systems. Briefly, the main advantages of an integrated transit system are:

- a. More efficient use is made of personnel and material resources.
- b. By coordinating the different transit services, unnecessary duplication in the services which are offered to the public can be eliminated.
- c. The public can easily be confused by a profusion of transit services. Organizing the transit services into one unified package should make it easier to market the individual services to the public.
- d. Integration of different transit systems will make it easier to organize through-service in the case of fixed-route, fixed-schedule operations. Also, passenger transfers between the different systems might be aided. For example, special points might be set up for transfers between demand-responsive and fixed-route, fixed-schedule systems.

As alternative transit options are devised later in this chapter, ways in which they can be integrated together to advantage will be noted. However, integrated transit systems may not be an unmitigated blessing. First of all, if a transit system is organized and funded on a county level, it may be necessary to provide transit service for everyone in the country, no matter what the cost. Second, it may be desirable to have different transit services operated by different organizations. For example, the type of organization which is most suited to operating a vanpool may not be the most suitable type of organization for operating a fixed-route,

fixed-schedule system. Of course, the fact that the two systems may not be totally integrated does not preclude some cooperation between them. Third, if all transit operations are controlled by an organization, innovation may be limited. Established, monopolistic bureaucracies may fall into fixed patterns and become resistant to new ideas over periods of time. For example, fixed-route, fixed-schedule bus and street car operators had anti-jitney legislation passed in the early 1900's which limited the development of demand-responsive type services. Thus, it may be desirable to ensure that any integrated transit organization is not given a monopoly, whether legal or conceptual, over transit in a region. Finally, there is the potential for a cross-subsidy problem in an integrated transit system. Cross-subsidies may occur when the profits from a profitable transit operation, such as possibly a vanpool, are used to subsidize unprofitable operations, such as a transit service for the handicapped. While it may be desirable to subsidize such a service, it is questionable whether the subsidy should come from other transit revenues. By increasing the price of any profitable transit service, cross-subsidation will make it more difficult for them to compete with the automobile. Also, money-losing transit operations are services which society as a whole has decided are needed. Therefore, the costs thereof should be borne by the entire society and not just by the users of profitable transit services, who, as a group, will probably have lower than average incomes.

ii. School Buses

The potential for cooperation between school bus and transit systems was noted in Chapter 4. This cooperation might be facilitated by the organization of an integrated transit system which could establish a working arrangement with local school systems, and then act as an intermediary in all arrangements with the school system. Cooperation between transit and school systems could take two forms:

- a. Since most school buses are presently used for only a small part of the day, it might be possible for demand-responsive transit systems or social service agencies to profitably use the school buses in the school buses' off hours. However, there are presently legal, as well as equipment barriers to using school district-owned

equipment for non-school related transportation. Thus, either the laws concerning the use of school district-owned equipment must be changed, or the jointly used vehicles must be owned by the transit system and rented to the school system for part of each day. The second alternative raises the possibility of having an integrated transit system also operate the school buses for local school systems. This would result in the maximum inter-system cooperation and ensure the implementation of the second form of cooperation, namely:

- b. The local school bus and transit bus maintenance operations might be coordinated in order to reduce costs through economies of scale (see Chapters 4 and 8).

iii. Private vs. Public Operation

There are two types of private transit operations, subsidized and non-subsidized. The subsidized operation is operated by a private firm under a government contract. The non-subsidized operation functions without any government aid, just like any ordinary private enterprise. These two types of private operations must be considered separately because of their different natures.

Subsidized private operation of transit services is occasionally put forth as a more efficient means of operating these services than public operation. The basic reason for this greater efficiency is held to be the fact that the private operator has the profit incentive to cut costs. However, in a subsidized private transit operation the availability of a subsidy may eliminate this incentive. In fact, determining the proper subsidy for a private operator may be a rather difficult task. This might be solved by having potential private operators submit bids for the operation of a transit system, much like private school bus operators do presently. Another possible subsidy arrangement in the case of the shared taxi is discussed in more detail in section 5 of this chapter.

Non-subsidized private operations appear to be possible in the case of shared taxis, subscription services, and vanpools, and in some fixed-route, fixed-schedule operations (disregarding

social-service agency vehicle pools). The main advantage of a non-subsidized private operation over a public operation is held to be its profit incentive to cut costs and to remain sensitive to the market. Thus, private transit operations may be more willing to try out new services than entrenched government agencies. However, non-subsidized private operations are susceptible to the argument that they are taking the cream of the crop and leaving the rest to the government. How applicable this argument is will depend on the individual situation in each small urban area, but the cross-subsidy argument which was presented in the previous section does tend to refute it. This is especially true in the case of vanpools in which case the private operators (the employers) have not been trying to derive profits from them to date. Another problem with non-subsidized private operations is that they may not be very well integrated with the areawide transportation planning process. This might be especially true in the case of shared taxis and private fixed-route, fixed-schedule operators. However, private operators may turn out to be very amenable to well-formulated proposals by transportation planners. Also, with their sensitivity to the market, some private operators could provide some very useful input for the transportation planners. However, since private operators do not tend to seek out transportation planners, integration of private operators into the planning process will occur only on the initiative of the transportation planners.

Other problems with private operators may include difficulties in coordinating their services with those offered by the public transit system and the fact that the existence of more than one transit system may confuse the public (it may be more desirable to present the public with a unified, comprehensible system).

iv. Capital Grant and Operating Subsidy Considerations

Only public organizations can qualify for federal and capital grants and operating subsidies. As these grants and operating subsidies can be a substantial source of funds, it is desirable that transit systems be owned by local government organizations whenever it is possible. It may still be possible for a private organization, either subsidized or non-subsidized, to operate the transit system by leasing the transit system's equipment from the local government. One other important consideration for capital grants and operating subsidies is

that transit organizations have transportation planning capabilities associated with them. This also tends to favor government involvement in the provision of transit services.

v. Possible Transit System Operators

There are a sizable number of organizations which could be involved in a variety of ways in the operation of the alternative transit systems. In Table 9-1 the potential operating relationships which will be considered in this study have been listed. These relationships will be discussed in section 5 of this chapter when each of the alternative transit systems is discussed.

vi. Potential Area-Wide Operations

Four options for an integrated, government-operated transit system were discussed in Chapter 4. Integrated transit operations are not without problems, some of which were noted in the previous section. When properly organized, their advantages outweigh their disadvantages, though. Specifically, only through areawide government involvement in the provision of transit services can coordinated transit planning occur. Also, since many transit operations cannot be operated at a profit, government operation or subsidization is necessary.

Intermunicipal agreements appear to be piecemeal and unstable solutions to the transit problems of a multi-town region, involving a town as a separate entity as they do. This can result in substantial political bickering and interference as each town tries to optimize its part of the agreement. Also, intermunicipal agreements do not usually incorporate the same areawide planning capabilities which the other areawide options have. Thus, it does not appear to be desirable to use intermunicipal agreements for a multi-town transit system. However, if it is only desired to make a limited extension of an existing transit system in a city or town to one or two neighboring cities or towns, the intermunicipal agreement may be the best option.

The differences between a public authority and a county department have already been discussed in Chapter 4. In comparing the public authority and the county department with the special district, the special district has one major disadvantage. This disadvantage lies in the fact that it is

		Transit Planning	Fixed- Route, Fixed- Schedule	Demand- Responsive	Shared Taxi	Sub- scription Service	Vanpool, Carpool	Social Service Agency Vehicle-Pool
1.	Local Government (County, city, town)	perform, possibly with some aid from 3.	operate or sub- sidize (3)	operate or subsidize (3)	limited subsi- dies to (2)	operate or sub- sidize (3)	coordinate efforts by (4) or op- erate with assistance from (4)	cooperate with (5) in the operation of
2.	Taxi Co.	-----	-----	-----	operate	-----	-----	-----
3.	Private firms under contract to local Governments	consult- ing	operate with subsidy	operate with subsidy	-----	operate with subsidy	-----	-----
4.	Employers	-----	-----	-----	-----	encourage employee use of	operate or aid in operation of	contribute vans from vanpools to
5.	Social service agencies	-----	-----	operate on limited basis	-----	-----	-----	operate or coordinate possibly with help from (1)
6.	Schools	-----	-----	contribute vehicles	-----	-----	-----	contribute vehicles
7.	Private bus operators	-----	operate in some occasions without subsidy	-----	-----	operate without subsidy	-----	-----

Table 9-1
Potential Transit System Operating Relationships

presently illegal to set up a special district for transit purposes in New York State. If these legal problems could be overcome through an act of the state government, the special district would have some unique advantages as a potential areawide transit operation. First of all, unlike the county department and the public authority, the special district would not necessarily be organized along county boundaries. Thus, the boundaries of the special district could be set so that it would only have to provide service for the urban area and immediate towns. It would not be necessary to sell thinly populated towns on the need for transit in urban areas or to go to the expense of serving those towns. The special district also has the advantage of being able to cross county lines when the natural service area of an integrated transit system crosses those lines. In addition, the special district has its own taxing authority. It is therefore not dependent on the year-to-year whims of city and county governments for its annual subsidies like the public authority or county department. However, there may be a disadvantage associated with this independent taxing authority. It may be harder for the special district to obtain increased taxing authority than it is for public authorities and county departments to obtain increased subsidies from city and county governments. Thus, independent taxing authority probably gives the special district greater stability and less flexibility. Finally, like the public authority and the county department, the special district can easily be set up with transportation planning capabilities. Because it would be well suited to the operation of an area-wide transit system, for the reasons given above, it would seem to be desirable that the State of New York legalize special transportation districts.

9.5. Alternative Public Transit Systems for Rural and Small Urban Areas

9.5.1. Fixed-Route, Fixed Schedule Service

There are several problems from the passenger's point of view with the fixed-route, fixed-schedule bus system. First of all, there is the need to walk, what are often substantial distances, to and from bus stops in the access and egress portions of a bus trip (it can be very expensive to provide extensive coverage of a small urban area with a fixed-route, fixed-schedule bus system). Not only is this walk tiring and overly long for some passengers, but it can be a very unpleasant experience for all bus passengers during inclement weather.

Secondly, there is the need to wait for the bus at the bus stop on the passenger's part. (Transfers can increase the problem.) This too can be particularly unpleasant in inclement weather unless bus shelters are available. As we noted earlier, the magnitude of the out-of-vehicle times is more important to passengers than the magnitude of the in-vehicle time. Another problem from the passenger's point of view is that the fixed-route, fixed-schedule system may not even connect many of the points between which the user would like to travel. Once again, this is because it can be very difficult to provide extensive coverage of a small urban area with a fixed-route, fixed-schedule bus system at a reasonable cost. Also, the fixed-route, fixed-schedule system may not operate at night or on Sundays which may be a significant hindrance to some individuals.

Still another problem is the fact that fixed-route, fixed-schedule systems are not at all suitable for use by many handicapped and infirm elderly individuals. First of all, there is the previously noted need to walk to and from the bus stop. Secondly, there is the problem of entering and exiting from the vehicle. While many transit vehicles are now modified for easier use by the handicapped and infirm elderly, this does not alter the fact that the riders must still walk to and from the bus stops.

There can also be non-user problems with fixed-route, fixed-schedule systems, as the operation of the large buses, which are often used in fixed-route, fixed-schedule systems in residential neighborhoods can lead to complaints by the neighborhoods' residents. Thus, large buses are usually limited to operation on the major streets of an urban area. Although the buses would tend to operate on major streets anyway, in some cases this may be a hindrance to the bus systems' routing.

The advantage of a fixed-route, fixed-schedule bus system lies in its ability to serve large volumes of passengers in areas of high transit demand inexpensively. However, when it comes to serving areas with low demands, a fixed-route, fixed-schedule bus system is very expensive on a per-passenger basis. Thus, as was noted previously, it would be very expensive to provide complete coverage of a rural or small urban area with a fixed-route, fixed-schedule bus system (complete coverage means that there is a bus route within three blocks of almost every residence and commercial establishment in that area). Thus, the usefulness of a fixed-route, fixed-schedule bus

system in a rural or small urban area is limited to corridors of high transit demand, if such corridors exist. In these corridors the fixed-route, fixed-schedule bus system can provide a basic, inexpensive transportation service.

In most small urban areas the fixed-route, fixed-schedule bus systems are operated by local governments or private firms under contracts to local governments. This is because of the fact that most small urban area fixed-route, fixed-schedule bus operations require some form of outside financial support. However, in some cases unsubsidized private operators have continued to operate some routes. When there are private and public fixed-route, fixed-schedule bus operations within a small urban area, it would seem to be desirable in most cases that the private operations be integrated into the public operations for the following reasons. Integration of the fixed-route, fixed-schedule bus systems would allow optimal use to be made of the transit planning and administrative capabilities in the area, and it would make the existing private operations eligible for capital grants. It would also allow routes and schedules to be coordinated and it would present the public with a more unified comprehensible system. However, it might be possible for all of these objectives to be achieved through cooperative efforts, such as leaseback arrangements, which would not necessarily involve total integration of the public and private bus systems.

9.5.2. Demand-Responsive Transit

i. Level of Service

From the passenger's point of view a demand-responsive system has a number of advantages when compared with a fixed-route, fixed-schedule bus system. First of all, the passengers don't have to walk to and from bus stops as the demand-responsive system provides door-to-door service. Secondly, the demand-responsive vehicles will go wherever the passengers want to go in the rural or small urban area which is being served. Thirdly, there is usually no need for the passengers to wait outside to flag down the vehicle. Rather, the passengers can wait inside and watch for the vehicle to come and then go outside to meet it. Also, a demand-responsive system provides service at the time when the rider needs it and not just once an hour like many fixed-route, fixed-schedule bus systems in small urban areas. Because of the aforementioned characteristics, the demand-responsive system is particularly well-suited for use by the handicapped and infirm. In addition, because the driver

of a demand-responsive vehicle does not have to maintain a pre-set schedule, he or she can take the time to help handicapped and infirm passengers on and off the vehicle. In a number of cases the demand-responsive vehicles have special lifts so they can transport passengers in wheelchairs.

A demand-responsive system can also have disadvantages from the riders' point of view when it is compared with a fixed-route, fixed-schedule bus system which it might replace. First of all, the fare of a demand-responsive bus is often higher than that of a fixed-route, fixed-schedule service. However, this should only tend to occur in areas with a high transit demand where a fixed-route, fixed-schedule system provides a more efficient, but lower quality service than a demand-responsive system. In considering replacing a fixed-route, fixed-schedule system in such an area with a demand-responsive system, it should be realized that any fare increase will be very significant to some individuals and will more than offset the advantages of a demand-responsive service. The second disadvantage of a demand-responsive system is that a telephone is needed to summon the vehicle. Not all homes in the United States have telephones. Those people who do not have telephones are presumably members of the economically disadvantaged group which transit should be especially trying to serve. Also, when individuals are not in their homes, it may be difficult in some cases to obtain access to a telephone with which to summon a demand-responsive vehicle. As a partial solution to this problem, demand-responsive systems might use direct telephone lines, such as some taxi companies have, to their dispatch offices in high demand locations. Such phones have been installed in the Rochester, N. Y., demand-responsive system.⁶⁸ Another disadvantage with demand-responsive systems is the need for passengers to make advance reservations for service in those systems which have such a requirement. This requirement has the potential to be a severe impediment to the system's use, depending on what types of trips the system is intended to service. If the purpose of the system is just to give handicapped, infirm, and other disadvantaged persons a limited amount of essential mobility, such as for medical trips, then the advanced reservation condition may not affect the system's use severely, as most essential trips are scheduled in advance. In fact, in this case, the advanced reservation condition could be useful in limiting the use of the system for non-essential trips. However, if the demand-responsive system is intended to serve general travel demands, then an advanced reservation condition would be a severe impediment to the system's use. The existence of such a condition would probably make a fixed-route, fixed-schedule system more desirable to many people.

In addition to providing passenger transportation, a demand-responsive system can also be used for other purposes such as package delivery of a meals-on-wheels type of programs.

ii. Operating Costs

Although, as in the case of fixed-route, fixed-schedule transit, it can be expensive to serve areas with low transit demand with demand-responsive transit, the cost of providing service with demand-responsive transit is still less than that with fixed-route, fixed-schedule transit. The costs of operating a demand-responsive transit service depends on a number of factors such as driver-wage rates, vehicle-maintenance costs, fuel costs, and the scheduling system which is used. One very important cost factor is the number of demands per square mile for the service, which in turn is related to the population density of groups which are served by the demand-responsive system in the area. In areas with very low demand densities, demand-responsive transit services can be expensive to operate as they are essentially functioning like a taxi service. In addition, they usually have bigger, more expensive vehicles, better paid drivers, and a more expensive dispatching arrangement than a taxi company. While it may be desirable to bear such expenses in low demand areas in order to provide some mobility for disadvantaged individuals, such expenses do not seem warranted in any service which is offered to the general public.

On the other hand, in areas with higher service demands, a demand-responsive system can be operated with a reasonable operating cost per passenger on the order of \$1.00⁶⁹. In this case, it would seem to be desirable to offer demand-responsive services to the entire population of the area. Generally, a population density of 3,000 or more persons per square mile has been considered necessary for the operation of such demand-responsive service.⁷⁰ However, the substantial success of demand-responsive systems in areas with population densities of not much more than 3,000 persons per square mile, indicates that this figure may be on the high side. The Mitre Corporation provided preliminary planning guidelines for demand-responsive systems in its report, Demand-Responsive Transportation Planning Guidelines.⁷¹ The use of these guidelines will be discussed in section 6 of this chapter when the potential for a demand-responsive system in Tompkins County, N. Y., is examined.

iii. Scheduling and Communications

One important component of any demand-responsive system is its scheduling arrangement. Both the advanced reservation and dynamic scheduling systems have been previously described. Presumably the advanced reservation system makes dispatching for the demand-responsive operator easier. However, the advanced reservation system's applicability seems to be limited to those cases in which demand-responsive transit is only intended to service the basic transportation needs of disadvantaged individuals. The advanced reservation system is totally unsuitable for a demand-responsive system which is offered to the general public as a substitute for a fixed-route, fixed-schedule transit system or their automobiles. This is because of the inflexibility of individuals' travel arrangements under the advanced reservation system. The only major case in which an advanced reservation system would not greatly hinder use of the demand-responsive system by the general public would be in the case of regular trips such as work trips. However, a greater suitability of the advanced reservation system for work trips, as compared to other types of trips, might result in substantial peak period problems, for any demand-responsive system which used it. While some demand-responsive operators seem to feel that an advanced reservation system is the only one under which they could operate efficiently, a number of demand-responsive systems have been operating efficiently using dynamic scheduling. However, it may be true that an advanced reservation system does result in more vehicle utilization.

A mobile radio system is essential in any dynamically scheduled system and desirable in an advanced reservation system. In an advanced reservation system a mobile radio can be used to inform the drivers of late cancellations and for the drivers to ask the dispatcher any questions they may have regarding no-shows and other problems. If a mobile radio system is purchased for a demand-responsive system, it may be desirable to also install mobile radios in any existing fixed-route, fixed-schedule vehicles at the same time. The only additional cost would be for the mobile radio units in the fixed-route, fixed-schedule vehicles. These units cost about \$1,000 each and with federal government and state capital grants the net cost of these units to the local government can be less than \$200. Mobile radios can be used on fixed-route, fixed-schedule buses to report emergencies such as breakdowns, to

request assistance (possibly from demand-responsive vehicles) when a bus is behind schedule or when there are too many people at a bus stop, to report traffic jams or other blockages to other vehicles, and to prevent or report crimes on the bus or along its route.

iv. Ownership and Operating Options

A demand-responsive system can be operated by local governments, private firms under contract to local governments, and social service agencies, as was shown in Section 9.4.4. By definition, a demand-responsive system cannot be operated by a private firm, such as a taxi company, on its own initiative, since such an operation would be considered to be a shared taxi service.

Social service agency demand-responsive operations are usually of a limited nature, as they usually serve only the agencies' client populations. Thus, they do not provide a service for the general public. Thus, local government operation or support of a private operation is needed for a full-service demand-responsive system. Also, there is no reason why a local government could not operate or support a demand-responsive service for disadvantaged groups on its own initiative.

If a fixed-route, fixed-schedule system is already being operated by a local government organization in an area, it may also be desirable to have any proposed demand-responsive system operated by the same organization. This would help to assure the achievement of the potential benefits of transit system cooperation and integration which were discussed earlier in this chapter. However, there may be some difficulties in such an arrangement, as the existing fixed-route, fixed-schedule management may be wary of the demand-responsive system and may therefore under-promote it. If such a situation seems likely in a specific area, it may be desirable to keep the fixed-route, fixed-schedule and demand-responsive operations separate, with coordination being achieved wherever possible.

9.5.3. Shared Taxis

The similarity between shared taxis and demand-responsive systems was noted in section 4 of this chapter. Thus, in considering shared taxis as an alternative transit system, it is best to compare them with demand-responsive systems.

Shared taxis have two advantages over demand-responsive transit systems. First of all, they make use of the existing transportation facilities in a community and do not require the establishment of a new organizational structure. Secondly, they tend to have lower operating costs for a number of reasons. One reason for this is that their drivers' pay and benefits tend to be lower than those of transit drivers. Also, as most taxi companies in small urban areas are not very big, the "sweat" equity which their owner-operators invest in their companies through long working hours can be significant. Finally, there is the profit incentive to keep costs down, which a public operation does not have.

However, shared taxis also have several disadvantages when compared with demand-responsive systems. First of all, since they are not operated by the government, subsidies have not been available for shared taxis to date. Thus, unlike the demand-responsive systems, shared taxis must cover their costs with their revenues. There are significant problems with obtaining government subsidies for privately initiated operations. One problem is the general feeling of most governmental agencies, that as long as they are paying for a service, they should be able to control and have their name on it. The second problem is that it is often very difficult to determine what the proper subsidy is. One possible solution to this problem would be to negotiate a per-passenger subsidy with the taxi company for special groups (handicapped, elderly, etc.). The subsidy should be less than the actual savings to the passenger on the theory that the taxi company will be gaining some new business which it would not have otherwise. Therefore, its margins on the new business can be lower (than normal and it will still be well off) as it has already covered its fixed costs with its existing ridership. That this is feasible is shown by the fact that some taxi companies have offered special discounts to the elderly on their own initiative. Thus, on a \$1.00 ride the local government might pay \$.35 to the taxi company and the taxi company might charge the passenger \$.50.

Another disadvantage with shared taxis is their ineligibility for federal and state capital grants. However, it may be possible to get around this problem by having the local governments purchase the vehicles and dispatch equipment, using capital grants etc., and then lease it to the taxi companies. The shared-taxi system also has some disadvantages which stem from its separation from the government. Because it is a private organization, it is not as easily integrated into the

overall planning process as a government organization would be (lack of control). Also, it may not be as responsive to public input through the government, although it may be more responsive to public input through the market.

A final disadvantage with shared taxis is their usual lack of integration with the rest of the transit system. In an integrated operation the shared taxis might take individuals in thinly populated areas to and from the transit system's fixed routes. This type of an arrangement would make transit services available to outlying residents in a relatively inexpensive manner. It is quite possible that taxi companies will be willing to engage in a joint effort of this nature if it is proposed to them by transit system operators.

9.5.4. Subscription Service, Vanpools, Carpools

In comparing these three similar transit systems, subscription service seems to be inferior to vanpools and carpools in most cases. There are a couple of reasons for this. First of all, a subscription service requires a special, paid driver, whereas in the case of a vanpool or a carpool the driver is one of the members of the pool. Secondly, since a subscription service uses a larger vehicle than a vanpool or a carpool, it will require a higher demand density to be successful and its routing will not be as efficient. For example, two 12-passenger vans can be routed more efficiently than one 24-passenger bus. The main advantage of subscription services over carpools and vanpools is that they make the vehicles available for use during the rest of the working day (the vanpool drivers usually get the use of the van during nonworking hours for a per-mile fee). However, there may be substantial problems finding uses for all of a subscription service's vehicles and drivers during the day if the subscription service is fully implemented. Also, it might be possible to allow other groups and organizations, such as social-service agencies and demand-responsive systems, to use the vanpool vans during working hours. In addition, there is the possibility of using school buses, which are already available, to satisfy non-peak period vehicle demands.

The major problem with subscription services, vanpools, and carpools is their inflexibility. The participants are unable to deviate from their pool's rigid schedule in their work patterns. This interferes with overtime work, getting into work late in the morning, etc. A demand-responsive service could provide a very effective solution to this problem. Members of

pools who had missed their cars or vans could use the demand-responsive service instead. It would probably be desirable to give these individuals a reduced fare on the demand-responsive system in order to encourage this arrangement so that they did not feel they were really paying twice.

One of the big advantages of vanpools and carpools is their low cost. No subsidy appears to be necessary as the cost per rider is low. For example, Minnesota Mining & Manufacturing has the following fare arrangement for its 67 12-passenger vans:⁷²

The passengers pay an average of \$25 a month to the company. The driver not only rides free but also receives fares collected from the ninth, tenth, and eleventh passengers and can use the van for personal errands for eight cents a mile.

In addition to being inexpensive, vanpools and carpools, with the demand-responsive service option, offer a service quality which is very competitive with a dedicated automobile.

In comparing vanpools and carpools, vanpools have the advantage of reducing the closeness of the vehicle environment and thereby reducing the potential for inter-personal tensions. Also, the employer initiative which is necessary for a vanpool and the fact that employees do not have to commit their own cars to the vanpool can contribute substantially to its success. A spokesman for the Highway Users Federation has stated that, "Where people are reluctant to use their own car in a carpool, they'll jump all over a van provided by the company."⁷³ The advantage of carpools is that they do not require employer initiative and also the fact that they are more suitable for serving employee groups where the demand is not large enough to justify the use of a van. One problem in a carpool may be in deciding who should provide the car. If the car is provided on a rotating basis by each of the pool's members, then no real savings in the required number of vehicles will result.

In considering what organizations would be best suited to operate a vanpool, employer efforts to date appear to have been very successful. However, local government involvement might make vanpools eligible for federal and state capital grants. In addition, local government initiative may be needed to get all the large employers in a small urban area involved

in vanpooling efforts. Thus, it would seem that vanpools might be best operated as a joint local government-employer effort.

9.6. Potential Transportation System Designs for Tompkins County

In this section each of the transit systems which was discussed in section 5 will be considered in terms of its potential for actual use in Tompkins County, New York.

9.6.1. Fixed-Route, Fixed-Schedule Service

i. Operational Characteristics

Because of the expense, it would be impossible to provide fixed-route, fixed-schedule services to areas in Tompkins County, other than those which are close to the City of Ithaca. Thus, any fixed-route, fixed-schedule service will continue to leave a large part of the population of Tompkins County unserved.

In the City of Ithaca the fixed-route, fixed-schedule service of the Community Transit System has most of the deficiencies which are typical of fixed-route, fixed-schedule systems. Although most of the City of Ithaca is reasonably well covered by the Community Transit System routes, service is provided on each route only once per hour, except in areas where routes overlap. In addition, Ithaca is noted for its inclement weather. Twenty bus shelters will be purchased in the near future, but this will still leave many bus stops without seats or protection from the weather. Also, although the Community Transit System has used small buses to date, the purchase of one new 45-passenger bus along with two 33-35 passenger buses is planned in the near future. The 45 passenger bus will presumably have the negative characteristics of the large buses associated with it which were described earlier in this chapter.

Despite its deficiencies, the Community Transit System does provide a valuable service for the residents of the City of Ithaca in an inexpensive manner. In recent years the ridership has increased steadily from 220,000 passengers in 1969 to 375,000 passengers in 1974 and is further increasing in 1975. Thus, the emphasis should be on improvements in the existing system and not on a replacement for it. A number of short-range changes, which were described earlier in this chapter, can be applied to the Community Transit System. These

changes will be described in the Recommendation Section of this chapter.

Tompkins County presently has two major fixed-route, fixed-schedule bus systems in addition to the Community Transit System. They are the Northeast Transit System (NET) and the Cornell Campus Bus System. In its first six months of operation NET carried 27,493 passengers. In fiscal 1973-74 the Cornell Campus Bus System carried about 3,000,000 passengers.

ii. Administrative and Ownership Characteristics

Unless a demand-responsive transit system is implemented on an areawide basis at some future time, operation of the Community Transit System by the City of Ithaca should be continued. Any service extensions to neighboring towns could best be accomplished by intermunicipal agreements. The reason for this is that there is presently not a sufficient demand for fixed-route, fixed-schedule service outside of the towns adjacent to the City of Ithaca. Since the fixed-route, fixed-schedule service would only serve a limited part of Tompkins County, operation of the bus system by a public authority or a county department would be inappropriate. Although a special district might be appropriate in the future, at the present time the legal problems involved in setting it up would outweigh its benefits. Thus, the intermunicipal agreement is left as the only feasible means of extending fixed-route, fixed-schedule service to the towns adjacent to the City of Ithaca in the near future, unless a complementary demand-responsive service is set up which will serve most of Tompkins County.

The advantages and disadvantages of transit system integration were discussed in Section 9.4.4 of this chapter. In considering the potential for integration of the transit systems in Tompkins County, it would seem that the three fixed-route, fixed-schedule systems which presently exist in Tompkins County might be the proper place to start.

In the case of a merger of NET into CTS, the combination appears to have most of the advantages which were cited in Section 9.4.4 and none of the disadvantages:

- a. Since Swarthout & Ferris, which is the bus company which operates NET, also operates charter buses, it is doubtful that any maintenance economies would be achieved by

the transfer of the NET routes to CTS. However, since Swarthout & Ferris is principally a charter bus operator, its management puts major attention in terms of promotion and vehicle quality on that part of their operation. Presumably, CTS's management, with its transit experience, would be in a better position to operate the NET system successfully. Also, CTS would be able to replace the present school bus type vehicles which are presently used in the NET service with more suitable transit vehicles.

- b. Combining the CTS and NET systems would eliminate some existing route overlap between the two systems.
- c. The combination of the two systems would eliminate public confusion regarding the differences between them. Also, public awareness of the NET service would be promoted by the inclusion of its schedule in the widely distributed CTS schedule.
- d. It is almost certain that a through-service from the village of Lansing to downtown Ithaca would be created as a result of the combination of the two systems.
- e. As a part of CTS, NET would be eligible for federal and state capital grants and operating subsidies.

Insofar as the potential disadvantages of the combined systems are concerned:

- a. The combination of CTS and NET would not depend on county funding. Therefore there would be no need to serve everyone in the county.
- b. NET and CTS are similar transit services. Hence, there is no advantage in having them operated by different organizations.

- c. Swarthout & Ferris has been unimaginative and outdated in its operation of NET. Thus, there would be no stifling of innovation by turning the operation of the NET system over to the CTS management.
- d. There does not seem to be a potential cross-subsidy problem in this instance, as neither of the two bus systems is profitable.

For these reasons it would seem to be highly desirable that the NET system be merged into the CTS system. However, Swarthout & Ferris holds an exclusive franchise for the NET route and has been rather intractable concerning the possibility of turning its franchise over to CTS. Also, an intermunicipal agreement would be necessary if CTS were to operate in the Village of Lansing and the Town of Ithaca. Given the present political environment in Tompkins County, this agreement might not be readily forthcoming. For these two reasons, what seems to be a highly desirable transit system integration will probably not be readily forthcoming in the near future.

It is questionable whether the integration of the Cornell Campus Bus System and the Community Transit System would be desirable. The reason for this is the fact that the two bus systems offer completely different types of services. The Cornell Campus Bus System is a short haul, high-volume service, charging no fare to date. It only operates on the Cornell campus and it runs buses along its route at least every 15 minutes and as often as every 5 minutes during peak periods. On the other hand, the Community Transit System has much longer routes with less frequent service. For this reason, it seems to be desirable to keep the two systems separate in terms of the services which they offer. However, as is noted in Chapter 8, some economies might be possible from a coordination of the maintenance operations of the two systems.

iii. Costs and Subsidies

The operating cost of the Community Transit System has been low on a per-passenger basis. Total operating costs in 1974 were \$166,283 or \$.44 per passenger. Given an average revenue of \$.22 per passenger, the deficit was \$.22 per passenger. Payments by New York State, Cornell University, and Ithaca College reduced the net cost to the City of Ithaca to \$54,215 or \$.14 per passenger. Thus, the Community Transit

System has been offering the City of Ithaca a very economical transit service. Part of the reason for this has been the concentration of service demands at Cornell University and downtown Ithaca. (Three of CTS's four major routes connect Cornell University and downtown Ithaca.)

In its first six months of operation NET's operating costs were \$18,000 or \$.69 per passenger. NET is subsidized by an area landlord and Cornell University. The NET fare is \$.30 on cash basis or \$.25 per ride for a subscription ticket, but the landlord's tenants are given free passes on the system, making any average revenue per passenger figure meaningless.

The operating cost of the Cornell Campus Bus System during fiscal year 1973-74 was \$259,800 or about \$.09 per passenger. The Cornell Campus Bus System does not have any fares as its operating costs are paid by Cornell University.

iv. Services for Special Population Groups

The Community Transit System does not serve the needs of the infirm elderly or the handicapped very well. This is not the fault of the CTS, but is rather typical of all fixed-route, fixed-schedule systems, as was stated earlier. Thus, none of the short range changes which were discussed in Section 9.4.3 will completely solve this problem. However, CTS has recently received a grant for the purchase of a special vehicle for use by the elderly. This vehicle will serve locations of special interest to the elderly in regular fixed-route. It is projected by CTS that this vehicle will provide 150 trips per day. The Community Transit System also provides very limited mobility for the captive rider as it serves only the Ithaca area and service is only provided once per hour to many destinations. However, this aspect of the service could be improved by the recommendations made later in this chapter.

9.6.1. Demand-Responsive Transit

i. Operational Characteristics

In considering the potential for a demand-responsive system in Tompkins County, it is important to realize that the City of Ithaca already has a successful fixed-route, fixed-schedule bus system. Because of the successful and efficient nature of the existing Community Transit System service, caution must be used in proposing any demand responsive system which might replace it.

The Mitre Corporation preliminary planning guidelines illustrate this fact clearly.⁷¹ To serve the projected ridership of 404,200 persons per year of a demand-responsive service which might replace the existing Community Transit System service would cost about \$380,000 per year according to the calculations in Table 9.2 which used the Mitre Corporation guidelines.* Thus, the projected demand-responsive operating cost is over twice as large as the present Community Transit System operating cost. Therefore, in formulating proposals for demand-responsive systems which might be implemented in the near future, the emphasis must be placed on systems which will complement rather than replace the existing Community Transit System. Thus, it is necessary to consider the transit demands which the Community Transit System does not presently serve very well. These demands include those for the infirm elderly and the handicapped, the transit demands of individuals outside the City of Ithaca, the demands for night transit service in the City of Ithaca, and the transit demands of individuals in those parts of Ithaca which are not served by existing transit routes.

Potential demand-responsive transit services which would serve those transit demands are as follows:

- a. Elderly and Handicapped. Estimates of the daily demand by the elderly and handicapped for a demand-responsive service in Tompkins County are shown in Table 9.3. These figures indicate that there is sufficient demand to support daily demand-responsive service in the City and Town of Ithaca and a less than daily demand-responsive service elsewhere in the county. Thus, that part of Tompkins County outside of Ithaca might be divided into sectors, with each sector being served on one day of each week. Service would be provided between origins and destinations which are both in the sector and between origins in the sector and destinations in the City and Town of Ithaca, or vice-versa. Service between sectors would be prohibitively expensive and hence it should not be provided. Five possible sectors are:

* The derivation of the 404,200 passengers per year figure will be described in Section 9.7.

1. Ridership per year	404,200
2. Ridership per day	1,304
3. Peak-hour ridership (Figure 9-1)	131
4. Service area	5.78 square miles
5. Peak-hour riders per square mile	22.6
6. Fleet size per square mile (Figure 9-2)	2.1--3.3 (assume 2.1 since service demands tend to be very concentrated at Cornell University and downtown Ithaca, making it an efficient many-to-few type service)
7. Fleet size	12 vehicles
8. Daily operating cost	\$1,150-1,350
9. Annual operating cost (including capital costs)	\$356,500--418,500

Table 9.2

Demand-Responsive System Cost Predictions

Caroline	5
Danby	2
Dryden	7
Enfield	6
Groton	2
City of Ithaca	75
Town of Ithaca	12
Lansing	6
Newfield	6
Ulysses	6

Table 9.3

Estimated Demand-Responsive Trips By
Elderly and Handicapped*

* The derivation of these demand figures will be described in Section 9.7.

Figure 9.1

Daily and Peak-Hour Ridership Versus Population

Source: Reference (71)

Figure 9.2

Fleet Size Per Square Mile Versus Peak-Hour
Demand Density

Source: Reference (71)

Figure 9.3
Daily Operating Cost Versus Fleet Size
Source: Reference (71)

Lansing
Dryden and Groton
Caroline and Danby
Newfield
Enfield and Ulysses

It is not necessary that the sectors be set up by towns. However, setting the sectors up by towns will make it easier for the service's users to determine which sectors they are in. It also assures that passengers will be able to reach all points in their home towns using the demand-responsive service. In the case of towns which are served on only one day of each week, it is expected that the ridership on the day of the service will be greater than that shown above, but less than the weekly total if a daily service were to be offered. For the purposes of this study, it has been assumed that the demand for service in those towns are served on a one-day per week basis will be 2.5 times as great as the daily ridership which was previously predicted for those towns. For example, in the Town of Lansing the ridership on the day of service is predicted to be 15 persons.

It is recommended that the service within the City and Town of Ithaca be provided on a dynamically-scheduled basis, if so doing will not significantly decrease the productivity of its vehicles. The service outside of Ithaca should be provided on an advanced-reservation basis, because it should be possible for one vehicle to take care of all the demands under such an arrangement, whereas two or three vehicles would be required in a dynamically-scheduled service.

Whereas service in the City and Town of Ithaca should be operated on a many-to-many basis, a route-deviation scheme seems to be better suited for service outside of Ithaca. In a route-deviation operation each vehicle would make a set number of round trips between the City and Town of Ithaca and the sector which was being serviced on that day at specified times during the day. Individual pickups and drop-offs would be arranged at the beginning and end of each of the two portions of each round trip. The round trips would probably take about

two hours including passenger pickups and drop-offs. Thus, the passengers would be required to adjust their schedules to the schedule, as is the case with a fixed-route, fixed-schedule operation. The reason for this type of arrangement is to force the passengers from low-demand density areas to schedule their trips at standard times so that the demand-responsive vehicle will not be providing a taxi-type of service.

- b. Transit Demands of Individuals Outside of the City of Ithaca. If demand-responsive service for the elderly and the handicapped is successful outside the City and Town of Ithaca, it may be desirable to make this service available to the entire population of the County outside the City of Ithaca. Such a service would not necessarily be prohibitively expensive. For example, assuming 2 hours per demand-responsive vehicle round-trip, 10 passengers carried during the round trip, and an operating cost of \$10 per vehicle-hour, the operating cost of the service would be \$2.00 per passenger trip. It is quite possible that the passengers would be willing to pay a fare of \$1.00, thereby making the services' deficit \$1.00 per passenger trip. (This analysis does not include potential reductions in the operating costs as the result of federal and state capital grants and operating subsidies.) The major problem in offering such a service would be the fact that residents of Ithaca might also request a similar service for the Ithaca area. As was noted previously, a demand-responsive service would be an expensive replacement for the present Community Transit System service.
- c. Evening Transit Demands. An evening demand-responsive transit system (in the present Community Transit System service area) would serve two purposes. First of all, it would provide a needed transit service for the City of Ithaca. Secondly, it would provide a means of testing the viability of a demand-responsive system in the City of Ithaca without the

investment of new capital. (It would use the existing Community Transit System vehicles and hopefully, it could also obtain the use of a mobile communications system which the Red Cross is planning to install.) Even if the evening demand-responsive service is unsuccessful, it might provide a useful indication from its service patterns of the areas between which the Community Transit System might consider operating fixed-routes during the evening.

It is proposed that the evening demand-responsive service be operated between 7:00 and 11:00, Monday through Saturday. The service should be many-to-many, with dynamic scheduling. It is probable that most of the trips will have their origin or destination at either Cornell University or downtown Ithaca. Thus, the service, while being offered as a many-to-many service, will probably be effectively operated as a many-to-few service.

It is expected that the evening demand-responsive service's ridership will be about 44,900 passengers per year or 145 passengers per day.* Thus, the service's peak-hour demand will probably be about 40 passengers total or about 6.9 passengers per square mile. Using Figure 9.2, this indicates that between .8 and 1.4 vehicles will be needed per square mile or about 5 to 8 vehicles total. The lesser figure should be the more accurate of the two since the evening demand-responsive service is expected to be effectively operated as an efficient many-to-few service.

- d. Lack of Community Transit System Service in Parts of the City of Ithaca. It might be possible to set up a route-deviation scheme in those sections of Ithaca where the demands

* The derivation of this ridership figure will be described in Section 9.7.

for fixed-route, fixed-schedule service are not substantial. However, there would be substantial public confusion and objections if only part of the Community Transit System were to be operated on a route-deviation basis. (The objections would probably come from those individuals who were still offered only a fixed-route, fixed-schedule service.)

Thus it would be necessary to extend the route-deviation service to the entire Community Transit route system. A route-deviation system would be very expensive on high volume routes and might not be much less expensive than a many-to-many service in the Ithaca area. Thus, although it might be considered as a future means of phasing demand-responsive transit into the City of Ithaca, a route deviation service does not appear to be feasible at this time. Rather, it would seem that the previously described evening demand-responsive service would be the best means of testing the viability of demand-responsive transit in the City of Ithaca.

ii. Administrative and Ownership Characteristics

While it would be possible for a social service agency to operate a demand-responsive service for the elderly and the handicapped in Tompkins County, government operation would be necessary for the other demand-responsive services. The Red Cross has recently received funds for two station wagons for a countywide demand-responsive service for the elderly and the handicapped. While the Red Cross has not decided at this time exactly how it will operate its demand-responsive system, it appears that it will be operating a limited version of the demand-responsive system for the elderly and handicapped which was described in the previous section. Red Cross operation of the demand-responsive system will have the major advantage of reducing the operating costs of the system because the Red Cross will use volunteer drivers. Thus, if the Red Cross is able to handle all the requests for the services of its demand-responsive system, it is desirable that

it operate the system as planned. However, if in the future it appears to be desirable to expand the demand-responsive service to serve other population groups or the entire population of Tompkins County, operation of the system by the county government would be necessary. (The County government might take over the operation of the present Community Transit System routes at the same time in order to provide an integrated transit service.)

In the case of an evening demand-responsive system in the present Community Transit System service area, this service should obviously be provided by the present Community Transit System organization. Some coordination between the Community Transit System and the Red Cross would be desirable if the Community Transit System decides to offer an evening demand-responsive service, as it would be possible for them to achieve some economies by using the same mobile radio system.

iii. Costs and Subsidies

In the models for the different demand-responsive systems the fares have been assumed to be as follows:

Elderly and handicapped service	25¢
Evening Demand-Responsive service	50¢
Full Demand-Responsive service in the CTS service area	25¢

The elderly and handicapped service fare has been set at a low level so as to approximate the donations which might be received by the Red Cross demand-responsive service (no fare will be charged by this service). However, a somewhat higher fare might actually be desirable, as it would encourage those individuals who were able to, to use the Community Transit System. The evening demand-responsive fare was set at 50¢, so as to restrict night ridership to a level that could be handled by the present 5 vehicle CTS fleet. A 25¢ fare was chosen for the full demand-responsive service as it was felt that any demand-responsive service which replaced the existing Community Transit System service would have to maintain the present Community Transit System fare.

Neither of the two presently proposed demand-responsive systems will be inexpensive in terms of their operating cost per passenger if they are operated by local government. It is estimated that if the City and Town of Ithaca provided daily service for elderly and handicapped it would cost approximately \$61,200 to operate per year or \$2.43 per passenger. This cost

has been based on an estimate of three vehicles required to provide the service for eight hours per day (Vehicle Productivity = 4.13 passengers per vehicle hour) at a cost of \$11 per vehicle hour. The operating cost of the elderly and handicapped service outside of Ithaca will be about \$20,400 per year or about \$4.00 per passenger. This cost has been based on an estimate of one vehicle required to provide the service for eight hours per day at a cost of \$11 per vehicle hour. Thus, these services would be fairly expensive for the local government to operate. However, Red Cross operation of these services, depending as it does on volunteers and station wagons, should reduce these costs considerably. Thus, if the Red Cross is able to operate the service successfully, it would seem to be an excellent solution to the transit needs of the elderly and the handicapped.

The evening demand-responsive service will cost about \$68,200 per year to operate. With a 50¢ fare the revenues for this service should be about \$22,400. This means that the system's deficit will be about \$45,800 or \$1.02 per passenger. While this deficit is high, especially considering the fact that the maximum taxi fare in the City of Ithaca is \$1.25, it may not be unreasonable. Since the evening demand-responsive service probably will be essentially a many-to-few service, as was noted earlier, its vehicle needs may be lower than were predicted by the Mitre preliminary planning guidelines. With proper routing and scheduling it is possible that only three instead of five vehicles would be required for this service. Operating the service with only three vehicles would imply a vehicle productivity of 12.1 passenger per vehicle hour which has been achieved in some other demand-responsive systems. In that case, the system cost would be about \$41,000 per year. The deficit would be about \$19,000 per year or \$.38 per passenger which seems to be reasonable. However, since there is no assurance that the system can actually be operated with three vehicles the \$68,200 cost figure will be assumed in the rest of this study.

iv. Services for Special Population Groups

One of the major advantages of the Red Cross demand-responsive service system for the elderly and the handicapped is the improved transit service which it will provide for those individuals. Other than taxi services, which many of these people cannot afford, no provision is presently made in Tompkins County for the transportation of infirm elderly and handicapped individuals. However, there are two aspects in which the Red Cross demand-responsive service is deficient. First, it

will probably not provide a daily service for individuals outside the City and Town of Ithaca. This will limit the use of this demand-responsive service as a means of traveling to and from work or school for handicapped individuals. However, this problem could be handled in many cases by the vanpools and carpools which will be described in section 9.6 of this chapter. The second problem with the demand-responsive service is that it will probably not serve some disadvantaged individuals such as the young or the poor. Hopefully, it will be possible to offer a countywide demand-responsive service to these disadvantaged groups at some time, possibly as part of an expanded service for the entire population.

9.6.3. Shared Taxis

At the present time, taxi companies are not allowed to offer a shared-taxi service under a City of Ithaca ordinance. Nevertheless, the taxi companies offer a conventional taxi service within the City of Ithaca at a cost which is very competitive with that of any proposed demand-responsive system. (For service within the City of Ithaca, the taxi fare varies between \$.75 and \$1.25.) It is quite possible that the taxi companies might be able to reduce their fares somewhat if they are allowed to offer a shared-taxi service. In this manner, a demand-responsive system might be set up without the need for local government involvement or subsidy. However, it is possible that the shared-taxi operators would provide increased competition for the Community Transit System. Nevertheless, given the advantages which a shared taxi service might offer, some reduction in the Community Transit System ridership and revenues as the result of shared-taxi competition would probably be much less than the increased cost to the City of Ithaca if it were to operate a demand-responsive system. In addition, if shared-taxi competition were to become a severe problem for the City of Ithaca it could raise the shared-taxi rates so that the loss of bus ridership to the shared-taxis would be reduced.

9.6.4. Subscription Service, Vanpools, Carpools

i. Operational Characteristics

Because of the disadvantages of a subscription service, which were described earlier, it will not be considered as a potential transit system for Tompkins County. Rather, emphasis will be placed on vanpools and carpools as major means of transporting people to and from work in Tompkins County.

Vanpools seem to be an excellent means, both in terms of cost and level of service, of handling many work trips to major area employers. The employers would benefit by reduced parking demands at their facilities. This would be especially useful in the case of Cornell University, which presently has severe parking problems. In addition, the employers might benefit from an increase in the size of their potential labor force because of their increased accessibility as a result of a vanpool program. Carpools are useful in those areas in which the employees' homes are too scattered to form efficient vanpools. The disadvantage of carpools as compared to vanpools lies in the fact that employees appear to be more willing to join and stay in vanpools than carpools.

ii. Administrative and Ownership Characteristics

As was noted earlier, vanpools would probably best be run as a joint government-employer effort. The county government could encourage and help major local employers to organize vanpool programs. In addition, if the county owned the vehicles, the vanpool program might be able to obtain federal and state capital grants. Also, the county would be able to obtain volume discounts if it purchased a large number of vans and it could set up an efficient central maintenance facility. Because of the substantial number of vans which would be involved in a countywide program, it would be possible to keep extra vans on hand to replace vans that were out of service. Presumably, the county effort on behalf of a vanpool program could be handled by a special county department or a public authority.

Because of its ability to obtain independent financing for van purchases and to operate in a more efficient manner, the public authority would probably be the better alternative of the two. The public authority could be set up with the intent that it might also operate any county transit services which might be set up at a later date. However, if federal and state capital grant funding are not available for the vanpools, then public authority ownership of the vans may not be politically viable. However, it might still be possible for the public authority to lease the vans from private finance companies or the van's manufacturers.

If it turns out to be impossible to make arrangements for the provision of the vans by a public authority, then it would be necessary for the employers to provide the vans. (A county department would probably be better able to handle the vanpooling program in this case.) If some of the employers

are hesitant to commit their funds to the purchase of the vans, it should be suggested that they lease the vans from a car leasing firm or from the vans' manufacturers.

Major employers in Tompkins County which should be considered in initial attempts to set up vanpools are Cornell University and Ithaca College (both employees and students could participate in the vanpool program), Morse Chain, N.C.R., S.C.M., New York State Electric and Gas, and Tompkins County.

In the cases of those employers or employee groups for which vanpools would not be feasible, the county vanpool organization could encourage them to set up carpools.

iii. Costs and Subsidies

In the case of vanpools, no subsidy by local governments appears to be necessary. Even without capital grants the costs of vanpools should seem very reasonable and could easily be paid by most employees. With the use of capital grant monies, the employees membership fees would be extremely low. In the case of carpools, since the only government or employer involvement would lie in encouraging their formation, no subsidies would be involved. In addition, the costs to the employees would be less than the costs of using their cars individually.

iv. Services for Special Population Groups

Both vanpools and carpools would be able to serve handicapped workers. In the case of vanpools, special wheelchair lifts and tiedown facilities could be installed on the vans as needed. In the case of the rider confined to a wheelchair, it would seem to be desirable that any extra costs associated with their use of the vans be borne by the government, the employers, the wheelchair riders themselves, or the vanpool as a whole in order to avoid placing a special financial burden on the members of individual vans. Vanpools and carpools can also provide a means of access to work for those individuals who are unable to afford automobiles, except in the case of rotating carpools.

It is interesting to note that the rudiments of a vanpool service for individuals without cars already exists in the automobile dealer courtesy car services. Eight of the Ithaca area car dealers use the courtesy vehicles to provide transportation to and from work for their service customers.

9.6.5. Transit Demand

i. Forecasting Total Demand

The total demand between major areas of trip origins and destinations will be forecast through the use of a model whose parameters were estimated by using regression analysis. The independent variables in the analysis could include land use variables, transportation system variables, and socio-economic variables as dummy variables. The model will be able to forecast total trips by all modes along major demand corridors.

ii. Estimating Modal Split

After the total number of trips has been forecast, the total number must be split into the various modes. The model used for mode split is a logit model of the form presented below.

$$P_i = \frac{1}{1 + e^{-G_i(x)}} \quad (9.1)$$

$$G_i(x) = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

where P_i is the probability that an individual will use mode i ; x_1 represents the cost difference between the usual mode of making the trip and the alternative mode, and x_2 is the time difference between the modes. Figure 9.4 shows the functional relationship between P_i and $G_i(x)$. The model parameters are calibrated using disaggregate data by means of maximum likelihood estimation procedure.

The model is calibrated using disaggregate data because these models tend to predict better (see Meyburg and Stopher, 1975)⁷⁴ than the aggregate models. The problem with the disaggregate models is that they must be able to predict or forecast the aggregate demand values for each mode of transportation. Using the average values of the transportation system in a model calibrated using disaggregate data from individuals to get aggregate percentage of modal share, introduces a bias problematic in the aggregation process.

The forecast aggregate demand using average cost and time differences will give the biased percentage of total trips $\bar{P}$. To remove the bias, the variance must be added. The unbiased percentage is $\hat{P}$.

Figure 9.4 Logistic Curve

$$\hat{P} = \bar{P} - \text{Var} (G(x)) \bar{P} (\bar{P}-1) (\bar{P}-\frac{1}{2})$$

where

$$\begin{aligned} G(x) &= \beta_0 + \beta_1 x_1 + \beta_2 x_2 \\ x_1 &= (C_a - C_b) \\ x_2 &= (t_a - t_b) \end{aligned} \quad (9.2)$$

C_a = cost of using an automobile for a trip
 C_b = bus fare
 t_a = travel time for the automobile
 t_b = travel time for the bus

$$\hat{P} = \bar{P} + [\beta_1^2 \text{Var}(C_a) + \beta_2^2 (\text{Var}(t_a) + \text{Var}(t_b))] \bar{P} (\bar{P}-1) (\bar{P}-\frac{1}{2}) \quad (9.3)$$

This equation was initially stated by Talvitie⁷⁵. $\hat{P}$ times the total number of forecast trips will be the forecast travel demand for the alternative. Each alternative will have associated with it different times and costs, and therefore different values for $\hat{P}$ and different demands for transit.

iii. Regression Model

The model used to forecast the total trips between the towns and cities in Tompkins County uses the data in Tables 9.4 and 9.5. The trip information is taken from the 1973 Tompkins County household survey. The total number of trips will be the dependent variable in the regression model. The independent variables for the between-towns model will be the population of the origin plus the population of the destination and the distance between the towns. For the within-zone trips a separate model is calibrated with the independent variable being only the population at the origin. The models are shown below.

$$\begin{aligned} TB &= .07676 P_1 - 5.763D \\ TW &= -4052.8 + 1.1287 P_2 \\ TB &= \text{trips between zones} \\ TW &= \text{trips within zones} \\ P_1 &= \text{population of origin zone plus destination zone} \\ P_2 &= \text{population of origin zone} \\ D &= \text{distance between zones} \end{aligned} \quad (9.4)$$

Due to the large variation in the number of trips between zones it was found that the only way to prevent zones with

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses	Population
Caroline	470	271	19	141	16	79	1574	61	79	26	12	2641
Cornell		11697	266	1313	184	91	9389	2210	1672	385	361	15
Danby			273	32	8	13	651	49	84	36	20	2237
Dryden				5121	24	352	1680	409	512	106	100	10316
Enfield					65	67	1148	177	86	8	180	2142
Groton						940	297	195	131	38	44	4860
Ithaca City							35917	4105	2406	1370	1395	25866
Ithaca Town								1995	1170	147	81	17486
Lansing									2951	50	203	6679
Newfield										1452	58	3720
Ulysses											3061	4362

Table 9.4
1973 Total Trips and Population

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses
Caroline	00	112	87	100	180	167	120	120	148	140	220
Cornell		00	68	100	80	120	12	12	53	80	108
Danby			00	160	100	200	68	68	127	53	160
Dryden				00	172	87	108	108	108	172	200
Enfield					00	232	80	80	140	60	72
Groton						00	160	160	120	232	252
Ithaca City							00	00	72	80	112
Ithaca Town								00	72	80	112
Lansing									00	140	188
Newfield										00	132
Ulysses											00

Table 9.5

Mileage Between Towns (X 10)

negative predictions was to add a correction factor, the residual, to the 1975 predictions. Table 9.6 shows the 1975 trip matrix. The matrix is assumed to be symmetrical; therefore, only the upper half of the matrix is presented.

iv. Demand for Alternative Systems

The total demand for transportation is shown in Table 9.6. The share of the total demand which can be assigned to the transit system in each of the alternative systems using the logit model is described earlier in this chapter. The proposed transit systems are composed of various combinations of the following subsystems. The first of these subsystems is the existing Community Transit System, (CTS). The second subsystem is a demand-responsive system for the CTS service area during the evenings. The third is a demand-responsive system for the elderly and the handicapped which would serve all of Tompkins County. The final subsystem is a demand-responsive system that would replace the CTS system and would serve the same area.

The same logit mode choice model will be used for the above subsystems as a basis for calculating a model share for the subsystem.

v. The Logit Model

The logit model was calibrated using data collected during the 1973 Tompkins County household survey. The data set includes all those individuals who used the automobile and the CTS bus as either their primary or alternative mode of travel. The resulting model is given below.

$$\bar{P} = \frac{1}{1 + e^{-G(x)}}$$

$$G(x) = -1.93 + .028 \text{ CD} + .203 \text{ TD} \quad (9.5)$$

$\bar{P}$ = uncorrected probability of transit use

CD = cost difference between automobile and transit

TD = time difference between automobile and transit

The corrected probability of transit use is given below.

$$\hat{P} = \bar{P} + \frac{[(.027976)^2 (219.7) + (.20365)^2 (84.3)]}{[\bar{P} (\bar{P}-1) (\bar{P}-\frac{1}{2})]} \quad (9.6)$$

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses
Caroline	549	275	28	174	27	83	1560	162	95	47	10
Cornell		12111	270	1342	190	89	9399	2332	1682	402	354
Danby			343	65	19	16	637	149	99	58	17
Dryden				5531	57	379	1690	531	551	151	121
Enfield					151	72	1135	278	103	31	179
Groton						924	278	290	141	54	36
Ithaca City							35649	4181	2397	1369	1370
Ithaca Town								3399	1276	259	169
Lansing									3107	78	207
Newfield										1704	68
Ulysses											2957

Table 9.6

1975 Trip Matrix

The variances are the variances of the original data set used to calibrate the logit model. The mode share can now be calculated for each of the subsystems. (It should be noted that these estimates are rather tentative. Refinements will be provided in the final report of this research project.)

vi. The CTS Subsystem

For the CTS system the values for the CD and TD are the mean values of the data set used to calibrate the logit model. The cost difference is $CD = -14.1$ cents and the time difference is $TD = -12.9$ minutes. These values when used with equation (9.5) produce a probability $\bar{P} = .00702$. The corrected probability is $P = .0195$. This probability is multiplied times the total trips in the service area for 1975. The total trips are composed of within-zone trips for the City of Ithaca and Cornell University plus their between-zone trips and 20% of the within-zone and between-zone trips for the Town of Ithaca and the City of Ithaca and Cornell University. The total trips for the CTS service area are 69,842 trips/day. 90% of the total trips are assumed to take place during the operating hours of CTS. Based on a mode share of .0195 and 295 days of service (256 weekdays and 52 Saturdays that have 75% of the average daily trips) this produces 1,226 trips/day and 361,000 trips/year on the CTS system in 1975. This represents a decrease of 14,000 trips over 1974 which is reasonable since the six-month figures for 1975 indicate that the ridership will be equal to or slightly less than 1974.

vii. The Evening Demand-Responsive System

This system would begin approximately at 7 p.m. and run for four hours. It is estimated that 10% of the total trips are taken during this four-hour time period. The 1975 total trips for this time period will be 10% of the 69,842 trips/day or 6,984 trips/day.

For this type of demand-responsive system the charge would be \$.25/ride more expensive. Thus, the mean cost difference is $CD = 39.1¢$. The time difference is increased on the average 4 min. to $TD = -8.9$. This is because the average wait and walk times of this system are much shorter.

The above values produce a $\bar{P} = .0079$ and a $\hat{P} = .0218$. The $\hat{P}$ multiplied times the total demand 6,984 trips/day times 295 days results in 152 trips/day and 44,900 trips/year for this evening demand-responsive system.

viii. Elderly and Handicapped Subsystem

The value for the mean cost difference for this subsystem is equal to the CTS system since the fare will remain at \$.25/ride, $CD = -14.1$. The time difference will only be slightly less than in the CTS case due to a decrease in the walk and wait time while there is an increase in the in-vehicle time; therefore, the time difference is $TD = -11.0$. The above values result in a $\bar{P} = .0103$ and $\hat{P} = .033$.

The demand figures for this system are found by multiplying the % of the town population that constitutes the elderly and handicapped times the total trips to and from the towns to the City of Ithaca. This figure times a correction factor times $\bar{P} \times 5$ days a week gives the trips/week. The correction factor reduces the total demand by 50% due to the fewer trips on the average that this group makes; this reduces the $\bar{P}$ to .0165 which is the approximate value of $\hat{P}$ in the following systems: Cranston, Rhode Island; Davis, California and St. Petersburg, Florida. This is a second reduction to 25% of the original demand for all the towns except the City of Ithaca and the Town of Ithaca. The second reduction is to allow for the fact that these towns will be served only once a week by this service.

Table 9-7 shows the process of obtaining the annual demand for this subsystem. The total demand is 533 transit trips/week and 27,716 transit trips/year for the elderly and the handicapped to and from the City and Town of Ithaca.

ix. Total Demand-Responsive Subsystem

This demand-responsive subsystem would replace the CTS system and serve the same area. The probability $\hat{P}$ would be the same for this subsystem as the one calculated for the evening demand-responsive subsystem. The service characteristics would be identical to those outlined above (viii.). The $\hat{P}$ is equal to .0218. This probability is applied to 90% of the total demand to give 1,370 transit trips/day and 404,200 transit trips/year.

9.7. Recommendations

i. Community Transit System

The existing Community Transit System service should be maintained and in some cases expanded. Because the

	Total Trips Per Day	% Elderly	% Handi- capped	Correction factor	$f \times \hat{P}$ Trips Transit Trips/Week	Transit trips/week
Caroline	3120	7.6	2.4	.25	13	676
Danby	1274	5.5	4.4	.25	5	260
Dryden	3380	6.8	4.9	.25	18	936
Enfield	2270	6.8	9.4	.25	15	780
Groton	556	10.9	8.0	.25	5	260
Ithaca City	35649	8.8	3.9	.50	372	19,344
Ithaca Town	8362	5.7	3.1	.50	60	3,120
Lansing	4784	5.4	2.2	.25	15	780
Newfield	2738	7.0	7.0	.25	15	780
Ulysses	2740	9.5	2.9	.25	<u>15</u>	<u>780</u>
					583	27,716

Table 9.7

Demand Forecast for Elderly and Handicapped System (1975)

sharp increases in ridership in recent years have markedly increased the load factors on the CTS vehicles, additional routes and/or an increased frequency of service along the routes would seem to be desirable. Consideration should be given to offering service every half-hour on some routes. Also, routes to the Tompkins County Hospital, along Elmira and Spencer Roads, and to Varna should be given consideration. Given the residential, curving, and narrow nature of many of the streets on the present CTS routes, the purchase of a 45 passenger bus by the CTS may be unwise. Service every half-hour with smaller buses would seem to be a more sensible solution to the present capacity problem. Plans have already been made to install additional shelters and new bus stop signs along the CTS routes. Consideration should be given to the installation of transit priority systems in the downtown Ithaca area. CTS already has a special fare for the elderly. No off-peak fare reductions or general fare increases or decreases seem to be desirable at this time.

ii. School Buses

The use of school-district vehicles for transit purposes (including social service agencies) should be legalized to aid efforts to utilize these vehicles more efficiently. Also, given present vehicle specifications for standard school buses, only a subset of their large fleet is suitable for alternative uses. Seat sizes constitute the major problems. In addition consideration should be given to the possibility of coordinating the school bus and CTS maintenance operations.

iii. Northeast Transit System

Continued efforts should be made to have the Northeast Transit System merged into the Community Transit System.

iv. Cornell Campus Bus System

It may be desirable to conduct an investigation of the possible economies which might result from a coordination of the Cornell Campus Bus and CTS maintenance operations. No other integration of the two systems appears to be desirable at this time, giving their present financing characteristics.

v. Demand-Responsive Systems

The Red Cross has already begun to organize a demand-responsive service for the elderly and the handicapped.

Thus, the major suggestion which can be made at this time regarding that service is that the Red Cross consider some of the guidelines which were presented earlier in this chapter when it organizes the demand-responsive system. Also, the Red Cross system should be carefully monitored so that it may be determined if it would be desirable to expand its services at some future time.

In the case of the evening demand-responsive service which might be operated by the Community Transit System, it is impossible to make a firm recommendation regarding that service at this time.

vi. Shared Taxis

The City of Ithaca ordinance prohibiting shared-taxi services should be repealed and the local taxi operators should be encouraged to set up shared-taxi services.

vii. Vanpooling, Carpooling

Because of the advantages of vanpooling for many work trips, it is recommended that work begin on implementing a vanpool program. The potential for obtaining capital grants for a vanpool program can be investigated. Also, inquiries can be made to area employers as to their interest in such a program. As a follow-up to these inquiries, a trial vanpool program could be started with one or two participating employers. Presumably, in the trial program, the vans would be leased by either the county or the employers from a leasing firm until the program had proven itself, at which time the purchase of some or all of the vans might be contemplated. Once the vanpool has proven itself with the initial employers, it could be expanded to other area employers. It would be preferable that as much of the vanpool operation be handled by a county public authority as possible with the public authority owning or leasing the vehicles. However, for political reasons it may be necessary to limit the county's role to organizing and coordinating employer vanpool efforts.

Parallel efforts should be made to organize carpools in those cases in which vanpools are not feasible. In this case individual employer efforts should be given backup support such as information or ride-matching services by the county government.

10. EVALUATION OF THE ALTERNATIVE MASS TRANSIT CONFIGURATIONS AND OWNERSHIP OPTIONS

10.1. Introduction

This chapter is concerned with the evaluation of alternative mass transit systems and ownership options for Tompkins County, New York. The purpose is to determine the proper method of evaluation and then to evaluate the alternatives to determine the suitability of each alternative to satisfy the overall objective. Sections 10.1 through 10.6 explain the methodology used and sections 10.7 and 10.8 evaluate the alternative mass transit systems and ownership options which have been proposed in Chapter 9 for Tompkins County, New York. The findings of this chapter are somewhat tentative, since methodological refinement are presently under study by the research team.

10.2. Type of Evaluation Methodology

There are many types of evaluation that could be used to evaluate the mass transit system and ownership options. In the past a cost benefit analysis has been the most prevalent method, using efficiency as the only criterion. This was a carry-over from the evaluation of highway networks. When efficiency is the only criterion, all costs and benefits have to be reduced to aggregate monetary values. In the evaluation of some projects, there are factors that cannot be reduced to monetary values for reasons of complexity or lack of data. An example would be environmental concerns. They are extremely difficult to quantify in some cases, yet they are an integral part of the analysis.

Criteria that cannot be quantified can be analyzed using a weighting system to evaluate each alternative for each criterion. This approach will be taken in this analysis for criteria that cannot be measured by reduction to a monetary value. This effectiveness evaluation will be discussed later.

The analysis of the efficiency criteria would normally take the form of a ratio, net present value, or rate of return, but in this case the most appropriate method would seem to be a straight tabulation of the costs and benefits with the effectiveness evaluation. A benefit/cost ratio would seem to hide the values of the costs and benefits in a ratio. A difference of .1 may or may not mean anything; it depends on the size of the project.

The problem with the rate of return method is that there may not be a unique solution if the streams of benefits and costs are irregular. Also, the rate of return method requires a trial and error solution procedure.

The net present value method is biased toward alternatives which have larger costs and benefits. Since in this project there will be more than a single criterion evaluated, the results will be tabulated in such a manner that the costs, benefits, and effectiveness analysis will be presented together. The decision-maker is then presented with a clear picture of the values for each alternative.

i. Discount Rate

A dollar in the future has less value than a dollar today; therefore, a discount rate is needed to devalue the cost and benefit streams over the life of the project to a single present value.

The current market rate is in the area of 12-14%. This market rate is larger than the normal discount rate since it includes a factor for inflation and taxes; therefore, it must be deflated to reflect constant dollars and gross productivity. The private market rate also has a risk factor that should be removed. After all the reductions to the private market rate are made, the rate that should be used falls into the 8-10% range.

The discount rate selected for the evaluation of the transit systems is 10% for the first five years, 11% for the sixth year, 12% for the seventh year, 13% for the eighth year, 14% for the ninth year, and 15% for the rest of the life of the project. The reason for the change of discount rate after five years is the uncertainty associated with the estimating of costs and benefits. All the forecasting results from models based on cross-sectional data rather than time series data. The forecasts depend upon too many factors that cannot be forecasted for 15 to 20 years; therefore, the discount rate is increased after the fifth year. The forecasts for the first five years will not be too inaccurate based on the assumptions of cost/benefit analysis.

ii. Project Life

The life of the project will be the length of life of the equipment. In this case, the length of the project

will depend upon the length of the life of the bus, which is approximately 15-20 years. This analysis will use a 15-year life span as its time horizon. For the alternatives that have automobiles rather than buses, one-fifth of the automobiles will be purchased new every year or the automobiles will be sold every five years. The present value of all alternatives will be on the basis of a 15-year project life.

iii. Assumptions

In order to complete an efficiency analysis certain assumptions must be stated. One assumption is that relative prices will remain constant. This assumption in the area of price of energy would seem to be heroic. This is one reason for increasing the discount rate. Another assumption is that consumers make decisions with perfect knowledge. In transportation, the traveler makes decisions upon perceived travel times and costs, not actual times and costs. The actual and perceived values may vary substantially. It is assumed that there will not be taste changes over time and that there will not be any technical innovation. These are some of the major assumptions made in order to use efficiency analysis.

10.3. Transit Demand

The demand for transportation must be forecast over the life of the project. After total demand is found then the transit share is developed using a logit model. The total process is described in detail in Chapter 9.

10.4. Costs

There are two types of costs associated with each alternative; one is capital costs for vehicles and the other is the operation costs, which include maintenance and administration costs. Both capital and operation costs are easily calculated once the demand is predicted so the number of vehicles can be estimated. When the number of vehicles is known, the labor costs for drivers, maintenance, administration and vehicle costs will be known. For the publicly operated services, federal capital grants are available to help with the cost of capital expenditures. These Urban Mass Transit Administration (UMTA) grants are for 80% of the capital costs. New York State also has a capital grant program that will provide up to 15% of the remaining 20% after the UMTA grant. If UMTA does not provide the full 80%, then New York State will

provide up to an extra 10%, the difference between the UMTA grant and 80%. The only capital costs included in the analysis are the actual costs to the operator of the transit service. If between the state and UMTA grants the operator of the service only has to supply 5% of capital costs, then this 5% will be the only figure included in the analysis. The capital expenditures would be for the purchase of equipment, for the construction of garage and maintenance facilities, and for the purchase of shelters.

The operating costs are divided into five categories: maintenance, fuel, administration, labor, and miscellaneous. Maintenance includes the servicing of engines, overhaul of engines and vehicle repair. The labor costs are for drivers, dispatchers and supervisors. The costs for oil and fuel may be easy to estimate based on the vehicle characteristics and vehicle miles within the system. Administration costs are for supervisors, support staff, accounting, personnel, public relations, and training. Miscellaneous costs include insurance and advertising.

New York State has an operating assistance program to help defray the operating costs of mass transit systems. The money is given out by formula to the transit systems. The formula is based on the number of passengers using the system and the number of vehicle miles. This transfer payment should be subtracted from the operating costs for the system and only the difference should be used in the cost figures for the evaluation. Cornell University and Ithaca College together subsidize the present Community Transit System with up to \$10,000 per year.

The analysis of the costs associated with the mass transit system are straightforward and fairly easy to estimate. The forecasting of the cost figures for the entire life of the project can be estimated with some uncertainty. There will be uncertainty associated with the cost of gas and oil during the forecasting period, especially with the present international petroleum situation. Overall costs for the alternatives in this evaluation do not present a major problem for estimation.

10.5. Benefits

There are basically only two quantifiable efficiency benefits and they are time and cost. Time can be transformed into a monetary value through a value of time multiplier.

Effectively evaluating the benefits from time and cost is evaluating consumer surplus of the demand curve for transit.

10.5.1. Estimating Benefits

The equations used to estimate the mode choice were shown in Chapter 9 on this report. They were

$$\bar{P}_t = \frac{1}{1+e^{-y}} = \frac{e^y}{1+e^y} \quad (10.1)$$

where $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$

x_1 = out-of-pocket costs for automobile minus out-of-pocket costs for transit

x_2 = time for the automobile trip minus time of trip for transit

$\bar{P}_t$ = unadjusted proportion of travelers using transit

$\bar{P}_a = 1 - \bar{P}_t$ = proportion of travelers using automobile

and y is interpreted as the total perceived cost difference between the two modes.

The $G(x)$ has now been redefined as y for simplicity.

$$\hat{P}_t = \bar{P}_t - \text{Var}(y) \bar{P}(\bar{P}-1) (\bar{P}-\frac{1}{2}) \quad (10.2)$$

where $\hat{P}_t$ = adjusted proportion of travelers using transit.

Another way of describing the mode split model is that the graph of y vs. $\bar{P}$ is a cumulative frequency distribution of the willingness to pay for the differences between automobile and transit travel. For any value of y there will be some small number of travelers at their margin such that any change in y will cause them to change their mode of transportation. For those at the margin there is no benefit of transit over the automobile nor automobile over transit. All those transit riders not at the margin must perceive a benefit by using transit. They would be willing to pay more in terms of cost and/or time than they are presently paying. Figure 10.1 shows the situation.

Figure 10.1 Willingness to Pay

y_1 is a combination of cost and time difference for a particular automobile trip compared with a transit trip that produces P_1 percentage riders. There will be small percentages of transit riders P_2 whose value of cost and time difference is y_2 , which is less than y_1 . If $y_1 > y_2$, then the cost and/or the time of transit in case two is larger. In this case, the individual transit riders would be willing to pay more in terms of cost and/or travel time than they are required to pay at present. The difference between y_1 and y_2 is a measure of the benefit.

$$B = y^* - y' \quad (10.3)$$

where y^* = total perceived cost that has to be paid
 y' = the value of y at which P_t percent are indifferent between auto and transit, where P_t is determined by the probability distribution

This B is in units that are a combination of dollars and minutes. If (10.3) is divided by β_1 , the coefficient of the cost difference term, then the units become dollars.

$$B = \beta_0/\beta_1 + x_1^* + \beta_2/\beta_1 x_2^* - y/\beta_1 \quad (10.4)$$

the term β_2/β_1 is called the value of time. B then becomes a print measure for benefits for each of a small number of travelers at point P_t on the cumulative distribution as shown below

$$B = \beta_0/\beta_1 + x_1^* + \beta_2/\beta_1 x_2^* - \ln[P_t/(1-P_t)]/\beta_1 \quad (10.5)$$

The benefits, then, for all the individuals that are at all P_t on the cumulative distribution function is given below.

$$B = N/\beta_1 \sum_j [y^* - y'] \Delta g_j$$

$$B = N/\beta_1 \sum_j [y^* \Delta g_j] - N/\beta_1 \sum_j y' \Delta g_j$$

where

Δg_j = fraction of travelers in the j^{th} group

N = total number of travelers.

By integrating the total continuous function, benefits can be found:

$$B = (N y^*/\beta_1) \int_{-\infty}^{y^*} f(y) dy - (N/\beta_1) \int_{-\infty}^{y^*} y f(y) dy \quad (10.6)$$

where

$f(y)$ = probability density function of y

$$f(y) = \frac{d(\frac{e^y}{1+e^y})}{dy} = \frac{[1+e^y]e^y - e^y e^y}{(1+e^y)^2}$$

$$f(y) = \frac{e^y}{(1+e^y)^2}$$

$F(y) = \hat{P}_t$ the adjusted proportion of travelers using transit

$$B = N y^*/\beta_1 F(y) \Big|_{-\infty}^{y^*} - N/\beta_1 \int_{-\infty}^{y^*} y e^y / [1+e^y] dy$$

Then integrating by parts gives

$$B = (N y^*/\beta_1 F(y^*)) - N/\beta_1 [y e^y / (1+e^y) - \ln(1+e^y)] \Big|_{-\infty}^{y^*} \quad (10.7)$$

Equation (10.7) estimates the shaded area under the mode split curve as shown in Figure 10.2.

Figure 10.2

Modal Choice Estimate

The shaded area is an estimate of the benefits for an alternative. Equation 10.7 is calculated for each alternative to get the cost and time benefits. The shaded area is in actuality the consumer surplus. If Figure 10.2 is rotated it is easier to see this. y^* is the cost and P_t is the percentage of the total travelers that use transit. The curve in Figure 10.3 is the demand curve for transit. The benefits must be found for each year of the project and then, using the discount rates, the present value of the stream of benefits must be calculated.

Figure 10.3

Demand Curve for Transit

10.5.2. Scale of Project

To determine the proper scale of the project the marginal and average costs must be calculated. Then, the point where marginal cost is equal to the demand is the equilibrium price. Costs and benefits are calculated at the equilibrium price. Figure 10.4 shows the situation. The demand curve is also the marginal benefit curve.

Figure 10.4

Illustration of Equilibrium Price

Q = total transit passenger miles for the system
 p = price per mile.

For a given origin and destination pair, the cost and the travel time for an automobile and the travel time for transit are constant. Therefore, the demand for transit will be a function of price of transit ride (p). This is the demand curve in Figure 10.4. At point F $MC=MB$, $p_a = A$, costs = $p_b = B$, and $Q=E$. p_a can then be used to determine the transit fare for each transit route and then the total benefits can be found using Equation (10.7). The summation over the individual routes will produce the aggregate benefits.

A sensitivity analysis of the variables C_a , C_b , t_a , and t_b should be run to determine the change in costs and benefits with changes in the variables. If there is another large increase in gasoline, which would increase C_a , what effect will this have on the evaluation? If the user charge is different from the p_a in the above analysis, how are the costs and benefits affected? There will be a good chance that the user fees will not be the same as those based on p_a because of political and other considerations. Those who do make the decision on the user fees should be made aware of the effect their chosen price has on the evaluation. Finally, the planner may want to know the effect a change in travel times, either automobile or transit, will have on the demand and evaluation. All the above information can be made available through a sensitivity analysis.

10.6. Effectiveness Analysis

An effectiveness analysis is a non-monetary method of evaluating the objectives. The methodology requires the identification of effectiveness criteria through which the alternatives can be evaluated. Figure 10.5 shows the tabulation of an effectiveness evaluation. Below each diagonal is the importance level attached to each criterion. If it is felt that a criterion is very important in the evaluation of an objective it is assigned a high number in the range of 1 to 10. If a criterion is relatively unimportant it is given a low number.

After the criteria are evaluated, then the alternatives are evaluated with respect to each of the criteria. If an alternative satisfies the objective extremely well through a particular criterion it is given a large weight, if not it is assigned a low weight.

Figure 10.5 Scheme for Evaluation

After all the cells in Figure 10.5 have been filled an over-all evaluation of the alternatives is developed by analyzing the weights assigned to the criteria and to the alternatives.

In the following sections the methodology described in sections 1 through 6 of this chapter will be used to evaluate first a set of alternative mass transit systems proposed in Chapter 9, and next a set of alternative ownership options proposed in Chapter 4.

10.7. An Evaluation of Alternative Transit Systems for Tompkins County

10.7.1. Objective

The objective for the transit system involves providing transit service for the maximum number of people at a minimum cost. The cost is more than the out-of-pocket cost. It includes social costs which can be estimated through the use of effectiveness criteria.

10.7.2. Criteria

In addition to the efficiency criteria which are measured by costs and benefits there are five effectiveness criteria. These five criteria are accessibility, use of natural resources, level of pollution, changes in land use, and reduction in congestion. These five criteria will be discussed and evaluated under the section labeled effectiveness which is found later in this chapter.

10.7.3. Alternative Mass Transit Systems

The four systems that are to be evaluated include three that use buses and one that uses automobiles. These transit systems are discussed in detail in Chapter 9. The first alternative is a total area-wide demand-responsive system servicing the area presently served by the CTS. This would be a system of small buses that would be dispatched on a route in response to a series of phone calls. The route would be fixed only after the calls were received and could be altered after the vehicle had been dispatched. The driver of the vehicle has mobile communications equipment on the bus so the route can be altered in response to additional requests for rides. The dispatching can be done manually or with the help of a small computer if the system is large enough to warrant it.

The second alternative is a combination fixed-route, fixed-schedule and demand-responsive system. The fixed-route, fixed-schedule portion of this system would be the existing Community Transit System (CTS). The demand-responsive system would be designed to provide transit for the elderly and the handicapped throughout Tompkins County. The total transit system would be a combination of the two types of systems.

The next alternative is to run the transit system as it is being presently run, without introducing major operational, financial or ownership changes.

The fourth alternative is the present fixed-route, fixed-schedule system during the day. In the evening there will be a change to a demand-responsive system which will serve the same area as the fixed-route system.

10.7.4. Demand for Transit

The demand for transit is forecast for each alternative in the same manner as the 1975 demand was predicted in Chapter 9. The forecast total demand for the year 1980, 1985, and 1990 are shown in Table 10.2, 10.3, and 10.4. The population forecasts in Table 10.1 are the only figures needed to produce the total demand matrices.

The transit demand can be found by using the logit model presented in Chapter 9 to predict the transit usage in 1975. Table 10.5 through 10.8 show the transit demand for each of the alternative systems.

10.7.5. Costs and Revenues

The costs shown in Figures 10.9 through 10.12 are calculated in Chapter 9, section 4.2. The costs are assumed to remain constant over the life of the project. The costs for the CTS system are the 1974 cost figures.

The revenues are based upon the user charge times the estimated ridership plus \$10,000 subsidy from Cornell University and Ithaca College, and plus .047 times the ridership for a New York State subsidy. The .047 is the 1974 subsidy divided by the 1974 ridership totals.

The final costs for the cost-benefit analysis are shown in the column labeled costs-revenues in Table 10.5 to 10.8. The present value of the stream of total costs is based upon a 10%

	1975	1980	1985	1990
CAROLINE	2711	2834	2894	2958
CORNELL	16200	16700	17200	17700
DANBY	2300	2319	2368	2330
DRYDEN	10679	11422	11927	12369
ENFIELD	2218	2319	2456	2510
GROTON	4846	4724	4648	4572
ITHACA CITY	25628	24219	23065	21962
ITHACA TOWN	18729	21728	23504	25277
LANSING	6818	7558	7981	8425
NEWFIELD	3943	4552	4911	5288
ULYSSES	4271	4208	4034	3854

TABLE 10.1

Projected Population 1975-1990 by Municipality

1980

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses
Caroline	688	286	40	241	44	84	1462	402	162	105	15
Cornell		12666	272	1398	198	80	9378	2601	1740	449	349
Danby			365	123	28	9	531	381	158	106	15
Dryden				6369	124	427	1639	819	665	255	173
Enfield					264	71	1035	516	167	86	182
Groton						786	161	510	188	91	21
Ithaca City							34412	4304	2345	1307	1257
Ithaca Town								6784	1563	536	394
Lansing									3943	182	259
Newfield										2391	110
Ulysses											2888

TABLE 10.2

1980 TOTAL TRIP MATRIX

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses
Caroline	755	291	49	284	59	82	1378	542	199	137	6
Cornell		13231	276	1436	209	75	9278	2776	1772	476	335
Danby			420	166	42	7	446	521	194	137	5
Dryden				6939	172	460	1589	994	736	321	199
Enfield					429	75	957	663	210	124	179
Groton						700	66	640	215	113	2
Ithaca City							32756	4352	2289	1246	1154
Ithaca Town								8788	1732	700	517
Lansing									4420	242	277
Newfield										2796	124
Ulysses											2690

TABLE 10.3

1985 TOTAL TRIP MATRIX

1990

	Caroline	Cornell	Danby	Dryden	Enfield	Groton	Ithaca City	Ithaca Town	Lansing	Newfield	Ulysses
Caroline	827	296	50	323	68	82	1298	694	238	171	1
Cornell		13795	273	1470	213	69	9232	2950	1806	505	322
Danby			377	197	43	1	358	654	226	163	1
Dryden				7438	210	488	1538	1164	804	384	219
Enfield					480	74	876	802	249	157	170
Groton						615	1	771	243	136	1
Ithaca City							31510	4403	2238	1191	1056
Ithaca Town								10789	1902	865	640
Lansing									4921	305	298
Newfield										3221	139
Ulysses											2488

TABLE 10.4

1990 TOTAL TRIP MATRIX

	TRANSIT DEMAND (Passengers)	COSTS (\$)	REVENUE (\$)	TOTAL COSTS Costs-Revenues
1976	404,340	380,000	130,089	249,911
1977	404,480	380,000	130,131	249,869
1978	404,620	380,000	130,172	249,828
1979	404,760	380,000	130,214	249,786
1980	404,900	380,000	130,255	249,745
1981	403,980	380,000	129,982	250,018
1982	403,060	380,000	129,709	250,291
1983	402,140	380,000	129,436	250,564
1984	401,220	380,000	129,162	250,838
1985	400,300	380,000	128,889	251,111
1986	399,960	380,000	128,788	251,212
1987	399,620	380,000	128,687	251,313
1988	399,280	380,000	128,586	251,414
1989	398,940	380,000	128,485	251,515
1990	398,600	380,000	128,384	251,616
Present Value of Costs				1,432,339

TABLE 10.5

Projections for a Demand-Responsive System

	TRANSIT DEMAND (Passengers)	COSTS (\$)	REVENUES (\$)	TOTAL COSTS Costs-Revenues
1976	389,249	247,900	124,312	123,588
1977	389,182	247,900	124,302	123,598
1978	389,114	247,900	124,291	123,609
1979	389,047	247,900	124,280	123,620
1980	388,980	247,900	124,268	123,632
1981	387,870	247,900	123,951	123,949
1982	386,759	247,900	123,634	124,266
1983	385,649	247,900	123,317	124,583
1984	384,538	247,900	123,000	124,900
1985	383,428	247,900	122,683	125,217
1986	382,951	247,900	122,550	125,350
1987	382,474	247,900	122,417	125,483
1988	381,998	247,900	122,284	125,616
1989	381,521	247,900	122,150	125,750
1990	381,044	247,900	122,017	125,883
Present Value of Costs				811,871

TABLE 10.6

Projections for a Combination Fixed-Route
and Demand-Responsive System for Disadvantaged

	TRANSIT DEMAND (Passenger)	COSTS (\$)	REVENUES (\$)	TOTAL COSTS Costs-Revenues
1976	361,720	166,300	117,430	48,870
1977	361,840	166,300	117,466	48,834
1978	361,960	166,300	117,502	48,798
1979	362,080	166,300	117,538	48,762
1980	362,200	166,300	117,573	48,727
1981	361,360	166,300	117,323	48,977
1982	360,520	166,300	117,074	49,226
1983	359,680	166,300	116,825	49,475
1984	358,840	166,300	116,575	49,726
1985	358,000	166,300	116,326	49,974
1986	357,700	166,300	116,237	50,063
1987	357,400	166,300	116,148	50,152
1988	357,100	166,300	116,059	50,241
1989	356,800	166,300	115,970	50,330
1990	356,500	166,300	115,881	50,419

Present Value
of Costs 321,542

TABLE 10.7

Projections for the Existing CTS Operation

	TRANSIT DEMAND (Passengers)	COSTS (\$)	REVENUES (\$)	TOTAL COSTS Costs-Revenues
1976	406,640	234,500	142,001	92,499
1977	406,780	234,500	142,048	92,452
1978	406,920	234,500	142,095	92,405
1979	407,060	234,500	142,142	92,358
1980	407,200	234,500	142,188	92,312
1981	406,240	234,500	141,872	92,628
1982	405,280	234,500	141,558	92,942
1983	404,320	234,500	141,243	93,257
1984	403,360	234,500	140,927	93,573
1985	402,400	234,500	140,613	93,887
1986	402,060	234,500	140,501	93,999
1987	401,720	234,500	140,391	94,109
1988	401,380	234,500	140,280	94,220
1989	401,040	234,500	140,169	94,331
1990	400,700	234,500	140,058	94,442
Present Value of Costs				600,614

TABLE 10.8

Projections for a Combination Fixed-Route
and Evening Demand-Responsive System

	B ₁ DEMAND RESPONSIVE	B ₂ CTS & DEMAND RESP. FOR DISATV.	B ₃ EXISTING	B ₄ CTS & EVE. DEMAND RESP.
1976	114,034	101,393	91153	103,820
1977	114,063	101,354	91183	103,856
1978	114,103	101,315	91214	103,893
1979	114,142	101,276	91294	103,928
1980	114,182	101,236	91274	103,954
1981	113,922	100,924	91062	103,718
1982	113,662	100,612	90851	103,473
1983	113,403	100,299	90639	103,227
1984	113,104	99,988	90428	102,993
1985	112,885	99,675	90216	102,737
1986	112,788	99,533	90140	102,650
1987	112,693	99,393	90065	102,563
1988	112,597	99,251	89989	102,476
1989	112,501	99,110	89914	102,390
1990	112,405	98,968	89838	102,302

TABLE 10.9

Annual Benefits (in \$)

discount rate for the first 5 years, 11% for the 6th year, 12% for the 7th year, 13% for the 8th year, 14% for the 9th year, and 15% for the 10th-15th years. The present value of the costs are displayed in tabulation of the evaluation at the end of this section.

10.7.6. Benefits

The benefits are calculated using equation (10.8). The values for y^* are the values of $G(x)$ which were calculated in Chapter 9, section 4.5. The $F(y^*)$ is equal to $\hat{p}$.

$$B = N[y^*/\beta_1 F(y^*) - \frac{1}{\beta_1} [ye^Y/(1+e^Y) - \ln(1+e^Y)]_{-\infty}^{y^*}] \quad (10.8)$$

From the demand-responsive system that replaces the CTS system the formula for the calculation of the benefits is given below.

$$G(x) = y^* = -1.9303 + .027976 \text{ CD} + .20365 \text{ TC} \\ \text{CD} = -39.1 \quad \text{TD} = -8.9$$

$$G(x) = y^* = -4.84$$

$$\hat{p} = F(y^*) = .0218$$

$$B_1 = .282 N_1$$

$$N_1 = \text{number of transit users} \quad (10.9)$$

Equation (10.9) produces the benefits listed in Table 5-9.

The formulas for the other systems are given below.

CTS and demand responsive for the disadvantaged:

$$B_2 = .252 N_2 + .372 N_3$$

$$N_2 = \text{CTS ridership totals}$$

$$N_3 = \text{disadvantaged demand responsive system ridership totals}$$

CTS system:

$$B_3 = .252 N_2$$

$$N_2 = \text{CTS ridership totals}$$

CTS and evening demand-responsive system:

$$B_4 = .252 N_2 + .282 N_4$$

$$N_2 = \text{CTS ridership totals}$$

$$N_4 = \text{evening demand responsive ridership totals}$$

The results of the calculations and the present values of the benefit streams are shown in Table 10.9.

10.7.7. Effectiveness Analysis

As mentioned earlier, there are other criteria in addition to efficiency which must be analyzed. These other criteria cannot be reduced to a monetary value, so they will be analyzed by assigning an importance weight from 1 - 10 for each criterion. A 10 means that the criterion is very important in the overall scheme of things, and a 1 means that the criterion is not very significant. Each alternative is given a magnitude weighting for each criterion. A 10 means that the alternative satisfies the objective extremely well through this particular criterion. A 1 means that the alternative does not satisfy the objective at all.

i. Criteria

The first of the five effectiveness criteria is accessibility. This criterion is weighted on the alternative's ability to give individuals access to employment, educational and recreational opportunities. Since this is one of the major functions of transit, it is given an importance weight of 10.

Reduction in the use of natural resources is the next criterion. As the world's natural resources become scarce and more expensive, reduction in the use of natural resources is becoming a more important criterion in the evaluation of transportation systems. This criterion is given a weight of 7.

The third criterion is the reduction in the level of pollution that is produced. This includes air, water and noise pollution. The different alternatives will produce different levels of pollution. This criterion is weighted with a value of 6 since pollution is not a major problem in Tompkins County. Pollution must not be allowed to become a problem.

The next criterion is changes in land use. Control of the changes in land use is important to both municipal government and to the individual resident of a community. Changes in the transportation system lead to changes in residential patterns and changes in the desirable areas for industrial growth. This criterion is given a weight of 6.

The final criterion involves the reduction of congestion that results from changes in the transportation system. This criterion is given an importance weight of 3 because congestion is not a great problem in Tompkins County.

ii. Effectiveness Evaluation

The effectiveness evaluation of the alternatives is shown in Figure 10.6. Accessibility is the first criterion that will be examined. The demand-responsive system provides transit service from the point of origin to the point of destination. This is the highest level of accessibility for any purpose that there is, so this alternative will be given a weight of 10. The combination of fixed-route and the demand-responsive system for the elderly and the handicapped provides less accessibility in the areas that are served by the fixed-route. With this type of service, point-to-point service does not exist, so the accessibility level is given a weight of 8. The existing system in Tompkins County serves only the City of Ithaca and a small area of the Town of Ithaca. The accessibility of this alternative is poor and is given a weight of 5. The fixed-route system with the evening demand-responsive service provides slightly more accessibility than the CTS system; therefore a weight of 6 is assigned to this alternative.

The reduced use of natural resources is the next criterion. Both the demand-responsive system and the combination of fixed-route and demand-responsive system for the disadvantaged, if used, would reduce the use of natural resources per trip. Buses may have a lower mile per gallon usage of gasoline than automobiles, but the fuel per passenger per trip is much less for the buses. **There is a parallel** situation with the natural resources that are consumed in the making of the vehicles. Therefore, the demand-responsive system and the combination system are given weights of 7. The existing system also conserves natural resources, but because of its limited service area, it is only given a weight of 5. The CTS system with evening demand responsive system would conserve more resources than the CTS system itself. This system is given a weight of 6.

The third criterion is the reduction in the level of pollution. Both the demand-responsive system and the combination system will reduce the level of pollution per passenger trip. The buses may produce more pollution per mile, but because of the number of passengers they can carry, they produce less pollution per passenger-trip. **These two alternatives are given** a weight of 6 for this criterion. **The existing system also** produces less pollution per passenger-trip, but because of the limited service area, it is given a weight of 4. The CTS with the evening demand-responsive system represents an improved pollution output over the CTS alone; therefore, this alternative is given a weight of 5.

Alternatives	Effectiveness Criteria				
	Accessibility	Use of Natural Resources	Reduc. Levels of Pollution	Change in Land Use	Reduction in Congestion
Demand-Responsive System	10	7	6	2	7
Combination of Fixed-Route & Demand Resp. for disadvantaged	8	7	6	5	7
Existing System	5	5	4	3	3
Fixed-route & evening demand-resp.	6	6	5	3	3

Magnitude Above Diagonal

- 1 - Little Effect
- 10 - Great Effect

Importance Below Diagonal

- 1 - Little Importance
- 10 - Great Importance

Figure 10.6 Tabulation of Effectiveness For Alternative Systems

Change in land use is the next criterion that is evaluated. The demand-responsive system encourages a sprawl type of growth. Since sprawl growth is inefficient, this alternative is given a weight of 2. The combination helps to direct growth in areas where there is a fixed-route system and to promote sprawl in areas where there is a demand-responsive system. This alternative is given a weight of 5. Although the existing system is a fixed-route system, it is too limited to nature to affect land use in any substantial way, so it is given a weight of 3. The CTS and the evening demand-responsive system will have the same effect on land use as the CTS by itself. This system is assigned a weight of 13.

The final criterion is the reduction of congestion. The demand-responsive and the combination systems would substantially help reduce vehicle congestion because of the increase in passengers per vehicle mile. These two alternatives are given values of 7. The existing system and the existing system plus an evening demand-responsive system help congestion in a limited way in a small area that is served. They are given a weight of 3.

10.7.8. Total Evaluation

The final total evaluation brings together the cost figures, the benefit figures, and the effectiveness evaluation in a single tabular form in Figure 10.7. The demand-responsive system that replaces the CTS system costs far outweigh the benefits. This system seems to satisfy the effectiveness criteria better than the other three systems, but because of the costs are nearly twice the benefits this system must be rejected.

The CTS and the county-wide demand-responsive system for the disadvantaged has costs greater than benefits. This system probably should be implemented based upon the need of the individuals who would use the service regardless of the evaluation.

The CTS system with the evening demand-responsive system has its benefits larger than its costs. The benefits are made larger than the costs because of the presence of the CTS system.

This evaluation has been developed on many assumptions especially with regards to the demand-responsive systems. These

Alternatives	Effectiveness Criteria						
	Cost	Benefits	Accessibility	Use of Natural Resources	Levels of Pollution	Change in Land Use	Reduction in Congestion
Demand Responsive System	1,432,339	744,011	10 / 7	6 / 2	7 / 3		
Combination of Fixed-Route & Demand Resp. for disadvantaged	811,871	659,385	8 / 7	6 / 5	7 / 3		
Existing System	321,542	594,712	2 / 7	5 / 6	4 / 3		
Fixed-route & evening demand-responsive	600,514	677,338	6 / 7	6 / 5	3 / 6		

Magnitude Above Diagonal

- 1 - Little Effect
10 - Great Effect

Importance Below Diagonal

- 1 - Little Importance
10 - Great Importance

Figure 10.7 Tabulation of Overall Evaluation for Alternative Systems

systems are new and the information available is incomplete. As stated in Chapter 9 they have been successful in the areas in which they have been implemented. The demand-responsive system may have a future in Tompkins County, and by testing this system on a limited evening service, an evaluation can be made on the performance of the operating system. This combination CTS and evening demand-responsive system should be implemented.

10.8. Evaluation of Ownership Alternatives for Tompkins County, N. Y.

The method which will be used in the evaluation of the ownership options is cost-effectiveness. In this method, the criteria that can be quantified are given monetary values and those criteria that cannot be quantified are evaluated using a weighted ranking method.

For this particular analysis it is assumed that the costs for each alternative will be identical. This means that one alternative will not have a cost advantage over another alternative. This assumption is not as far-fetched as it might seem. Any ownership option for a mass transit system would require the same number of managers and operators regardless of the method of ownership. The policy making organization can be assumed to be the same size; therefore, costs would be almost identical. This leaves the evaluation in the form of an effectiveness analysis.

The analysis will be approached from the local level. The alternatives will be judged on their value to the area encompassed by the mass transit system rather than from a regional or national perspective.

In this chapter, the effectiveness evaluation of the ownership option will be a six step procedure. The first step is to define the objective that must be fulfilled by the alternative. The second step is to describe the alternatives. The third step is to introduce the criteria that will be used to determine the relative merit of each alternative. The fourth step is the actual evaluation of the alternatives. The fifth step is a tabular presentation of the evaluation, and the final step is an analysis of the merits of the system ownership alternatives.

10.8.1 Objective

The objective of this evaluation is to determine the ownership option which will oversee the operation of the mass transit system most effectively. Effectiveness in this case is defined by the criteria that are discussed below.

10.8.2. Identification of Alternatives

This evaluation will be concerned with four ownership alternatives. The first alternative is to organize the system into a public authority. The public authority is created by the state legislature with specific and general powers to operate the transit system within Tompkins County, New York. The law that creates a public authority gives it the power to issue bonds, collect user charges, apply for Urban Mass Transit Administration (UMTA) grants, and state and federal operating subsidies.

The second ownership alternative involves the creation of a special mass transit district. Special districts are used for organizing water, sewage, and fire protection, but they have never been created for mass transit. Because of this, the special district for mass transit would have to be created by the state legislature to operate within Tompkins County. The funding opportunities are similar to those available to the public authority except that the public authorities tend to receive larger UMTA grants.

Intermunicipal agreements are the third alternative. These are agreements between local governments to operate a transit system. Usually one municipality will own the transit system and agree to supply other municipalities with mass transit service for a fee. This type of organization has the same funding possibilities as a municipality. In Tompkins County, the City of Ithaca would provide the service through the Community Transit System (CTS).

The final alternative is to organize the area-wide transit system into a county department under the Tompkins County Board of Representatives. The county government would create a department controlling the mass transit system within the county. A mass transit system organized in this manner would be funded by the same methods which are used for the rest of the services provided by the county government. This alternative, as well as the preceding three, is discussed in greater detail in Chapter 4.

10.8.3. Criteria

Each criterion which will be used in determining the relative merit of the alternatives will be weighted by magnitude and importance. The magnitude is a weight assigned to an alternative indicating how satisfactorily it fulfills a given effectiveness criterion. On a scale of 1-10 a magnitude of 10 means a superior ranking and a magnitude of 1 means an inferior ranking of an alternative. The magnitude is the top number in each cell of the tabulation in Figure 10.8.

The importance of the criterion, which is the bottom number in each cell, gives the level of significance placed on a criterion with respect to all other criteria. The higher the importance weight, the greater the importance of that criterion.

The funding possibilities for each alternative is an extremely important criterion. Since this analysis is evaluated from the standpoint of within the county, an alternative that can provide more transfer payments from outside the county will be given a better evaluation. Funding is given an importance weight of 9.

The next criterion is the ease with which the ownership option could be implemented. This includes political as well as structural ease of implementation. This criterion is given a weight of 8 for importance since, if it is too difficult to implement, the alternative will not be used no matter how it is rated for the rest of the evaluation criteria.

The third criterion is an evaluation of each ownership option with respect to its ability to coordinate all facets of an areawide transportation system. This criterion is given an importance rating of 6. This is an indication of how effectively the alternative ownership options can provide the management necessary to consolidate many independent organizations into a single system.

The fourth criterion is the flexibility available to the organization which is forming the ownership group. Does the organizing group have latitude in determining the powers and responsibilities of the ownership organization, or is the organizing group extremely restricted by law? This criterion is given a weight of 5 for its level of importance.

The next criterion is the flexibility available to an ownership alternative after it has been formed. Is the organization given broad powers to make its own decisions, or are its

Alternative	Effectiveness Criteria					
	Funding	Ease of Implementation	System Coordination	Flexibility in Formation	Flexibility After Formation	Government Intervention
Public Authority	8 9	5 8	7 6	6 5	8 5	4 2
Special Benefit District	7 9	4 8	6 6	7 5	6 5	8 2
Intermunicipal Agreement	7 9	9 8	2 6	8 5	8 5	8 2
County Department	7 9	7 8	6 6	8 5	6 5	8 2

Magnitude Above Diagonal

1 - Little Effect
10 - Great Effect

Importance Below Diagonal

1 - Little Importance
10 - Great Importance

Figure 10.8 Evaluation of Transit System Ownership Options

powers extremely narrowly defined? This criterion is also rated at a weight of 5 for its level of importance.

The last criterion is an evaluation of each alternative's independence from local government. How involved is the local government in the decision process? This is given a low value of importance (2) since in one way or another, the mass transit organization will be responsive to the need of the people; it is not necessary to channel public response through local politicians.

10.8.4. Evaluation of Alternatives

The evaluation of each ownership alternative will be accomplished by comparing the magnitude weights for each criterion. The criteria will be taken in descending order of importance. The larger the size of the magnitude weight, the better rating that alternative receives. Figure 10.8 is the tabulation of the evaluation.

The first criterion evaluated is the funding capability of each alternative. The special district, the intermunicipal agreement, and the county department all have approximately the same access to financial resources. All three ownership options can issue general obligation bonds and revenue bonds, and they can tax or borrow. They are also eligible for state operating assistance funds based on the number of passengers using the transit system and the number of system vehicle miles. These ownership options are eligible for federal Urban Mass Transit Administration (UMTA) capital grants, for local subsidies, tax credits; they also collect user fees.

Public authorities do not have as many funding options open to them, but rely on generous grants and subsidies to supplement the system's user charges.

In New York, public authorities do not have the power to tax. This means that in addition to not having the taxation option, they cannot issue general obligation bonds which require an agreement to tax for the repayment of the bonds. However, public authorities do receive greater aid from the New York State operation assistance funds. The formula that is used to calculate the funds available for public authorities includes the population of the area served by the authority in addition to the system vehicle miles and the number of passengers using the system. Public authorities receive more federal UMTA grants,

perhaps because of generally superior planning capabilities. Also, public authorities have the power to issue revenue bonds, collect user fees, receive local subsidies, and borrow from the state.

Although the public authority has a smaller number of funding sources, it is able to bring in more state and federal funding. Since this evaluation is being made at the local level, the external funding capability of the public authority would outweigh the smaller number of funding sources. Therefore, the public authority is given a weight of 8 and the other three ownership options are given a weight of 7.

The second criterion is the ease of implementing the ownership option. The public authority, the special benefit district, and the county department will all require legislation from the County Board of Representatives. The public authority and the special benefit district will also require state legislation. In the case of the public authority, this has been done many times, but there are no special transit districts in New York so there may be problems getting this kind of a bill through the state legislature. These three options would also require negotiations for the use of or purchase of the Community Transit System. Implementation of the intermunicipal agreement would require the setting down on paper of the agreement between the City of Ithaca, the operator of the CTS, and each of the municipalities involved.

The intermunicipal agreement is extremely easy to implement, so it is assigned a weight of 9. The creation of a county department involves only the County Board of Representatives, therefore it is given a value of 7. The public authority and the special benefit district require action by the state legislature, so the assigned weights are 5 and 4 respectively.

The third criterion is the ability of each ownership alternative to coordinate the county-wide transit system. Since the powers invested in the public authority stem from the state rather than from local government, there would be slightly greater authority associated with the public authority. The weight for the public authority is 7.

The special benefit district and the county department would have the operating policy set by the county government. This is also true for the special benefit district even through the creation of the district would be the result of a state law, because the agency that sets policy for the district would still

be the County Board of Representatives. The ownership options of the special benefit district and the county department are weighted at a value of 6.

In the case of intermunicipal agreements there would seem to be a power base primarily associated with the City which runs the transit system. Coordination of the large transit would seem to be a problem for this type of ownership; therefore it is given a weight of 2.

The number of choices available to the group or groups requesting the formation of the ownership option is the fourth criterion by which the ownership alternatives are to be evaluated. Are the choices strictly regulated by law, or are there great latitudes left to the organizers of the option? Both the county department and the intermunicipal agreement options have great flexibility. The county legislation in one case, and the agreement in the other case, can include almost any powers and responsibilities that the parties agree to.

The special benefit district's powers and responsibilities are not defined at this time since there has never been a transit district established in New York State before. By looking at special districts in other states and looking at other types of districts within New York, it can be stated that the districts would be slightly more restricted than the intermunicipal agreements and county department. The special benefit district is given a weight of 7, and the intermunicipal agreement and the county department are given a weight of 8.

There is flexibility in choosing the powers and responsibilities for the public authority, but the state legislature has placed more restrictions on the actual formation of the authority, therefore the assigned weight is 6.

The fifth criterion is the flexibility of the powers of the policy making agency after the implementation of the ownership option. Within the limits of the powers prescribed by the state legislature, the public authority is given a wide range of latitude to do anything necessary to accomplish its function as a mass transit authority. There are similarities between a private corporation and a public authority with regards to the freedom of operation. The similarity ends at the point of government intervention, which will be discussed later. For this criterion, the public authority is given a weight of 8.

The intermunicipal agreement ownership option is very structured and it is constrained by the agreement. The agreement may be renegotiated at any time to alter the conditions. The ability to renegotiate the agreement at any time indicates that there is flexibility through negotiation. The intermunicipal agreement option has a weight of 8.

The special district and the county department do not have the flexibility of the other two options. They are both assigned weights of 6.

The final criterion is the degree of government intervention in the decision-making processes. The public authority is relatively independent of local government. The authority is required by law to submit financial reports to the state, have public hearings for rate changes, and have all subsidies approved by the legislative body within the county of operation. In effect, the authority, which has a board appointed by the governor of the state as its policy-making agency, is autonomous. The authority is given a weight of 4.

10.8.5. Analysis of the Ownership Options

By looking at Figure 10-8 one can see that the public authority option dominates the special benefit district option in most of the criteria. The special benefit district option is more flexible in its formation and it also has a much greater level of government intervention. The special benefit district could be discounted on the basis of this evaluation.

With the remaining three options the decision is much less obvious. The intermunicipal agreement option is rated slightly higher than the county department for the ease of implementation criterion and the flexibility after formation criterion which have an importance rating of 8 and 5. The county department option is given a higher rating for the criterion of coordination of the transit system which has an importance weight of 6. In the remaining criteria the two alternatives are given weights that are equal. There is no clear domination of one alternative over the other.

The public authority option has higher weights in three of the six criteria than the county department option or the intermunicipal agreement option. In the criteria rated as the most important and third most important, the public authority dominates, and in the criteria rated as the second and fourth most important, the county department option and the intermunicipal agreement options dominate. There does not seem to

be an obvious single superior ownership option among the public authority, intermunicipal agreement, and county department. The decision will have to be made by the policy-makers in local government based on the information presented in this report.

11. MARKETING OF INCREMENTAL CHANGES IN EXISTING BUS SYSTEMS

11.1 Introduction

The private automobile has played an increasingly important role in passenger transportation over the last few decades. This holds true both for inter- as well as the intraurban context. Certain advantageous features inherent in the automobile make this development relatively plausible.

Comparatively recent developments in the transportation area, namely increased concern over air and noise pollution, congestion, energy shortages, inefficient land use etc., have led to more serious concerns about the improvement and/or development of acceptable alternative modes of passenger transportation. Public transportation service, particularly in urban areas, has become one of the top priorities at the federal, state and local level.

Two major aspects of public transportation service are to be considered if it is to compete with the private automobile and supplement it at the same time. First, public transportation service has to offer performance and service characteristics that establish it as an acceptable alternative to the use of the private auto. Second, public transportation service has to be promoted and marketed in a manner comparable to that of commercially sold services and products, such as the automobile.

This chapter concentrates on the second aspect, namely that of marketing public transportation. It is based on an extensive review of relevant marketing literature, as well as on the practical experiences of a number of communities in the U.S. which have embarked on different marketing programs. These programs promote the use of the transit system through improved visibility of the vehicles, their stopping places, routes and schedules, and through various advertising approaches. Derived from the general overview of transit marketing strategies is a compilation of programs suitable for use in small urban and rural areas. An analysis is made of the current marketing efforts undertaken in Tompkins County, New York by the two major revenue-producing transit systems, the Community Transit System and the North-East Transit System. Recommendations for these systems are made on the basis of these analyses and on the basis of marketing strategies suitable for small urban and rural areas.

In looking at a potential future public transit system for Tompkins County, N.Y. it has been shown that the core of the system would lie in the resources of the existing systems in addition to incremental additions of new hardware such as new buses, bus signs, and shelters. Justification is made in this report for the need of marketing to promote these changes.

11.2 Review of Marketing Strategies Used in Public Transit Operations in the United States

11.2.1 Definition of Marketing Strategy

A transit marketing strategy can be defined as a "set of market research, product planning, pricing, and promotional policies designed in accordance with the basic objectives relating to volume of traffic desired versus costs of providing the service."⁷⁶

In order to discuss marketing strategy in terms of the above definition, it must also be realized that any transit facility does not exist in an isolated setting. Therefore, any action taken by transit management is limited by a wide number of constraints, both political and socio-economic. Similarly, there are a wide range of opportunities and resources that a marketing strategy can employ effectively. It is sufficient to state at this point that an awareness of such constraints and opportunities must be maintained for an effective strategy.

i. Marketing Research

A marketing strategy must be based upon detailed knowledge of the consumer and his preferences. Marketing research which seeks to investigate the most effective ways a transit system may be marketed depends on inputs from monitoring studies of service improvements. Monitoring service improvements is usually accomplished by administering attitudinal surveys to determine how favorably the public reacts to certain improvements, which types of improvements are valued over others, and what the optimal design for individual improvements is. Finding answers to these questions, both in terms of the general public and segments of the public divided by age, sex, income, or occupation, are necessary in order to research the best ways to promote these changes.

In marketing research objectives are defined with strategies developed to meet these objectives. In a public transit system, broad objectives of a marketing plan are to stimulate ridership in peak and off peak hours by appealing to market segments that show growth potential as transit riders. The concept of market segmentation recognizes that consumers may be grouped according to differences in observable market behavior and in individual needs and preferences. It argues that such differences can be used by marketers to maximize profits within defined constraints. Based on monitoring ridership greater potentials for increased ridership may be found in different market segments based on age, income, location, or sex. In a large urban area it may be found that the housewife shopper must be focused on in marketing strategies. In a small urban area perhaps all market segments should be aimed at in a marketing campaign. Once this is established, marketing research can de-

termine advertising and promotional strategies designed to appeal to these groups. Segmentation analysis also provides a valuable guide to media strategy. For example, radio, T.V., and even newspapers may provide a wasteful form of promotion to potential users of a corridor transit route, and direct mail may constitute a far more cost effective approach to communicate with potential users.

In finding the best means to market mass transit, one of three approaches suggested by Boyd, Ray and Strong⁷⁷ is to take the characteristics of the "ideal" mode as given and focus on changing consumer perceptions of the attributes of cars and transit. The objective is to achieve a better fit between the characteristics of bus travel and those of the ideal, and/or a worse fit between those of car travel and the ideal. For example, the difficulty and cost of finding a parking space when driving downtown in a car would be compared to the ease of taking a bus.

Another concept that plays an important role in designing marketing techniques is to stress the importance of characteristics that public transit possesses relative to cars, while trying to decrease the importance of characteristics on which a transit system performs relatively badly.⁷⁸ For example, advertising could stress the importance of the cost and pollution savings of a bus trip, while decreasing the importance of the fact that an automobile trip may be more convenient.

Lastly, marketing strategies should try to change the optimal attitudinal range of the consumer. It can be argued that the characteristics possessed by the "ideal" may possess both a preferred level and a minimum acceptable level (threshold level).⁷⁹ If it can be shown by further research that failure by a mode to achieve a threshold level of performance on any one characteristic will result in complete rejection of that mode from further consideration, then this strategy may have considerable influence in affecting modal choice. Strategies could try to broaden or narrow attitudinal ranges in certain areas, for instance, it is known from research that consumers want a safe form of transportation and the survey indicated that respondents perceived buses and trains as far safer than cars. If consumers could be convinced to insist on a higher minimum level of safety, then it seems plausible that to far many more travelers, cars would become an unacceptable mode.

ii. Product Planning Policy

Product planning in the public transportation area generally includes four basic characteristics: speed, comfort, convenience, and safety. Speed is related to the total elapsed time between origin and destination. Comfort can take the form of upholstered seats, privacy, smoking (or non-smoking) areas, and possibly air conditioners. Consideration might be given to comfort during waiting periods as well as actual transit

time. Convenience involves frequency, hours of service, routes, and such amenities as wide doors and aisles and ample storage for packages. Safety not only includes freedom from accidents, but also safety from robbery or assault in transit as well as in gathering and distribution points.

Typically, reasons for use or non-use of municipal transit stems from one of the above characteristics. For example, in a study by Beier⁸⁰ in 1970 in Minneapolis-St. Paul, the motivational factors for use of the automobile instead of municipal transit are (in decreasing importance):

1. Quickest travel time
2. Eliminates waiting periods
3. Freedom from schedules
4. Reliability of car
5. Protection from weather
6. Likes to drive car
7. Lowest costs
8. Unfamiliar with bus

The survey suggested that improvements necessary in the bus system to attract riders are:

1. Faster transit time
2. Elimination of need to transfer
3. Reliable schedules
4. Bus within one block

Lovelock⁸¹ in a 1973 study of about a dozen transit systems found similar reasons for use and non-use of the system. These typically include (not ranked):

1. Reliability
2. Cost
3. Enjoyableness
4. Speed
5. Convenience
6. Status
7. Comfort
8. Modernality
9. Safety
10. Punctuality
11. Simplicity

This brief listing presents the marketing strategist with a large number of considerations in the operation and marketing potential of the system. The determination of such information is usually accomplished through surveys.

iii. Pricing Policy

Pricing is another important aspect of the

of the marketing problem. Pricing policies lead to the problem of equity among users, particularly with regard to the poor as well as the disadvantaged. Some consideration must be given to the fare structure and method of fare collection. This also includes consideration of the distribution and use of discount tokens and tickets.

Alternative fare structures include:⁸²

1. Flat fare - One price regardless of class of service or distance traveled.
2. Zone fare - Price increases according to distance traveled. Historically resisted by transit industry because of problems of collection.
3. Transfer charge - Evolved from free transfer privilege as costs increased, and transit companies were reluctant to increase flat or zone fares.
4. Class fare - Establishes a premium charge for special classes of service, e.g., express service.
5. Discounts - Through use of tokens, tickets, or passes a discount is offered in connection with the above types of fare.
6. Promotional - A discount fare applicable only to specific classes of riders or during certain hours of the day to promote new riding
7. Retailer cooperative - Attempts to promote transit and retailers by offering free rides when a specified number of purchases are made. Not too successful.

A more fundamental issue stems from the nature of the transit operation itself. The transit system can be required to be self-supporting with the fares structured accordingly, or it can be subsidized, usually by some government agency which would provide a different fare structure. An important consideration in the pricing policy adopted is the relationship between price increase and ridership.

This relationship is presented in the empirical Simpson-Curtin formula which says that there will be a .33% loss in ridership for each 1% rise in price.⁸³ The validity of this equation is left to question particularly in small urban environments and due to the recent increase in gasoline prices.

iv. Promotional Policy

Promotion is a latter step in the marketing strategy. This typically involves paid advertising. Often other forms of promotion are less costly.

According to the Washington Metropolitan Area Transit Authority, the main promotional objectives of any marketing

system are:

1. To educate the consumer as to the presence of the system.
2. To persuade the consumer to use the system.
3. To inform the consumer of system operation and individual benefits.
4. To make it easy for the consumer to use the system.

Such objectives can be met by:

1. Promotion through media and other means.
2. Public informational aids such as signs and time schedules.
3. Personal selling such as through bus-driver courtesy.
4. Packaging such as by use of attractive bus colors and other aesthetic considerations.

11.2.2 Basic Recommendations for Produce and Service Marketing

i. Marketing of Products

To market is to sell a product or a service profitably and continuously. A product or a service cannot become truly successful until the correct marketing plan is tailored expressly for it. In studying the successful marketing strategies of various products, a few general observations were found to help in planning a successful marketing strategy. These include:

1. Although a product may satisfy a need, it will not be highly marketable unless it also gives a benefit to the consumer. For example, a poorly run transit system may attract riders who have no other alternative modes of transport, but if another mode became feasible, these captive riders would no longer ride the transit system. Many times the marketer must create a benefit by eliminating the negative qualities of a product and creating new markets.
2. In deciding on the changes to be made in a product, or the qualities of a product to be stressed in a marketing plan, it is important to rely on the attitudes and opinions of consumers rather than the attitudes of the management who must make the marketing decisions.
3. The development of a successful advertising attitude is very important. Advertising is a good business tool and can be thought of as the application of the art of human persuasion. Good advertising depends on successful dissemination of information in newspapers, radio, and television.

ii. Marketing of Services

The marketing of a service can be much different from marketing a product because a service possesses several distinctive characteristics which can create serious marketing problems. First, services are intangible. The burden of selling falls mainly on a company's promotional program where the advertisements must concentrate on the benefits derived from the service rather than emphasizing the service itself. In addition, services are heterogeneous in nature which creates a problem in standardization and quality evaluation. Management must do all it can to insure a consistent and high quality performance. Thus the company can build a good reputation to sustain repeat patronage and facilitate word-of-mouth advertising. Another characteristic that differentiates products and services is that services are highly perishable. Empty bus seats is business that is lost forever. Markets for services fluctuate considerably. The use of transit fluctuates within a day. Therefore, it is important to show consumers the advantage of using transit facilities during the non-peak hours.

Procedural considerations involved in market analysis and planning are essentially the same whether a firm is selling a product or a service. A marketer of a service such as public transit should understand the components of population and service as they affect the service market. Buying patterns for the service must be determined by answering the questions of when, where, and how do consumers buy a service and who does the buying. In addition, the consumer's motivation for buying the service must be carefully analyzed. Motivations must be distinguished for each market segment. By differentiating the motives for different segments, a marketing strategy may be better designed to reach each segment. For example, many transit companies identified senior citizens as a separate unit and then established a senior citizen's fare to reach that market segment.

Management should use an organized, systematic procedure based on motivational research to determine what services will be offered, and what the company's policies will be with respect to the length and breadth of the service line offered. Once this is determined the promotional and advertising programs should portray the services in as appealing a manner as possible, and build a good reputation. Building a reputation of dependability, high quality, and courteous and efficient service should be the prime concern of a transit system.

11.2.3 A Proposal for Marketing Transit by the American Transit Corporation

Marketing public transportation is a many-faceted, never-ending challenge and responsibility. Existing patrons

must be kept aware of adjustments in service or fares; potential patrons must receive sufficient information and motivation; positive attitudes by employees must be developed and maintained; the community as a whole must be receptive to transit and offer support and encouragement. Meeting this challenge and responsibility requires a flexible, viable and total marketing effort.

There is a need for marketing efforts to achieve two basic goals:

1. Increase the level of peak ridership.
2. Promote greater use of service in off-peak hours.

One must keep in mind that individuals become patrons either through necessity or through choice.

It is the feeling of the American Transit Corporation that promoting greater use of the bus in off-peak hours will hinge largely on the cooperation of merchants. Much of the off-peak ridership potential is to be found in the shopping public, but the shopper must be motivated to shop. In other words, while frequent, reliable, low-cost bus service is necessary in transporting the shopper, the shopper must be offered attractive, positive reasons to go to the shopping areas. Further, the negative reasons shoppers have for not shopping by bus must be eliminated, if possible, or at least reduced in scope.

The American Transit Corporation uses four basic marketing tools. The first of these tools is promotion. Promotion is creating interest and awareness in bus service and calls for activities or events that will educate and motivate individuals to use the bus. A.T.C. uses promotion projects such as "New Image," bus hostesses, shopping bags, rain hats, "win a trip" contests, bus maps, and lockers.

The second of these marketing tools is advertising. Advertising is a supporting tool in marketing which can be used to bring home the message that the sponsor wishes to convey. Although it is anticipated that public service time and editorial space in the news media will be utilized to the fullest extent, it is recommended that paid advertising be employed in newspapers, bill boards, radio, and television. Also, a novel, yet effective method of making transit routes and schedules available to the public would be through space in the telephone directory. In this way, each household with a phone would have a complete set of routes and schedules for the entire year.

The third tool in transit marketing is community relations. The city transit system must initiate a deep involvement with the community so that the transit system itself is a "citizen" of the community. Some initial projects to meet this goal are a speakers' bureau to speak to groups in order

to promote transit and its benefits, news releases with material including schedule changes, employee awards, etc., customer publications, and annual reports.

The fourth marketing tool is employee relations. The driver will be the bulwark of the marketing program. To the rider the driver is the transit system. It is, therefore, imperative that all the transit employees be made to feel their efforts are both necessary and appreciated. Several motivational programs can be instituted including merit awards and newspaper features.

Each marketing program of any corporation must have a budget. A one-year marketing budget to implement the many projects is suggested.

11.2.4 Examples of Marketing Strategies in Selected Cities

i. Denver, Colorado

The Denver Metro Transit System initiated many service and marketing changes starting in April 1971. As part of its service improvement program base fares were reduced from forty cents to thirty-five cents, a special discount fare of twenty-five cents was started for adults riding the bus between 9:30 a.m. and 2:30 p.m., as well as for senior citizens, the military in uniform, and physically or mentally disabled citizens. Student fares were also lowered from twenty-five cents to twenty cents.

In September 1971, many new route and schedule changes began. Five new express routes were started to serve outlying areas and express service was added to five existing routes. Frequency of service was increased on crosstown and trunk lines. A shuttle service went into effect between downtown and the parking area at a nearby stadium, running every seven minutes during rush hour and every twenty minutes during shopping hours.

To make it easier for residents to take advantage of the new routes and schedules, new, colorful schedules were printed that were color-coded to show the sector that the bus operated in. The buses themselves displayed colored flags that were coded to the same area as was listed in the bus schedule. Color bus signs, stating "Board Here" were placed at all bus stops.

The marketing program used many promotional and advertising techniques to popularize the new service changes. One effective promotional technique was to hold a poll where Denver residents selected between two designs of color schemes for the bus. The most popular choice was initiated into the transit fleet. Also, a telephone information line was started and advertised on the radio, in newspapers, and on bus signs and

schedules. The schedules themselves were advertised through literature distribution in downtown streets and businesses.

The success of these service and marketing changes was shown by an increase in ridership of 10.5% from April 1971 to January 1972. An additional increase in ridership of 19.8% was shown from January 1972 to August 1972, compared to ridership figures for the same period in 1971.

ii. Phoenix, Arizona

In August 1972, the Phoenix Transit System started a program of major fare changes and special discount tickets. The size of the base fare zone (the thirty-five cent zone) was increased, thereby reducing the cost of traveling for many commuters. In addition the five-cent transfer change was eliminated. A discount fare of fifteen cents was started for children between the ages of six and eleven and a reduced senior citizen's fare of twenty cents began. A special "Good All Day" ticket was sold for \$1.25, allowing the holder of the ticket to ride any bus an unlimited number of times for a day.

Marketing strategies included printing special brochures listing fares, transfer zones, points of interest and the information telephone number. Also, advertising printouts were distributed listing the bus as the "way to go" because it is economical, convenient, and safe. The "All Day" bus ticket was advertised as a way to do sightseeing in Phoenix and leaflets listed five possible bus tours plus points of interest and their addresses.

iii. Syracuse, New York

The Central Regional Transportation Authority (CENTRO) of Syracuse, New York initiated many changes beginning in 1971 when CENTRO took over mass transit operations from the former Syracuse Transit Corporation. In the last four years the CENTRO has undertaken massive service and marketing improvements.

In the area of service improvements, 97 new buses were purchased, equipped with air conditioning and tinted glass. Four specially equipped buses were purchased to serve the elderly and handicapped in a special Call-A-Bus service. The buses were also equipped with two-way radio and a new automatic fare collection system. A new computerized vehicle scheduling system was installed and new routes and schedules were developed. In addition, new bus signs and shelters were located on major routes. Fare changes include a reduction in fare for off-peak travel during weekdays and a reduced fare for the elderly. Special services include a "Park and Ride" service where citizens can purchase weekly or monthly parking permits and obtain bus ride coupon books at the low cost of twenty rides for one dollar. Also, the CENTRO runs a subscription service designed

to allow workers to board express buses in parking lots near their homes and ride directly to work and back. Fifteen of Syracuse's largest corporations are being aided by this service.

Marketing facets of this expansive plan include promotional programs such as "Transit Tuesday" and "Super Shopper's Special." Held in conjunction with the Downtown Development Council of the Greater Syracuse Chamber of Commerce, these events offer special sales and free rides home to customers who shop downtown. In the fall of 1973, a "Farmer's Market Bus" was inaugurated which brought nearly 65 farmers each Tuesday into a central location downtown to sell their produce. A special free shuttle service circulates downtown during the noon hour to accommodate office workers who would like to shop at the Farmer's Market. This event is also subsidized by the Chamber of Commerce.

Another promotional program sponsored with Carrol's Corporation is a special token package where, for \$3.50, one may purchase a package of ten bus tokens and four special purchase coupons redeemable at any Carrol's Restaurant. The total retail value of the package is \$5.00.

Advertising of the many promotional and service changes in the city has been done by issuing news releases to newspapers, radio stations and agencies in the city. Also a special bus publication is printed periodically to publicize pertinent bus information, area news, and forthcoming events.

11.2.5 Analysis of Cost Effectiveness of Alternative Strategies

i. Cost-Effectiveness Model

Evaluation of alternative marketing strategies is based on the concepts of efficiency and effectiveness.⁸⁴

The efficiency of a system is the monetary return on the investment for the system. In comparing efficiencies of systems, one is simply comparing the dollar value of each alternative.

Effectiveness, on the other hand, measures the extent to which a plan meets specified goals and objectives. In deciding upon alternative marketing strategies one must weigh and rank the objectives desired, and see which strategy best fulfills the most important objectives. For example, in transit marketing strategies, the results of a survey might determine that direct mail or a transit information kit delivered in person might be the most effective and inexpensive way to obtain a specified growth rate. On the other hand, secondary objectives such as improved community relations might require a full media approach.

The weighing of objectives is a subjective process because biases are introduced by the people who are employed to weigh the various goals and objectives. Many types of people may make these decisions; the engineers and planners involved in the study; elected officials of the region concerned; independent planning consultants; state or federal agencies concerned with the project; or a panel of experts appointed by elected officials. At the present time one can see changes in the make-up of the group responsible for determining the subjective weights. For some time, in transportation evaluation the weights have largely been determined by engineers and planners, modified by the elected regional representatives. Now the establishment of objectives is moving further towards the communities involved in the consequences of alternative plans.⁸⁵ It is clear, from past experience that decisions made by the analyst alone are not generally the best when viewed for a region as a whole. A transit marketing strategy will be most effective if the needs and desires of the population to be served is satisfied. The present trends towards community involvement in the weighing procedures and market research to find out the desires of the population is a welcomed move and should lead eventually to new mechanisms for establishing objectives.

A second bias associated with weighing procedures concerns the mechanism for obtaining information from people on the trade-offs between objectives. The surveying techniques used to find this information envelop two major problems. First, the respondent often finds it is hard to formulate stable judgments and attitudes towards a currently non-existing alternative, since these attitudes may be different if the alternative were in existence; and second, one must aggregate the varied responses which may encompass many different intensities of feeling. Although answers to these problems have not been produced yet, there may be promise in the use of applied psychology in these areas.

When one makes a decision, it is on the basis of effectiveness and efficiency. The Cost-Effectiveness Method attempts to put a framework on the decision-making process. The effectiveness and the efficiency are measured by indicators of object-attainment and costs, respectively. The costs are defined as the total monetary outlays needed in order to achieve the alternative in question.⁸⁶ Any cost model that accurately describes the components of cost of the alternatives may be used. For example a cost model of a transit marketing strategy may consist of these elements:

1. Marketing research costs
2. Product improvement costs
3. Advertising costs
4. Promotional costs

Any model can be used that accurately describes the cost com-

ponents of each strategy. Also, costs may be modelled on a time-dependent basis, with information supplied of costs, at various points in time, as a function of construction phasing or scheduled operations of the transportation plan. In addition, cost models could be formulated in such a way as to relate to objective attainment.⁸⁷ For example, costs for a transportation system could be divided as follows:

1. Route miles of service - \$ per mile
2. Seat miles of service - \$ per mile
3. Passenger miles of service - \$ per passenger-mile

Effectiveness may be defined as the characterization of all the relevant consequences of the alternatives exclusive of costs. This goal achievement may be described mathematically, verbally or pictorially. The consequences described do not have to be measurable quantities. For example, a particular transit marketing strategy could fulfill the objective of changing attitudes towards the transit system. In evaluating the alternatives, one must bear in mind the relevance of the alternative consequences and the feasibility of the level of detail supplied about each consequence. In order to formulate the relevant consequences of the alternatives, the transportation system and its relation to the environment must be known. In the area of transit marketing one must recognize the population to be reached and what features the transit system offers this population.

In considering feasibility as a criterion to determine consequences, it is important to note that the net quality of decision-making is going to have an optimum in terms of level of detail and number of factors considered, and there is a level at which any more input of factors will not improve the quality or ease of a decision.⁸⁸

To summarize, a decision employing cost-effectiveness will choose an alternative that best fulfills the objectives outlined for it, within the limits of cost.

ii. Examples of Cost-Effective Transit Marketing Strategies

In all the transit marketing strategies surveyed, the main marketing objectives to be fulfilled were:

1. To create a positive attitude towards public transit.
2. To create a reason and desire for the consumer to buy public transit.
3. To educate and inform the public about public transit.
4. To make it easy for the rider to buy and use the service.

The strategies aimed at four segments of the community: non-riders of public transit, who prefer the automobile as an alternative to public transit; non-riders who do not have a viable alternative means of transit, such as people without a drivers license; the economically and physically disadvantaged; and riders of the transit system whose use of the bus system could be increased.

a. Cleveland Transit System

An example of a market strategy whose objective was to lure more automobile riders to the bus was a three-month advertising campaign run by the Cleveland Transit System. The objective of the campaign was accomplished by extensive advertising on radio, television, and in the newspapers. The theme of the program was "CTS. It's not hard to take," and advertising concentrated on three main points: there is economical savings involved in riding the bus versus driving a car, there is frustration savings by taking a relaxing and comfortable (not to mention speedy) ride on the bus, and there is an ecological advantage to taking the bus, which is a decrease in pollution.

The three month advertising budget totaled \$112,000, which was approximately 1.7% of the gross revenue over the three-month period. 6.6% of the advertising budget was used for advertising agency fees and the rest of the budget was split almost equally for media coverage by radio, newspapers and television.

Over a five-week survey period the average revenue improvement due to the advertising campaign ranged from \$21,000 to \$26,000. Weekly ridership increased an additional 75,000 to 79,000 rides. Subtracting the cost per week of advertising, which was \$9,400, from the average additional revenue of \$25,000, the CTS gained \$15,600 per week during the five weeks surveyed. From a cost-effective standpoint, the increased ridership and increased revenues convinced the Cleveland Transit System to renew its advertising contracts again for another three months.

b. Madison Metro System

Facets of the 1973 transit marketing plan of the Madison, Wisconsin Metro system were directed towards greater usage of the bus system by riders and non-riders. An increase in off-peak ridership was promoted by introducing a 55¢ Shoppers' Pass, good for unlimited rides during off-peak hours, and a 5¢ Shoppers' Shuttle was initiated that carried passengers to the downtown shopping area. Braille bus schedules were printed to facilitate use of the transit system by the blind. Community relations were improved by publishing news releases, customer publications, and by establishing a Speaker's Bureau. Employees of the transit system were not ignored; safety programs and a

newsletter were started for the workers' benefit.

The marketing budget was broken down into these categories:

1. Promotional Material Cost	\$ 7,900
2. Advertising Cost	15,400
3. Community Relations Cost	2,700
4. Employee Relations Cost	3,900
5. Contingency & Miscellaneous Cost	<u>4,800</u>
TOTAL COST	\$34,700

So far the only indication that the above mentioned objectives have been fulfilled has been an increase in ridership in 1974 of 17.2% over ridership in 1973, for the first six months of the program. In the original marketing proposal for Madison Metro, it was proposed that within the next five years an extensive marketing research program would be conducted to further pinpoint the priorities in each segment of the ridership market.

c. Seattle Metro System

The Metro Transit System of Seattle, Washington initiated their marketing campaign in January 1974. The goals of the campaign were to create a positive public attitude toward the Metro Transit System and gain increased ridership. These objectives were accomplished by timely and appropriate media communication, application of market analysis techniques, and development of employee concern for the success of the system. The many Park-and-Ride stops, free bus rides within a large downtown area, and special service bus runs to recreational activities seemed geared to promote increased usage of the bus by automobile drivers, people without drivers licenses, and the poor in the downtown area. The theme of the campaign was that life styles are changing, that everyone is taking the bus and that the transit system is improving in response to community needs.

The marketing program budget was divided as follows:

	<u>Cost</u>	<u>% of Total Budget</u>
1. Existing Service	\$242,400	48.6%
2. Special Services	68,000	13.6%
3. New Services	55,000	11.0%
4. Community Services	129,850	25.9%
5. Internal Services	<u>4,750</u>	<u>0.9%</u>
TOTAL	\$500,000	100.0%

Figures were not available about how the budget allocations were subdivided on each project or what types of media were

employed. The success of the program was indicated by the fact that in January 1974, ridership increased 16% over January 1973.

11.3 Recommendations for Small Urban Areas - Including Ithaca, New York

The marketing strategies and recommendations gathered in this section are based on an extensive review of the transit marketing techniques used in many cities of the United States. As stated previously, the objectives of a good marketing plan should be to create a reason and desire for the consumer to buy public transit, to create a positive attitude towards public transit, and to make it easy for the rider to use the service. The strategies recommended here fulfill these objectives.

The recommendations proposed in this section are divided into two major areas, Promotional Recommendations and Advertising Recommendations. A discussion of specific service changes in the transit system is deferred to Chapter 12 of this report. In that Chapter, marketing research efforts concentrate on testing and monitoring the effectiveness of different service improvements. In that task recommendations are presented concerning those improvements that are most suitable for a small urban area such as Tompkins County.

11.3.1 Promotional Recommendations

Every successful marketing plan must have promotional and advertising campaigns. Promotion is creating interest and awareness and in a transit system. This calls for activities or events that will educate and motivate individuals to use the bus.

A promotional program in a service company such as a transit system should have two major goals. One is to portray the service benefits in as appealing a manner as possible. The other is to build a good reputation. Because the firm is marketing intangibles, a good reputation is, perhaps, even more important in a service company than in a product marketing business. Excellent performance in any area of a company's marketing program will, of course, enhance the image of the firm, but the promotional effort can play an especially important and helpful role. Promotional techniques will be discussed in three areas: Community Participation, Business Participation, and Community Relations.

i. Community Participation

Transit system participation in community events is an important activity that favorably displays the system to the public. The spirit of transit involvement with the community may be shown by having local elected officials actively support the system through speeches, letters to their constituents, and exploitation of the fact that city officials may use

the transit system.

Another way the transit system can foster the feeling that the transit system is like a member of the community is by having the system participate in city promotions such as parades or holiday events. This was shown to be highly successful in Madison, Wisconsin.

ii. Business Participation

A continuing theme in the marketing campaign is to make it as easy as possible for the community to obtain information and tickets for the buses. One way the transit system could achieve this goal in conjunction with other businesses is to establish a "Booster Club" made up of local businessmen who donate money and space in their establishments for schedules and maps, in return for advertisements on buses. The American Transit Corporation feels that promoting greater usage of the bus in off-peak hours will hinge largely on the cooperation of merchants. For example, merchants could monetarily back shopping shuttles to and from the downtown area. This would be especially effective on days when there are sales. Also, businessmen could be encouraged to sell weekly or monthly bus tickets. Another promotional activity would be to have businessmen sponsor special promotional fares, such as free college rates upon return to school in September. This has been done in Ithaca and has been fairly successful. It should be continued in order to acquaint incoming college students with the transit system.

Large employers of Ithaca residents such as Morse Chain, Cornell University, and Ithaca Gun Company could arrange with the bus system to purchase weekly or monthly tickets for their employees. Deductions from the worker's pay would be made by the employer and the tickets would be placed in the worker's pay envelope for the worker's convenience. The pay removed would then be forwarded to the bus company.

iii. Community Relations

Increased community relations shows that the transit system is a citizen of the community, responsive to community and consumers needs. One project that can help to foster this image is a Speaker's Bureau, where the head of the transit system or the advertising manager speaks to local civic groups and social clubs, as well as to radio and T.V. talk shows. He would promote the transit service by describing the of the system and ways in which people can help the system grow. A point to be stressed is that cooperation is a two-way street- the people help the system and the system aids the community.

Another idea is to hold contests to focus interest on the bus system. Contests can be held to pick a color scheme

for the bus or pick a new name or slogan for the system.

If new buses are purchased for the system, the oldest remaining bus should be painted and restored to be used for publicity purposes; to participate in community affairs and also to act on an information center and showcase bus for the transit system.

The bus drivers can greatly improve community relations by their friendliness and courtesy. To the rider, the driver is the transit system. In Madison, Wisconsin, a "Courtesy Crusade" was held on St. Valentine's Day where the customers voted for the most courteous driver, and drivers were given merit awards and featured in local media articles. This can also help establish an "esprit de corps" where employees see the company and themselves succeeding together. Then they can sell the system by actions and by word-of-mouth.

A dynamic and thoughtful promotional program is essential for the success of the public transit operation. Community awareness of the service is almost as important as the service itself.

11.3.2 Advertising Recommendations

Another very important marketing tool is advertising. Advertising is a supporting tool in marketing which can be used to bring home the message the sponsor wishes to convey. The purpose of advertising is to expose the public to the service, to induce ridership by promoting and stimulating a desire to satisfy transportation needs through the bus service, and to project and develop a favorable image of the transit company. Advertising also has the power to decrease or eliminate negative psychological associations and to strengthen a positive image of the operation.

The advertising techniques discussed here try to stress the advantages of the transit system over other modes of travel. Themes that describe these advantages are:

1. There are environmental advantages in taking a bus during the energy crisis, since taking the bus would result in a decrease in air pollution.
2. It is cheaper to ride a bus than drive a car and taking a bus avoids parking problems and costs.
3. The bus has dependable and high-quality service.
4. The bus offers accessibility to major interest and activity points.
5. The bus drivers are friendly and courteous.

System changes that improve the service of the bus should be advertised, such as fare changes, route and schedule changes, and bus changes. Points of interest on current routes should also be made known to the public.

All promotional activities that the transit company either sponsors or participates in should be announced through the media. This will increase the popularity of the events and the transit company.

The three types of media can be employed in many effective ways. On radio, the transit system could sponsor daily time-temperature checks, or sponsor news broadcasts or radio shows. Public service announcements should be used to advertise the system. In addition, promotional events should have radio coverage.

The newspapers should be used to advertise maps, schedules, and fares at particular intervals, especially at the beginning of the advertising campaign. Active newspaper reporting of advances in the system and public relation events should be encouraged in order to take full advantage of these events.

On television, public service announcements should try to be obtained on local stations and if the cost is not prohibitive, certain shows could be sponsored by the transit system. Also promotional events could be covered on local news shows.

The buses themselves can be their own advertisement by their distinctive color scheme and by trading advertising space with local businessmen in the Booster's Club.

It is very important that the public be given the opportunity to obtain maps and schedules. Effective dissemination of maps and schedules can be achieved by advertising a map and schedule in the yellow pages of the phone directory. In order to inform the public of this yellow page inclusion, posters could be placed in buses and at major downtown establishments. Direct mailing of schedules to as many people, institutions, companies, and offices as is feasible has been shown to be successful in cities such as Denver, Colorado. Another means of distribution is the use of "take-one" displays in business establishments and on an information bus, if one is available.

In order to carry out an extensive advertising campaign, it is recommended that the transit system either hire an advertising firm to coordinate the campaign for the transit system, or if expenses will not allow this, gain the aid of local university (business, engineering, design) expertise or the aid of local businesses in setting up the advertising program.

Also recommended is the designation of a special marketing manager to coordinate the general marketing system

and act as a liason between the advertising inputs and the transit system. The marketing manager should be in charge of a continuous market research program. The market research program is a tool which serves as a benchmark for the determination of the effectiveness of the total marketing effort. It also can be coordinated with a local university, if possible.

11.4 Marketing of Public Transit in Tompkins County, New York - Short-Run and Long-Run Strategies

11.4.1 Community Transit System

i. Fare Structure

At present there is a flat fare of 25¢ for adults, and discount tokens are available for public school students, senior citizens, and the general public (8 tokens for \$1.00 for students and senior citizens, and 5 tokens for \$1.00 for the general public). The 25¢ standard fare has been in effect since 1965.

Tokens are available at several local outlets. These outlets sell the tokens as a public service and receive no compensation. It might be noted that at present, no identifying signs are displayed at any of these token outlets.

Cash fares accounted for 60.5% of the total income for the bus system in 1974 while tokens, senior citizen fares and student fares accounted for 9.3%, 3.9% and 1.4% of the total income, respectively (see Table 11.1).

Each year in the 1971-1974 period, free tickets have been issued by local area merchants, specifically the Downtown Businessman's Association. These tickets, which are printed in the Cornell Daily Sun and other publications, provide free bus transportation during a week-long period. They are issued by the Downtown Businessman's Association in early September in hopes of attracting incoming students to the downtown business area. No reimbursement is made by the Downtown Businessman's Association to the CTS for the transportation provided. The CTS has seen the tickets as free advertising for the bus system and a public relations gesture. In 1974 these free tickets accounted for just over 1% of the total yearly ridership.

From 1971 to 1974 ridership on the CTS increased approximately 33%. From 1971 to 1974 there have been year to year increases in senior citizen tickets sold of 806%, 164% and 23% respectively. This is possibly a result of increased distribution of such tickets as well as promotion by senior citizen related organizations. The number of student tickets used declined slightly from 1971 to 1973, but in 1974 showed a rise of 6.6% over 1973 totals. The number of tokens used has

COMMUNITY TRANSIT SYSTEM REPORT OF OPERATIONS (YEAR TO DATE 1974)

January - December

	1971	1972	1973	1974
INCOME:				
Cash Fares	\$ 55,322.73	\$ 52,754.71	\$ 59,492.42	\$ 67,812.42
Tokens Sold	11,150.60	10,792.00	10,751.00	10,416.00
Student Tickets Sold	1,645.00	1,520.00	1,505.00	1,611.00
Sr. Citizen Tickets Sold	150.00	1,360.00	3,600.00	4,426.00
Other Income	13,115.17	16,144.15	10,565.00	10,000.00
New York State Operation Subsidy	---	---	---	17,802.97
TOTAL INCOME:	\$ 81,383.50	\$ 82,570.86	\$ 85,913.42	\$112,068.39
OPERATING EXPENSE:				
Clerical Wage	\$ 2,597.04	\$ 2,354.27	\$ 2,447.54	\$ 2,948.46
Driver Wage	63,695.48	63,205.83	80,153.86	82,790.00
Mechanic Wage	13,872.32	14,991.66	14,620.58	24,917.74
Bus Painting Labor Cost	---	---	---	4,236.00
Clothing	498.40	356.70	598.75	673.85
Gas & Oil	4,428.12	4,565.24	6,421.73	11,182.20
Office Supplies	130.19	38.31	99.77	116.98
Equipment Parts & Supplies	5,317.67	7,051.94	11,896.32	17,341.51
Telephone	286.27	306.92	392.16	494.02
Printing	196.30	345.60	318.60	539.13
Equipment Maintenance by Others	127.57	998.44	2,686.57	2,761.49
Travel & Mileage	---	---	---	83.19
Insurance	4,352.00	5,017.00	4,402.00	5,982.00
Rent of DPW Workspace & Facilities	1,200.00	1,200.00	1,200.00	1,200.00
TOTAL OPERATING EXPENSE	\$ 96,701.36	\$100,431.91	\$125,237.88	\$155,266.57
Depreciation	10,569.64	7,802.95	8,632.52	11,056.72
TOTAL EXPENSE	\$107,271.00	\$108,234.86	\$133,870.40	\$166,323.29
NET LOSS BEFORE CAPITAL INVESTMENT	\$ 15,317.86	\$ 17,861.05	\$ 39,324.46	\$ 43,198.18
NET LOSS AFTER CAPITAL INVESTMENT	\$ 25,887.50	\$ 25,664.00	\$ 47,056.98	\$ 54,254.90
NUMBER OF PASSENGERS CARRIED:				
Cash Fares	207,116	211,015	238,408	277,588
Tokens Used	55,244	44,965	46,367	48,449
Student Tickets Used	11,134	11,372	10,283	12,188
Sr. Citizen Tickets Used	1,481	8,442	25,326	33,673
**Free Tickets Issued by Merchants	7,073	2,850	4,642	4,032
Shuttle Bus - 6/17/74 - DBA	---	---	---	15
TOTAL PASSENGERS CARRIED	282,048	278,644	325,026	375,945

** 2 weeks only: 8-30-71 / 9-16-71
 8-28-72 / 9-9-72
 8-30-73 / 9-15-73
 8-28-74 / 9-7-74

TABLE 11.1

COMMUNITY TRANSIT SYSTEM REPORT OF OPERATIONS (YEAR TO DATE 1974)

decreased slightly from 1971 to 1974. In the past four years, approximately five to six times as many cash fares have been collected as have tokens.

ii. Routes and Schedules

The Community Transit System operates the present city-wide bus system. At present the operation consists of four regular routes serviced at one hour headways by a fleet of seven buses, with an annual ridership (1974) of 375,000 persons.⁸⁹

The present bus routes are clearly designed to serve the main demand regions of the city, i.e., downtown and Cornell University, situated on East Hill. This is shown by the fact that three of the four routes connect Cornell University and downtown in a generally East to West route while the remaining route runs generally North and South across the city.

The routes at present are presented in a color-coded map and schedule that has been prepared as a community service by a local bank.

Route 1 runs East-West through the downtown area and to Cornell University and its North dorm area. The route then runs through the adjacent "Collegetown" area, returns downtown and goes to the residential area of West Hill.

Route 2 serves Cornell, Ithaca College, and the downtown area with a circular route confined to the East and South Hills.

Route 3 generally follows the same circular route as Route 1, connecting downtown, West Hill and the Cornell campus. The route also has a spur into the neighboring village of Cayuga Heights which is the only service provided outside the city to other residential areas.

Route 3 approximately 1/2 hour behind Route 1 so there is in effect a bus serving the West Hill, downtown, and Cornell Campus route every 1/2 hour. This frequency might have marketing implications.

Route 4 is the only route covering a general North-South pattern through the city providing service from the lake front to the Weston-Ithaca Plaza area located on Route 13.

Route 5 operates a once-daily schedule during the early morning peak hour. It connects Cornell University with the downtown area.

Ridership figures were provided by the Department of Public Works (see Figure 11.1 and Table 11.2). A quick exam-

Figure 11.1. Community Transit System - Weekly Ridership 1972-1974

ination of the weekly riderships shows a strong correlation between the times that the major educational institutions are in session and the ridership. For example, ridership clearly drops at intercession, spring break, and Thanksgiving break as indicated by the graph. This is in addition to the sharp summer month decline in ridership.

This decline in ridership can partially be attributed to the decline in the student-educational employee usage of the bus during non-session periods. This reasoning is supported by the fact that three of the four major routes are directly routed to the educational facilities. The contention of the student-employee effect is also supported by the fact that Route 4 is patronized at a constant level throughout the year as indicated by the ridership graph. Route 4 as previously mentioned has no direct link to either Cornell or Ithaca College.

	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
January	22,634	24,880	30,745	30,766
February	28,782	29,056	36,555	35,143
March	26,979	27,918	35,380	31,959
April	25,944	28,628	34,038	35,465
May	22,818	25,056	30,695	30,132
June	16,563	20,136	22,018	23,911
July	15,771	21,687	23,408	
August	17,520	21,186	25,220	
September	26,770	29,094	32,919	
October	25,721	33,324	36,671	
November	25,022	30,670	32,520	
December	24,120	28,745	31,649	

TABLE 11.2

Monthly Ridership Figures

iii. Informational Aids

At present the buses are painted red, white, and blue with the lettering "Community Transit" System on the sides. Each bus has a destination sign over the front windshield which is changed periodically throughout the circular trip.

CTS routes through the downtown area are marded at curb side by blue and white signs that read "CTS Bus Stop." These signs are typically the same size and mounted on similar posts as "No Parking" signs. These signs are mounted facing the curb and have no route information beyond indication of a CTS bus stop.

In the areas away from the downtown area and the

college campuses there are generally no designated bus stops or signs. It is the policy of the CTS to pick-up and discharge fares at any desired point along the bus route in these areas. There are several bus shelters located on the Cornell campus at designated CTS stops. These shelters are presently used both for CTS as well as the Cornell Bus System. There are several newer shelters located in the downtown urban renewal area. For example, there is a new "glass" shelter located at the new Seneca Street parking garage.^{90,91}

Funding for new facilities has been requested from the federal government. (UMTA Capital Grant Application, 1974.) These new facilities are intended to upgrade the CTS and to relieve some of the problems and shortcomings of the presnet system.

The request for approximately \$435,000 from the federal government is for the funding of three new 45-passenger buses, and a special transport for elderly persons. The funding is also intended to be used for the design of bus system graphics at approximately 45 stops and for approximately 25 small bus shelters at most stops in the city. In addition, four larger heated shelters are proposed for the downtown urban renewal area with additional funding being requested for maintenance and storage facilities.

The federal government, if the grant is appropriated, will supply 80% of the necessary funds with 10% coming from each of state and local governments. The earliest anticipated funding is for Fall, 1975.

The requested funding and subsequent installation of new facilities should have an impact on the efficiency and appeal of the CTS.

iv. Advertising

Unlike many communities the CTS does not sell advertising space on its vehicles, either on placards over the package rack or on the bus exterior. The only real advertising that has been done by the CTS in the past few years has been through public service promotion spots provided by local radio station WTKO. These consisted of frequent spots with a catchy jingle and an informational announcement. They were produced and provided free of charge by WTKO as a service to the community.

During the Fall of 1974 the CTS distributed informational flyers along with maps and schedules to several areas of the city, particularly to apartment buildings near the Cornell campus. This information consisted of a single typewritten mimeographed sheet in a "Did you know that...?" format in addition to an attached schedule.

The schedules distributed are a public service of the Tompkins County Trust Company, a local bank. At a cost of about \$3,500, the bank has produced 20,000 of the four panel brochures giving a route map, time schedule, as well as promotional advertising for the bank. The brochure does not include information such as fares and token outlets, nor does it include the phone number of the CTS for further schedule information.

The color coding for the bus routes was apparently chosen arbitrarily by the bank's advertising agency for purposes of clarity. The bank has given all but a small number of the 20,000 schedules to CTS for distribution as it sees fit.

v. Operating Budget

The operating budget is of interest in that there is little evidence of a budget for marketing. Printing costs were \$539 in 1974 which presumably includes "in-house printing" as well as advertising printing costs.⁹² This is approximately .3% of the total expenses.

The major increase in costs to the system has been in repair and maintenance as well as in fuel costs. Ridership has increased by 33% in 1971-1974 while total operating expenses have increased approximately 55%. Income has been approximately constant for the 1971-1973 period, increasing from approximately \$81,000 to \$86,000. In 1974 the income jumped to \$112,000 with the increase mainly due to revenues from cash fares. \$10,000 of this \$112,000 is in subsidies from Cornell University and Ithaca College. Cornell University and Ithaca College paid \$7,500 and \$2,500 respectively to support the system in 1974. Despite these subsidies CTS still was in the red in 1974 for about \$54,000 (after capital investment).

11.4.2 Market Research to Determine User and Non-User Perceptions of the Community Transit System

i. Description of Survey

In 1972 and 1973 a study was conducted to determine the efficiency of the marketing techniques used by the Community Transit System. A dual interview strategy was used, in which interviews were conducted on the buses and also in households close to bus stops.

Both home interviews and rider interviews were carried out in two periods, October 1972 and March 1973. Between these two dates, a new bus route was introduced. However, data collection was confined to the three routes that were operating in both survey periods.

Each survey used the same questionnaire, which was concerned with determining usage of the buses, awareness of

advertising efforts for the buses, knowledge of the system, preferences for financing of the system and ratings of certain aspects of the bus service. Questions were also asked on household size, car ownership, car licenses, age and sex of the respondent.

ii. Analysis of Results

A total sample of 255 persons were successfully interviewed, comprising 214 bus users and 41 non-users. Extensive tabulations have been prepared to describe these two sample populations, but only those considered to be the most pertinent are summarized in this section.

The most common trip purpose among bus users is for shopping (see Table 11.3) representing 34% of responses on trip purpose. Work and school trips account for a further 47% of all trips (26% and 21% respectively). More than half of the bus users who responded made less than one trip and one to three trips per week. It is notable, however, that the bus rider interviews are different in this respect from the home interviews of bus users. In the former group, 45% of respondents made less than four trips per week, while 76% of home interview respondents fell in that category.

Most respondents were reasonably knowledgeable of the location of the nearest bus stop (see Table 11.4) (98% of riders and 78% of non-riders knew the location of their nearest bus stop) but only bus riders were predominantly knowledgeable of the bus times at that stop. Only 17% of non-riders claimed this knowledge, compared with 85% of riders.

Only riders were questioned on their knowledge of the system, in terms of how to reach various destinations within the city. Over 95% of riders (see Table 11.5) know how to get downtown by bus and 70% know how to get to leisure activities, the latter being the least well-known.

Ten level-of-service characteristics were identified in the questionnaire and respondents were asked to rate each characteristic on a five-point semantic differential scale, on which 5 represented very satisfied and 1 represented very dissatisfied. Only one characteristic was rated in aggregate as unsatisfactory - comfort while waiting - as evidenced by a mean score of under 3 (2.5 in this case). Correspondingly, 40% of all users rated this characteristic as unsatisfactory (see Table 11.6). Frequency was rated unsatisfactory by 37% of the respondents, parcel storage by 26% of the respondents, and routing by 17%. All other characteristics were rated unsatisfactory by 10% or less of respondents. The most satisfactory aspect of the bus system was the "helpfulness and politeness of drivers," which received the highest mean score of 4.5 and was rated unsatisfactory by less than 1% of the respondents.

Trip Purpose	Trip Frequency (per week)					
	Less Than 1	1-3	4-6	7-10	More Than 10	Total
Shop	53%*	47%	54%	7%	25%	34%
School	11%	18%	33%	61%	19%	21%
Work	16%	27%	36%	32%	69%	26%
Leisure	18%	9%	8%	4%	0	9%
Other	18%	18%	3%	4%	13%	10%
TOTAL	27%	27%	21%	18%	7%	100%

TABLE 11.3

* Percentages add to 100 in columns except for the row labeled "total", which indicates % age of population in each column.

Trip Frequency and Trip Purpose

Knowledge of Nearest Bus Stop	Respondents By Bus Use		Respondents By Intervw.		All Respondents
	Users	Non-Users	Home	Bus	
Don't Know	2%	22%	10%	3%	6%
Know both location and bus times	85%	17%	52%	88%	74%
Know location but not times	13%	61%	38%	9%	20%
Estimated walking time (min.)	3.03	2.45	2.35	3.08	2.83

TABLE 11.4

Knowledge of Nearest Bus Stop

Knowledge of Destinations	Respondents by Interview		All Respondents
	Home	Bus	
Downtown	90%	98%	96%
School/Work	71%	90%	85%
Leisure Activities	66%	71%	70%
Bank	71%	78%	76%

TABLE 11.5

(* Percentage of all respondents who have that knowledge)

Knowledge of Bus System by Destinations

Level-of-Service Characteristics	Response	
	Mean Score	Percentage Dissatisfied
Comfort While Waiting	2.5	40%
Frequency	3	37%
Storage for Parcels	3	26%
Routing	3.5	17%
Ticketing*	4	2%
Helpfulness and Politeness of Drivers	4.5	<1%

TABLE 11.6

(* A further four characteristics have been omitted from this table)

Overall Responses on Level-of-Service Characteristics

The majority of respondents would prefer to see the bus service continue its present 25¢ fare. Generally, 65-70% of the respondents expressed this preference, with little variation between users and non-users. Only 15% of the respondents would like to see the bus service offered free, with again almost identical responses from both users and non-users. The combination of this response to bus financing and the small number of complaints about tickets (cited as unsatisfactory by only 2% of the respondents) suggests that current fares and fare collection are generally considered to be satisfactory to both users and non-users.

A major hypothesis of this investigation was that people are generally poorly informed about transit services, and that advertising of the system is inadequate. This hypothesis appears to be confirmed by the survey described here. Approximately 55% of all respondents are unaware of any promotional activities on behalf of the bus system (see Table 11.7). As might be expected, a larger proportion of non-users are unaware of advertising than users, the proportions being 70% and 51% respectively. Similarly, nearly half of all respondents learned about the bus system from observation alone (this is shown in Table 11.8). Only 5% learned about it through advertising, while 14% learned from the free bus maps. The biggest source of initial information on the bus system, apart from observation, was "friends," indicated by 26% of all respondents. It is also notable that almost 20% of all respondents, and 65% of non-users, did not know that a system map exists. However, 56% of users have their own copy, while, not surprisingly, only 5% of non-users have a copy of the system map. Difficulty of use of the map did not appear to be a significant problem.

iii. Conclusions

From the data collected about the demographic characteristics of transit users and non-users, it was noted that bus users in the sample were predominantly female, and with almost half the riders under 23 years of age. Nearly half the bus riders could be considered to be captive to the bus mode because they come from non-car-owning households, and over half of the riders are from households with fewer than three members. In contrast, the non-user sample comprised half males and half females, almost all of whom were over 23 years of age. None of the non-users came from households without a car and almost three-quarters of the sample came from households with more than three members. Thus, on the basis of these demographic measures, it appears that the non-users are a markedly different segment of the population from the users. (It should be remembered that users and non-users were all sampled from households within the service area of the bus system, and in reasonable proximity to a bus stop.)

Aware of Promotion	Trip Frequency (per week)					
	0	<1	1-3	4-6	7-10	>10
Radio	30%	47%	44%	49%	39%	69%
T.V.	-	3%	-	-	-	-
Paper	20%	11%	9%	10%	-	13%
None	60%	45%	51%	49%	61%	31%

TABLE 11.7

(Percentages sum to over 100% since multiple answers were permitted)

Variations in Awareness of Promotion with Bus Usage

How Originally Learned About System	Trip Frequency (per week)					
	0	<1	1-3	4-6	7-10	>10
Map	-	12%	19%	15%	24%	13%
Friends	6%	24%	29%	40%	24%	25%
Media	8%	9%	5%	-	5%	-
Drivers	-	7%	4%	9%	8%	13%
Observation	83%	43%	39%	36%	38%	44%
Don't Remember	3%	5%	4%	-	-	6%

TABLE 11.8

(Percentages sum to over 100% since multiple answers were permitted)

Variations in Learning About the System with Bus Usage

Among bus users, over half of the sample used the bus less than four times a week, and the most common trip purpose was shopping. About one-quarter of the sample used the bus to travel to work, and a somewhat smaller proportion used it to travel to school. The most common complaint about the level-of-service offered by the bus system concerned comfort while waiting for a bus. This suggests that more attention should be paid to the provision of bus shelters, etc., than has been given in the past, a concern also expressed by other investigators. Other frequently-raised complaints were limited to service frequency, parcel storage on the vehicle and bus routing. It is interesting to note that storage facilities were of most concern to those using the bus for school trips, where one-third of respondents were dissatisfied, while only one-quarter of those using the bus for shopping trips were dissatisfied with storage. For all trip purposes, all age groups, and all trip frequency groups, waiting comfort and service frequency were the most common complaints made. The only exception to this was found when analyzing complaints according to the sex of the respondent, for which it was determined that men complained more about storage facilities than service frequency.

In general, it was found that publicity about the bus system was ineffective in informing both users and non-users about the services offered. However, bus users appeared to be somewhat more aware of promotional activities, maps, etc. than non-users. More than half of all respondents, however, claimed to be unaware of any promotional activities for the bus system, and almost three-quarters of the sample learned about the bus system from observation or from friends. Well over three-quarters of the bus users were aware of the location of the nearest bus stop to their home and at what times buses were scheduled to arrive at it. In contrast, just under two-thirds of the non-users know only the location of the bus stop, while almost one-quarter know neither the location nor the times of buses at the nearest stop.

From the survey, it is possible to draw some tentative conclusions about publicity for small transit systems, and also to make suggestions about the form of future studies. First, publicity that is intended to increase bus ridership must generally be aimed at a different segment of the population than that from which existing ridership is drawn. Second, current promotional efforts, comprising display advertisements in the local newspaper and public service spots on a single local radio station, are largely inadequate in reaching either users or non-users. It is clear, however, that more information is needed on those attributes of a bus system which can attract patronage from present non-users. To this end, it is suggested that attitudinal studies, using tried and tested market analysis and preference analysis techniques, be carried out. Currently, further work, using similar techniques, is needed to

establish more accurately and completely what attributes of a bus system are currently unsatisfactory to each of the users and non-users. Finally, this study has again demonstrated that a large proportion of bus usage is by people who have no other mechanized mode of travel available to them. This suggests that significant patronage increases will largely be achieved only by an increased understanding of "brand loyalty" to the automobile and by studies aimed at penetrating such market situations.

11.4.3 North-East Transit System

i. Description of System

The North-East Transit System is a privately operated system which serves the major apartment complexes in the Cayuga Heights-Southern Lansing area and Cornell University.

The NET System began operation in September of 1974 as a result of a survey of area residents in February of 1974, which was used to estimate the demand for public transit. Due to the low levels of ridership experienced on some routes in the early stages of system, a second survey was carried out in November 1974 which attempted to determine what the users of the system believed were the major deficiencies. As a result of this survey, there were a number of changes that were made. The first of these changes was the beginning of a more intensive information availability campaign. Posters describing the system and its attributes were put up throughout Cornell University and in the apartment complexes. Also, pamphlets clearly illustrating the bus routes and schedules were distributed throughout the area.

The second change altered the routing and scheduling of the system, thus decreasing the travel time of passengers on the buses.

The presence of route identification on all buses was the third change made. A large letter indicating the route which the bus was following was placed in the window of the bus.

Finally, the fare structure was altered somewhat. While the price of one ride remained at 30 cents, one now had the option of purchasing a ticket book containing twenty tickets for \$5.00 which figured to be 25 cents per ride.

11.4.4 Market Research to Monitor Recent Changes in the NET System

i. Description of Survey

In February and March 1975, a questionnaire

was distributed to apartment complexes and homes in the South Lansing area to measure the impact of the changes in the North-East Transit System, as they were perceived by the users and non-users of the system. Also, the survey was designed to determine if the changes were perceived as improvements, and if so, if they had any effect on ridership. Comments and suggestions were solicited for further changes which would improve the quality of the NET System. A copy of the survey used is included in the Appendix.

ii. Analysis of Results

A total of 333 individuals completed the questionnaire, indicating a response rate of 18%. Users of the NET represented a mix between Cornell students, Cornell employees, and local townspeople. Cornell students represented 41% of the total sample, Cornell employees and local townspeople accounted for 26.4% and 27% of the responses, respectively.

A total of 92 people indicated that they had first anticipated using the bus and are not now using it. This represents about half of the non-users that responded to the survey. It was possible to determine why these people are not now using the service. This was done by asking people who were not users why they did not use the bus. Table 11.9 gives a tabulation of this data. The major reasons for not using the bus were scheduling and frequency, followed by a closely related category which was termed "inconvenience."

The major changes in the NET System that were recognized by respondents were routing, travel time, and scheduling, and these changes also represented the most important reasons for increased ridership. 55% of those respondents who used the bus more often cited scheduling as an improvement. 65% cited routing as an improvement, and 60% of the users thought travel time was shorter. This is shown in Table 11.10.

One portion of the survey listed various aspects of bus service to be rated from 1 (very unsatisfactory) to 7 (very satisfactory). A computer program tabulated the number of positive and negative deviations from the average response for each aspect of service.

Three distinct categories seem to exist in the results. There were a large number of negative deviations with few positive deviations for the categories of hours of service, frequency of service, and comfort while waiting for bus. There were a large number of positive deviations with few negative deviations for the categories of reliability of schedule, travel time on bus, and courtesy of driver. There were a sizable number of both positive and negative deviations for the categories of comfort of vehicle, routing and scheduling, availability of

	First Reason Given	Second Reason Given	Percent
Scheduling and Frequency	40	3	46.7%
Inconvenience	14	4	19.5%
Travel Time Too Long	3	3	6.5%
Fare Too High	4	5	9.7%
Lack of Information	6	1	7.6%
Routing	5	4	9.7%
Doesn't Go To Cornell	7	1	8.6%
Rides Bicycle	0	0	0
Already Has a Car	6	2	8.6%
Needs a Car	2	0	2.1%
Unreliable Service	0	0	0

TABLE 11.9

Non-Users Who Anticipated Using the Bus Service When It Was First Proposed

Apartment Complex	Routing		Walking Distance		Travel Time		Scheduling		Availty. of Info.		Schedule Clarity		Clean Buses		Fare Stru.		Route ID	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lansing West	3	60.0	2	40.0	2	40.0	4	80.0	4	80.0	3	60.0	0	0	0	0	2	40.0
Lansing East	3	75.0	1	25.0	2	50.0	2	50.0	1	25.0	2	50.0	0	0	0	0	1	25.0
Lansing North	4	33.3	0	0	4	33.3	3	25.0	3	25.0	3	25.0	2	16.7	0	0	3	25.0
Winston Court	6	75.0	1	12.5	7	87.5	5	62.5	3	37.5	2	25.0	0	0	0	0	6	75.0
Village Apartments	8	100.0	0	0	8	100.0	5	62.5	4	50.0	3	37.5	0	0	0	0	3	37.0
Gaslight Village	1	100.0	0	0	1	100.0	1	100.0	1	100.0	1	100.0	0	0	0	0	1	100.0
University Park	1	50.0	0	0	0	0	2	100.0	0	0	1	50.0	0	0	0	0	1	50.0
TOTALS	26	65.0	4	10.0	24	60.0	22	55.0	16	40.0	15	37.5	2	5.0	0	0	17	42.0

TABLE 11.10

Improvements Perceived by Those Who Use Bus More Often

information, and fare. This is shown in Table 11.11. Thus, on the basis of these results, it would seem to be desirable to concentrate the major part of any improvement efforts on the hours and frequency of the buses and on obtaining bus shelters. If possible, improvements might also be desirable in vehicle comfort, routing and scheduling, information availability, and fares.

No effort seems to be necessary in the areas of reliability, travel time on bus, and driver courtesy. However, one assumption in this interpretation of the data should be noted. This assumption was that all of the categories were equally important to the respondents to the questionnaire. Such an assumption is highly questionable. However, there were no means available which could be used to determine an ordering of the importance of the different categories to the questionnaire's respondents. It is nevertheless interesting to note that 35% of the people who gave reasons for not using NET cited scheduling and frequency reasons. Also, consideration should be given to the relative costs of improvements should be implemented.

Respondents were also given the opportunity to give additional comments. This kind of question serves two purposes. First of all, it gives people the opportunity to air any grievances they may have regarding the transportation system in their area. This is good public relations for the system because it gives people the impression that someone is listening to their problems and complaints that the users of the system are faced with. Although this information by itself is not strong enough evidence to warrant another change in service, it does indicate possible areas of future improvements.

The response to this question was overwhelmingly in favor of a late bus and was very much against the cutback in service experienced during the last intersession. Some of the major complaints apparently were members of the Cornell faculty and staff that did not have the same vacations as students. Some of the other comments pertained to some of the service characteristics already dealt with, and they tend to support the conclusions that were previously drawn.

iii. Conclusions

The changes in the service that came about at the time North-East Transit was formed have been shown to be improvements by the criteria established in the analysis of results section. Changes in routing, travel time on bus and scheduling have been shown to be the most important factors leading to the increase in ridership which was experienced soon after the formation of NET.

It was found that the respondents were relatively

	Deviation					
	-3	-2	-1	+1	+2	+3
Hours of Service	14	25	31	9	1	-
Frequency	6	18	35	15	1	-
Comfort While Waiting for Bus	14	33	37	7	1	-
Reliability	-	4	7	50	16	2
Travel Time	-	-	15	39	13	4
Driver Courtesy	-	-	1	53	32	9
Comfort of Vehicle	6	13	24	26	6	1
Routing and Scheduling	4	5	22	18	8	3
Availability of Information	3	9	16	24	11	1
Fare	3	12	19	27	11	2

TABLE 11.11
Results of Second Evaluation Method

satisfied with the reliability of service, travel time, and courtesy of bus drivers. They were somewhat indifferent towards the comfort to vehicle, availability of schedule information and the fare structure. They were dissatisfied with the hours of service, frequency of service, and comfort while waiting for the bus.

Although this survey cannot show that a change in the hours of service and frequency of service will lead to an increase in ridership, this implication can be made based on the strong dissatisfaction of the users in those areas and the fact that the changes made in routing, travel time, and scheduling were at least partially responsible for the increase that was observed after these changes were made.

If any future attempts are made to improve the system, then it is recommended that hours of service and frequency of service receive strong consideration as possible areas for improvement. These improvements should be made known to the apartment dwellers and homeowners of the South Lansing and Cayuga Heights areas by increased advertising and promotion of the system. Advertising and promotion strategies are discussed in Section V of this task report.

11.4.5 Potential Future Public Transit System

In the design of any mass transit system, three things are desired for the system to be desirable: first, one must ascertain what the public perceives as an effective transportation substitute for the automobile; second, to design a system which incorporates as many of the desired features as is feasible and effective; and third, to market such a system. The core of a future public transit system in Tompkins County would consist of the existing resources plus additions of new hardware elements. Based, in part, on the first-year tasks of this research project, an application was filed by the City of Ithaca to the Urban Mass Transportation Administration for new buses, bus stops, and bus shelters, as well as a new bus maintenance facility. At this stage of research a feasible public transit system is being designed, the next step being the construction of a timetable of implementation of changes in the system. This time table would be designed to permit a phasing in of system changes, together with an appropriate timing of the desired publicity and marketing strategies. These publicity and marketing plans are detailed in Section 3, Recommendations for Small Urban Areas - Including Ithaca, New York. The strategies were compiled by extensive studying of the marketing programs suitable for use in small urban and rural areas and analysis of the data on user and non-user perceptions of the Community Transit System presented in part A of this section. The marketing strategies are designed to appeal to the three major groups that the system will be designed to serve: non-users of public transit who

do not have ready access to the automobile, such as people without drivers licenses, the poor and the disabled, and users of transit who could be compelled to use the transit system more often.

12. MONITORING OF PUBLIC TRANSPORTATION SERVICE IMPROVEMENTS

12.1 Introduction

In recent years the design of transit systems in the United States has increasingly sought to be consistent with the needs expressed by potential and actual transit users. Public officials and citizens are asking for improvements which will make mass transit a viable alternative to satisfy the public's needs. It has been shown that mere provisions of equipment have not been sufficient in this regard. Despite the one billion dollars allocated to public transit by Federal agencies since 1970, transit patronage has continued to decline. In order to implement changes in the system which will prove to be efficient, answers must be sought to the questions of who will use the transit system and why. The perceptions of all segments of the population must be carefully analyzed.

In a local context, a great number of changes to the public transportation service in the greater Ithaca area have been proposed by local policy decision-makers largely in conformance with the recommendations of this research project. These changes pertain to service area expansion, upgrading of the bus fleet (through an UMTA Capital Grant), provisions of bus stop shelters and signs, and the implementation of a marketing program for the transit service. This task attempts to monitor the results of such changes in small and large urban areas, and to assure that such changes will be consistent with the desires of potential customers.

A discussion of the survey instruments and survey research techniques used will indicate the type of data collected in this study. Monitoring efforts concentrate on changes in ridership coupled with comparisons of level-of-service satisfaction ratings. Recommendations for improvement strategies are proposed that are suitable for small urban areas as well as in Tompkins County, New York. A follow-up study of perceptions of riders within a specific transportation corridor in Tompkins County is made in this chapter. This corridor was surveyed as part of the first year effort of this research project, which led to the creation of the North-East Transit System (NET), which now serves this high travel-demand density area.⁹³

12.2 Description of Monitoring Techniques

12.2.1 Monitoring Ridership

Increased ridership is the primary indicator for confirming the success of a change in a transit system. Methods used to determine increased patronage include counting farebox revenues

and conducting manual counts of passengers. These counts should take place both before and after changes have been implemented. The procedure used in conducting a manual count is to station observers in buses where they can maintain records of persons entering and leaving the vehicle. The time is often recorded to estimate ridership during peak and off-peak periods.

12.2.2 Attitudinal Surveys

Attitudinal surveys are conducted to determine user and non-user perceptions of the transit system. The most expensive but most accurate type of attitudinal survey is the home-interview survey. This survey is conducted by contacting a sample of households selected by choosing every n^{th} dwelling unit from a list of all households in the area. Depending on budget constraints and currency of sources, samples may be taken from meter listings, census lists, street directories, or any other reliable source which may be found. Sample rates vary from 1% of the population in large metropolitan areas to 10% in small cities.

Besides including attitudinal questions on the transit system, information which is gathered at the interview includes data on the characteristics of the household as well as information on trips made by members of the household. Characteristics of the household which are determined include number and ages of residents, occupation, car ownership, and sometimes, income.⁹⁴ This data is used in cross-tabulations to analyze preferences in terms of socio-economic characteristics. These results can show how individual changes affect particular subgroups of the population.

Travel data is acquired for every person five years of age or older since at this age persons make purposeful trips, such as trips to school, and these trips may have an impact on the planning process. Travel data include information on origins and destinations, trip purposes, mode of travel, time of day, land use at origin and destination and car loading⁹⁵ (if an automobile is the mode of travel used).

Attitudinal questions are phrased in a variety of ways. Commonly used are semantic differential questions. In this type of question a feature is rated on a number basis, the numbers expressing ranges of feelings from one extreme to the other; (for example, "very satisfied" to "very unsatisfied"). Similar questions are often used for cross-checking purposes, for example, in a monitoring survey respondents may be asked to write down features in which they have noticed change. A later question may list characteristics and have the interviewee write down if he has observed that the characteristic has changed for the better, changed for the worse, or not changed at all. These questions ascertain both readily and marginally noticeable changes.

Paired comparisons are also used to define preferences. In this technique each item of the total series is presented to the respondent paired with each other item at least once (e.g., items A, B and C are presented as A and B; A and C; and B and C). One item of each pair must be selected in each case. Preference is determined for each item relative to each other item.

The interviewing procedure begins with mailing letters to prospective interviewees the day before the interview is to take place. When the interviewer arrives, he presents suitable identification, further explains the nature and purpose of the survey and gives repeated assurances of confidentiality, in order to facilitate accurate responses and a favorable reception. He then attempts to interview all persons in the household that are sixteen years of age or older. Typically an interviewer manages to complete six to eight interviews per day.⁹⁶

Checks are made on the interviewers by telephone calls and by a small number of re-interviews in order to ascertain if the information has been accurately obtained. These cautions, coupled with careful editing, coding, and keypunching, will generally insure an accurate survey.

Other attitudinal surveys include on-board surveys, and in-home surveys. On-board surveys are distributed on the bus and completed while the passenger is on route to his or her destination. These surveys are short and may include attitudinal questions and characteristics of the transit user such as age, sex, frequency of transit use and origin and destination of the trip currently being taken.

In-home surveys seek to obtain the same information as the home-interview survey, but questionnaires are either mailed out to the interviewees, and mailed back, or given out to households and mailed back. This type of survey is less expensive to administer than a home-interview survey, because of labor costs, but generally produces lower return rates and less accurate data. The cover letter that accompanies the survey should explain the purpose of the survey in such a way as to encourage response. Peterson and Strauss⁹⁷ showed in a survey done for the Chicago Rapid Transit System that survey form length only marginally affects the rate of return of the questionnaire if the survey is shown to be relevant to the public by maintaining communication between users, potential users, and transit administration. Any survey performed should try to stress the usefulness the questionnaire will have to the respondent and encourage interest in the survey by telling the respondent where he may find out the results of the completed survey.

12.3 Monitoring of Specific Service Improvements

This section of the report attempts to examine the effects of individual service improvements on all segments of society. This is done by analyzing attitudinal surveys, ridership figures and reports from transit companies. In cases where a variety of service improvements were initiated, attempts are made to isolate the impact of each improvement and discover how improvements are perceived relative to each other. Level of satisfaction ratings for service change are examined with regard to different socio-economic groups such as the elderly, the young, low, middle and high income groups. In some aspects of service, transit systems across the nation were surveyed to determine criteria for effective improvements. The categories of service improvements are Fares, Special Services, Informational Aids, Route and Schedule Changes, Equipment Changes, Marketing, and Demand-Responsive Service.

12.3.1 Fares

A review of studies evaluating the effects of increased or reduced fares will be summarized in this section, in addition to a discussion of special fare rates.

The effect of fare increases on ridership is to decrease patronage, although a net increase in revenues is gained. Simpson and Curtin postulated an average fare elasticity of $-.33$ (loss of patronage of $.33\%$ for each 1% increase in fare) from a regression line which was drawn through the experience from 77 fare changes in cities of various sizes.⁹⁸ This fare elasticity has become accepted as a rule-of-thumb elasticity.⁹⁹ The main loss of ridership is from "discretionary" riders, who have other transportation alternatives. A study by Kemp¹⁰⁰ came to the conclusion that fare increases cause a greater loss of patronage on weekend travel versus long-haul trips. Ridership losses were also greater in suburban areas, rather than central city areas.

Fare decreases generally cause a smaller increase in ridership than would be predicted by the Simpson Curtin formula.¹⁰¹ Kemp reviewed a number of empirical studies of fare elasticities and noted that:

These very low elasticities mean, of course, that there isn't much traffic growth to be gained by using the farebox as a stimulus to ridership. Nor can low fares be expected to attract many people out of their cars. Moreover the elasticity values indicate that fare cuts are bound to lead to reductions in gross revenues.¹⁰²

Percentage-wise, fare decreases increase shopping trips more than work trips, since the discretionary trips are more responsive to service and fare changes. A study of free fares in St. Louis showed that shopping trips increased 33% while work trips increased 9%.¹⁰³

Studies on the effect of fare decreases on different population segments show that as an individual's income increases, fare reductions are less important than service improvements. One study showed that low fares were ranked highest in relative importance first by the elderly, then by lower income groups, and third by people under age 20.¹⁰⁴ Certain groups, such as the elderly, are more responsive to fare changes, even though features such as "having a seat" and "no transfer trip" were more important than lower fares.¹⁰⁵

Cities that have made substantial fare reductions include Atlanta, Georgia, where in March 1972 a fare reduction from 45¢ to 15¢ increased patronage 13%. St. Louis, Missouri lowered its fares from 45¢ to 25¢ and experienced a 15% increase in ridership. In 1973, downtown Seattle instituted free fare, and patronage increased 56% after six weeks. In all these cases, however, fare decreases resulted in a net loss in revenues. A study by Charles River Associates in Boston, Massachusetts came to the conclusions that transit ridership is more responsive to service improvements than fare reductions, and that service improvements can be made at a fraction of the cost of abolishing fares and will achieve many of the benefits attributed to fare-free transit.¹⁰⁶ This agrees with a statement by Kemp:¹⁰⁷

The accumulated evidence shows, however, that ridership is significantly more sensitive to changes in the level of service (particularly door-to-door journey times) than to changes in fare, although service elasticities also are numerically less than unity. In other words, the prospects for stimulating ridership through improved service are much better than the prospects for gains through the farebox.

In another study, Smith¹⁰⁸ came to the following conclusions (among others) based on the results of 25 Department of Transportation bus and rail demonstration projects:

- i. Fares of public mass transportation cannot be raised sufficiently to eliminate the deficits inherent in their operation. A compromising attrition of ridership will occur first.
- ii. A reasonable increase in fares accompanied by an improved level of service will not generally result in an appreciable attrition of patronage.

- iii. Fare reductions will not attract sufficient ridership to offset reduced patronage.
- iv. Improved or increased levels of service or both, particularly in the peak periods, will result in increased passenger volumes which, in some cases, may be sufficient to cover the increased costs.¹⁰⁹

Deuker and Stoner of the University of Iowa conducted a study entitled "Examination of Improved Transit Service."¹¹⁰ The private bus service in Iowa City, which has been of low quality, was taken over by the city shortly before the study was initiated. In their initial study, the major parts of which were implemented, Deuker's and Stoner's major recommendations were that a new route system be implemented, that new buses be acquired, and that the bus fare be reduced from 25¢ to 15¢. The fare reduction was recommended because, "An on-board survey showed that the 25-cent fare was attracting primarily captive riders and few choice riders. Past experience had indicated that a fare greater than 15 cents was unattractive to the choice rider."¹¹¹ After these changes were implemented, the bus system's ridership increased substantially from about 2,000 patrons per weekday on the old system to about 6,000 patrons per weekday on the new system. It is interesting that the patronage increase was so much greater (relative to the original patronage) in Iowa City than in Atlanta, despite the fact that the fare decrease in Iowa City was less than the decrease in Atlanta. Although caution is necessary when comparing two diverse cities, it appears therefore that it was Iowa City's emphasis on service improvements which brought about the major part of its patronage increase. This conclusion agrees with Kemp's statement that transit ridership is more sensitive to changes in the level of service than to the level of fare.

i) Special Fare Rates

In many of the cities in the context of this project, ridership increases could not be obtained that reflect the percentage of ridership gained by implementing the special fare rates. However, it was determined that in the cities surveyed these fares were helpful in increasing ridership in the segments of the population the fares applied to.

Senior citizen fares are in effect in many transit systems in the United States. Examples of some cities that have these fares are Denver, Phoenix, San Diego, New York City, Syracuse, Ithaca, Chicago, and San Francisco. The amount of fare reduction varies from city to city as does the time when the fare rates are in effect. In Madison, Wisconsin, fare rates of 15¢ (regular fare is 25¢) are in effect between the hours of 9 A.M. to 3 P.M. In Pittsburgh, Pennsylvania and Detroit, Michigan, senior

citizens may ride free of charge between 9 A.M. and 4 P.M. on weekdays and all day on weekends. All-day senior citizens fares are in effect in Boston, Massachusetts and Ithaca, New York. Generally the fare reduction is from one-half to two-fifths of the normal fare and the fare may be in effect all day, or only during non-peak periods, depending on the ridership during peak hours.

Other types of special fare rates are student rates and children's rates. Children's rates vary from fares reduced for children under high school age to free fares for pre-school children accompanied by an adult. Children's rates are found, for example, in Denver, Phoenix, New York, Chicago, and San Francisco. Special fares may also be established for high school students, college students, or all three, depending on the population distribution of these groups. Student rates are in effect in Denver, Phoenix, San Diego, San Francisco, and Iowa City. In Boulder, Colorado, students may buy a discount Daily Pass at a cost of 50¢ per day (one-way fare is 25¢). This ticket allows unlimited rides for the day. In addition, riders under 15 years of age may purchase a summer pass for \$10, permitting unlimited use of the transit system for three months. These special fares have helped to increase ridership in Boulder from an average of 60,000 passengers per month in 1973 to 125,000 passengers per month in 1974.

Discount fares have been successfully used in many cities to attract ridership on a continuous basis. Pittsburgh, Pennsylvania began selling annual permits in July 1973 and sold 1,001 permits through July 1974. The hundred-dollar permit saves riders \$53 a year. (Base fare is 40¢.) Also weekly and monthly tickets are sold. When the Pittsburgh transit system reduced the cost of their monthly permit from \$13.50 to \$10.00 in 1973, sales increased from 2,000 to 17,000 permits a month, within a year. When the cost of weekly permits was reduced from \$3.10 to \$2.60, sales doubled from 3,000 permits a week to 6,000 permits. Currently many commuter trains have such a fare category. The new PERT Dial-a-Bus system in the Rochester, New York area sells weekly tickets for its work, school, and "feed-a-bus" service. When this system offered a reduced fare plan for group ridership, demand by family members and especially senior citizens grew from an average of 200 passengers per week in 1974 to a high of slightly over 1,000 passengers.

An extension of the weekday discount ticket is the weekend pass. Pittsburgh's \$1.00 Weekend Family Plan, which allows four people to ride the bus as many times as they would like on Saturdays and Sundays, accounted for ridership increases of 22.1% on Saturdays in June 1973 and 45.4% on Sundays in June 1973. Weekend passes are also in effect in San Diego, and San Francisco, California, where all-day tickets are sold for Sunday travel. New York City has also experimented with a half-fare Sunday service.

A discount fare that has been used in many cities to attract the segment of the population that can freely use the transit system during off-peak hours is the Shopper's Pass. In December 1973 the Madison, Wisconsin Metro System initiated a 55¢ Shopper's Pass, good on the day of purchase between the hours of 9:00 a.m. and 3:00 p.m. on weekdays and between 9:00 a.m. and 6:00 p.m. on weekends (one-way fare on this system is 25¢). This special fare in conjunction with other service improvements, helped to increase ridership on the Metro an average of 15.5% for the first six months of 1974. In December 1973, New York City initiated a Midtown Bus Plan where for 75¢ (regular one-way fare is 35¢), one can travel on an unlimited number of buses in a defined midtown area. The 75¢ ticket is good from 9:30 a.m. until 4:30 p.m. and on Thursdays, when the stores are open late, it is also good from 6:30 p.m. until 10:00 p.m. Ridership has shown a continuing increase from initial January 1974 figures of approximately 6,000 riders per week to averages over 8,500 passengers per week through 1974. In 1972, Phoenix, Arizona began selling a \$1.25 ticket that is good all day for boarding any bus in the system (one-way fare is also 35¢).

Special fares for the handicapped are in effect in many cities. Variations in these fares exist in the areas of cost applicability of fares. The definition of handicapped sometimes varies from city to city. In Denver, Colorado the blind, mentally retarded, and physically handicapped qualify to obtain the reduced fares. In San Francisco, California, these fares apply only to the blind.

12.3.2 Special Transit Services

Special bus runs can provide communities with convenient access to a variety of events and places. Types of special transit services include Shopper's Shuttles, recreational bus runs, and Park-and-Ride services.

Recreational Bus runs are provided in many cities. In 1973, the New York City Metropolitan Transit Authority initiated a Culture Bus Loop, where a special bus makes many stops along a 17-mile route. The \$1.00 ticket allows riders to get on and off the bus an unlimited number of times during the day. Since its inception, the bus service has been used by over 10,000 people in the first six weeks of service. The transit system in Phoenix, Arizona also runs a similar service.

In 1971 the A.C. Transit Company in Oakland, California equipped a special bus to carry cyclists and their bicycles over the San Francisco-Oakland Bay Bridge. This service provides access to the many scenic bikeways previously inaccessible to many riders because foot and bike traffic is prohibited on the bridge. Although specific ridership figures could not be obtained, this is said to be a very popular service.

Another type of recreational bus run popular in many cities is special transit service to football and baseball games. In San Diego, California the price of admission was combined with the fare. This type of service is also offered in San Francisco, California and Cincinnati, Ohio. The Detroit, Michigan transit system combines fare and admission price to a major racetrack.

Many transit systems offer seasonal service to recreational areas. In Madison, Wisconsin a special zoo bus runs during the summer months. The bus is painted bright yellow with animals painted on the sides. In the winter of 1974 the Seattle Metro System initiated a weekend service to three ski areas. The service is especially popular with high school students. San Francisco, California offers special bus runs during New Year's Eve, the 4th of July, Christmastime, and also for summer youth concerts, Easter sunrise services, and to summer camps and parks.

Park-and-Ride services are increasingly being established to save riders the inconvenience and cost of locating parking spaces in downtown areas. Pittsburgh has a Park-and-Ride Service that connects over 2,000 parking spaces with express buses, trolleys and regular transit service. In Atlanta, Georgia, a park-ride lot was especially constructed to serve transit passengers. It opened in January 1975. Seattle also has a park-and-ride service operating during peak and off-peak hours. The University of Iowa has a park-and-ride service for campus travelers, as does Cornell University in Ithaca, New York.

Shopping shuttles provide customers with easy access to large shopping areas. Shopper's shuttles are run in San Francisco, Syracuse, and Madison, each charging a dime for a trip. One variation of the shopper's shuttle is found in Albany, New York where two different shopping plazas sponsor free buses to their respective shopping areas from stops at the nearby State University. One bus provides service on four days and the other bus runs only on Saturdays.

12.3.3 Informational Aids

The basis for much of the monitoring reported in this section is a five year Mass Transportation Demonstration Project on Transit Information Aids, sponsored by the Department of Transportation and undertaken in Washington, D.C.¹¹² This study developed design criteria for effective informational aids, based on surveys and investigations of 23 transit systems in the United States, and based upon experiments utilizing these criteria.

The majority of bus companies surveyed in the Washington D.C. study on informational aids reported that they offer information services as much for the purpose of generating good will and customer satisfaction as for the purpose of increasing or altering the use of buses. Replies also pointed out that various information services meet different needs, and that they complement each other.¹¹³ Many of the companies stressed the importance of providing particular kinds of information for particular purposes or events. Examples are the distribution of maps and schedules to residents of new areas being served, explanations of changes in fares or routes, or information about special bus runs or services.

All the companies offer information through their bus drivers, although differing in scope and intensity of information training given to drivers and the extent to which information responsibilities are part of their regular duties.

The transit systems also provide some visual information on the buses and in some cities each bus carries a wall map showing its route. In addition, all companies provide telephone information services to various degrees. In Oakland, California, special free information phones were installed at key bus stops and bus shelters, providing riders with twenty-four hour service for receiving questions concerning route, schedule, and service information. Denver, Colorado also has a twenty-four hour information phone line. Most of the companies said they encourage these inquiries, a few discourage them, based on financial considerations.

The use of information booths vary from city to city. Bus routes are less apt to terminate in major terminals or transfer points where extensive information can be displayed than the routes of commuter or subway trains.

i) Maps and Schedules

The Washington, D.C. study developed criteria to be used in the design of route maps and schedules.¹¹⁴ The study showed that effective route diagrams should show the beginning, end, and important intermediate points on each route. The map should indicate routes that intersect and stops where transfers may be made, as well as indicating neighborhoods or communities through which the route passes. Important shopping facilities, parking areas, historical centers, and landmarks should be shown. Ideally the map should be presented in network form, highlighting the routes but avoiding unnecessary detail. Finally, the map should print the approximate length of time the route takes between local or express points to enable the rider to plan a convenient time schedule.

In large urban areas three types of route maps should be printed: system-wide maps, neighborhood maps, and maps for individual routes. The system-wide map would define how the major routes connect portions of the city, and show major destinations and landmarks. The neighborhood maps would further define each area by showing how the routes relate to the street plans of the area. Route maps would outline the streets and destinations a specific route encompasses and could also be used as an information device on the interior and exterior of the bus.

In conjunction with the route maps, schedules should be designed to fit easily into a pocket or purse. In a telephone survey conducted as part of the Washington study, the majority of people who wanted more information on the transit system wanted schedules more than any other information device (52%).¹¹⁵

A report by Lovelock¹¹⁶ discussed an interesting design concept successfully used in London, scheduling routes on "clock headways" (i.e., every 10, 15, 20, 30, 60 minute intervals). Scheduling a transit service in this way results in simpler timetables which are easier to remember. The drawback of this plan is that it sometimes results in less efficient utilization of equipment.

Based upon the review of twenty-three transit systems in the United States, the most effective means of disseminating this information was found to be the distribution of maps and schedules from "take-one" racks on buses and at other points, mounted at bus stops, conveyed through push-button devices installed at certain bus stops, stores, hotels, and other points where they can be policed to prevent vandalism. Schedules may also be displayed through newspaper advertisements placed cooperatively by stores, shopping centers, theaters, and other interested parties.

ii) Bus Stop Signs

The demonstration project also found the following criteria to be an important part of any bus stop sign design:¹¹⁷ that the sign can be seen clearly at a distance of a half block or more, that the sign indicate which bus lines use the stop and if used by more than one bus line, indicates different services by color or other graphic devices. Additionally, the signs should indicate where the buses go, how frequently, and at heavily traveled points should indicate where the riders should stand while waiting for the bus. To riders already on the bus, the sign should clearly state what stop it is and what transfers may be made. Also recommended was the establishment of standardized graphic symbols depicting a bus for use on signs. In conjunction with an overhaul of their mass

transit system, Boston developed a new symbol ("logo") for bus signs, and developed route destination signs with background colors similar to those of the rapid transit line to which it was headed (rapid transit was color-coded by route).¹¹⁸ Different variations of bus designs can be found on signs in Syracuse, Denver, Albany, and on experimental routes of the above mentioned Washington, D.C. study on informational aids. Posting easy-to-read signs indicating stops, accompanied by clear signs giving the schedules and routes is an effective technique to increase visibility of the system.

When the new Golden Gate Transit Services were introduced in the San Francisco Bay Area in January 1972, many cosmetic touches were employed to heighten the visibility of this system.¹¹⁹ New and old vehicles are painted in a bright white and green color scheme with an eye-catching three color symbol on the sides, back and front of the vehicles. The symbol also appears in reflective paint on the bus stop signs. Good visual design, combined with advertising activity is believed by management to have contributed to the faster than anticipated increase in ridership.¹²⁰

iii) Bus Shelters

As part of a Department of Transportation Demonstration Study on information aids, criteria were developed to be met in designing bus shelters. Shelters were to be designed primarily to furnish overhead protection in areas where large groups of riders congregate to wait for buses and provide a well-designed setting and support for bus stop signs, timetables, route diagrams, and other informational aids. Bus shelters should also house public telephone and trash receptacles. Aesthetically, the shelters should enhance the appearance of public areas by being simple, inconspicuous, and not subject to architectural dating. The shelters should be of low initial cost, low maintenance cost, and easy to remove to different locations. In addition, the shelters should not create traffic visibility hazards or obstruct the views of shops or businesses.¹²¹

Currently being used in many cities is a modular type of bus shelter, allowing the size of the structure to be adapted to traffic conditions at any given area. A modular shelter currently being widely marketed in the North-East is made of transparent, unbreakable plastic sheets enclosed in a stainless steel frame.¹²² These new lighted, transparent structures can also serve as a deterrent to crime, depending on the area and time of day the structure is being used.

A study by Notess¹²³ found that for all income groups, use of the bus increases the nearer the stop is. A 1968 survey of the Buffalo Metropolitan area showed that twenty percent

of workers within one-tenth of a mile radius were using the transit system, compared to ten percent utilizing the system who lived an eighth of a mile away from a stop.¹²⁴ In Atlanta any stop where eighty or more people board a bus daily was considered a potential shelter location.

iv. Destination Markers

Based on survey research referenced in previous sections the design for a successful front end destination marker on buses should incorporate the following elements:¹²⁶ The markers should be large enough so that all lettering is legible at a distance of at least one half block and route numbering is legible at a distance of one block (This pertains to conditions during both day and night for a person of average eyesight. Markers should include information on destination, route followed, and type of service (local or express). Color should be investigated as an element of marking to reduce the number of words required. Lastly the markers should be designed to provide ease in transferring the signs to new or old buses.

12.3.4 Route and Schedule Changes

Monitoring studies of the effects of changes in routing and scheduling have shown that increased frequency will increase ridership, although no empirical method of prediction of this increase has been developed.¹²⁷ One study found that reduction in waiting time at a bus stop was more attractive to passengers than a reduction in riding time.¹²⁸ This observation supports related findings developed in travel demand modeling research. In areas where transit service is frequent, it has been shown that fare reductions increase ridership more than service improvements. (shown for five minute headways.)¹²⁹ When headways are longer, however, service improvements have a greater effect on ridership. A survey conducted in St. Louis, Missouri in 1973, showed that 66% of the people said they would ride the bus more frequently if headways were reduced from 30 minutes to 15 minutes.¹³⁰ The results of a survey performed in 1974 by the Metropolitan Atlanta Rapid Transit Authority concluded that for users and non-users, greater frequency was cited as the most important service improvement.¹³¹

In differentiating the importance of increased frequency for different income groups, a 1965 study in Boston showed that increased frequency was more important than reduced fares to upper and middle income groups.¹³² Increased frequency was also recommended in order that upwardly-mobile low income groups will continue to use the transit service even if another mode of travel becomes available.

Changes in transit service may have a greater effect in a low service area since obviously an increase in frequency in an already relatively high frequency route would have less effect

than an increase in frequency in transit service with long headways. It has been shown that there exists a minimum acceptable waiting time below which an increase in frequency makes little difference. A study by the Stanford Research Institute showed that a difference of two to five minutes was sufficient to be a "just noticeable difference."¹³³ In deciding upon scheduling changes trade-offs must often be made between decreasing headways on existing routes or increasing or extending the number of routes. Decisions must also be made on the time of the service improvement: peak hour, daytime, evening, or weekend. In the St. Louis study, improvement in peak-hour service was cited as a needed improvement by 24% of those responding, but service improvements in other time periods were cited by nearly all respondents.¹³⁴

Studies on origins and destinations show an increasing variety of routes taken on trips, and an increasing dispersion of jobs and residential areas.¹³⁵ This shows that more investigations should be made of route changes and extensions to non-central Business District oriented trips and to CBD trips from outlying areas which have a large headway for these trips.

12.3.5 Equipment Changes

A report by Lovelock¹³⁶ concluded that one of four complementary approaches to stimulate public transportation patronage was to improve the attributes of transit vehicles and stations. He suggested refurbishing and repainting vehicles and stations, and purchasing more modern equipment. Many studies have shown that improving vehicle appearance and comfort can substantially contribute to increased patronage. A survey of citizen attitudes in Houston¹³⁷ found that convenience and comfort were more important considerations than cost or speed, although cost was the most important consideration for low-income residents. Confirming the Houston study, a report by Holland¹³⁸ concluded that for non-captive transit riders, attributes connected with car-speed, comfort, convenience, and a wide choice of destination, are as important (or more important) than fare. The Holland report was a review of articles and reports written in the last ten years relating to service and fare changes.

Case studies of actual transit systems have also confirmed the above findings. In January 1972 when the Golden Gate Transit System took over operation of transit services between Marin County and San Francisco, the principal change was the introduction of a fleet of 132 new buses. The buses featured air conditioning, greater leg room, reclining seats and bright color schemes. After ten months transit ridership increased from 4,500 riders per day to over 7,000 riders per day. Although other changes were made, such as the addition of a few new routes and a simplified fare and transfer structure, transit management considered the equipment change to be a major attraction for new riders.

Research by Lisco¹⁴⁰ into the Skokie Swift Rapid Transit Service developed some interesting relationships between travel time, comfort, and price. He concluded that commuters place a value of \$2.50-\$2.70 per day on commuting time and an extra value of \$2.00 per day for the difference in "comfort" between driving and riding the Skokie Swift Service. He concluded from these figures that the comfort and time savings afforded by the Skokie Swift Service was more important than the relatively high 45¢ one-way fare in attracting ridership on the popular commuter service. Research and actual experiences of transit services seem to show that transit vehicle comfort is a very important factor in commuter satisfaction.

12.3.6 Marketing

Monitoring is an important input to be used in designing marketing techniques and testing their effectiveness. Attitudinal surveys are used to locate potential users and to discover those features of route location, scheduling, cost, comfort, and convenience which will encourage more people to use public transportation. Knowing these attitudes, the positive and negative aspects of the transit image can be established for groups within an urban area. Once these images are established and the magnitude of the market assessed, a strategy for developing and publicizing a transit system which is consistent with this image can be outlined. Often positive attitudes towards transit are held by only certain segments of the population. By identifying these segments and pursuing an aggressive marketing strategy, a marketing program can be designed to bring ridership to the optimum level. Attitudinal surveys can also be used to test the effectiveness of marketing programs after they are implemented by testing if there has been any change in the attitudes and behavior of the respondents.

Specifically, techniques for determining consumer preferences and perceptions include home surveys, on and off bus surveys and actively seeking suggestions from the public. Ways to gather suggestions from the public comprise such means as using "take one and return" forms on the bus, a special information and suggestion phone line, and other media-related means. A careful system of record-keeping should be developed to facilitate response to such consumer needs and concerns.

Monitoring efforts provide the necessary information to formulate any successful marketing strategy. In Chapter 11 of this report marketing strategies are recommended for small urban areas, including Tompkins County, New York. The extensive monitoring of cost-effectiveness of marketing techniques provide a basis for the development and evaluation of marketing techniques presented in that chapter.

12.3.7 Demand-Responsive Systems

A demand-responsive system is intended to provide door-to-door transportation for transit riders. Experiments utilizing demand-responsive vehicles have employed four systems. First is the route deviation system where endpoints and certain intermediate points are defined, but deviation from these routes is in response to demand. This system is used in Mansfield and Columbus, Ohio. Many-to-one service picks up passengers in an area to be transported to one destination. An example of this system is in Bay Ridges, Ontario. Another variation of this system is in Ann Arbor, Michigan and Regina, Saskatchewan where the transit system picks up passengers according to demand and delivers them to a few key points. In the many-to-many service passengers are picked up and delivered in an area according to demand, with no limitations on points of delivery. This system is used in Columbia, Maryland. The demand-responsive systems are usually coordinated manually. Requests for service are made anywhere from a day to several minutes ahead of the desired travel time, depending on the scope of the operation. A central dispatcher relays the routes to drivers by a two-way radio system, and the passenger is picked up as soon as possible and taken to his destination. The system is organized to keep waiting and travel times, route deviation, and costs at a minimum. In larger systems, computerized monitoring and dispatching may be used.

In September 1973, a symposium was held in San Francisco to review the status of ten demand-responsive systems, including those mentioned above.¹⁴¹ Conclusions that were drawn from the monitoring of these systems were the following:

- i. Technical and operational feasibility of the systems has been proven.
- ii. The manually controlled system has greater capacity than originally believed. At MIT a study had previously calculated that no more than a dozen vehicles could be successfully controlled in a manual system but this estimate has been far exceeded in places such as Davenport, Iowa, where 25 cabs are operated and in Lowell, Massachusetts where 40 cabs are operated manually.
- iii. The effectiveness of a demand-responsive system as a rapid transit feeder system is still uncertain. Systems have shown various success rates in attracting commuter patronage.
- iv. The ideal demand-responsive vehicle is not yet available. The consensus of opinion at the symposium was that a 15 passenger vehicle would be at optimum capacity. In future designs of

such vehicles attention should be paid to ride quality, head room, passenger amenities, and equipment durability.

- v. A demand-responsive system can tap a new market not previously reachable by transit. When a demand-responsive system replaced conventional bus routes in Ann-Arbor, Toronto, Mansfield, and Regina, higher patronage levels were reached. Also, it appears that a premium fare can be charged for this premium service.
- vi. A demand-responsive system will not reverse the need for deficit financing. In all the experiments reviewed, only the system in Batavia, New York came close to breaking even because of low labor rates.
- vii. In marginal-demand areas, a demand-responsive system can be more cost-effective than fixed-route transit. This has been proven because the cost of running a bus continuously in a low-demand area will be greater than sending a demand-responsive bus to pick up the low volume of persons who require transportation.
- viii. For the transit-dependent, a demand-responsive system can greatly increase mobility. Demand-Responsive systems appear to be an effective means of transporting the elderly who cannot physically manage the standing and waiting, boarding, and getting a seat that the use of conventional mass transit requires. In every major urban area some form of a demand-responsive system is provided for the elderly, mainly sponsored by private agencies.
- ix. A demand-responsive system can provide an effective service to the large, poorly served, "serve passenger" market. Transportation studies indicate that the number of automobile trips made to "serve another passenger" represent a market as large as the current mass-transit patronage. The experiments have shown that a demand-responsive system can penetrate this market.
- x. Labor rates are the main cause of the deficit level of the experimental systems. With the small-capacity vehicles used in the system, there is an upper limit on the passengers-per-hour. Therefore the system is very labor intensive -- the higher the driver's salary, the higher the deficit.¹⁴²

Monitoring efforts have also evaluated individual demand-responsive systems. A report monitoring the Haddonfield, New Jersey Dial-A-Ride Demonstration which is the largest Dial-A-Ride service in the United States, showed that ridership had grown steadily throughout the project but did not have problems arising from high peak-hour demands.¹⁴³ 85% of the riders did not have access to automobiles. The study revealed the following factors that partially account for the high percentages of captive riders: First, the main proportion of trips are to a commuter train and many additional commuters to this line live outside the service area of the Dial-A-Ride service. Second, experiences from other Dial-A-Ride services show that auto owners often wait until they are faced with the need to replace their autos before they use Dial-A-Ride service.

In a study by Bauer,¹⁴⁴ results of a home-interview survey were analyzed to determine design preferences for the system. The city in which the survey was conducted was chosen based on its representativeness of about one hundred cities in the nation whose densities might support a Dial-A-Ride service. For the total group surveyed, the most important characteristics were found to be arriving at the destination at the planned time, having a seat, and making a trip without changing vehicles.¹⁴⁵ The most desired fare structure was shown to be a fixed basic fare, and the fare payment method preferred was the traditional one of paying in cash and receiving change. Examination of the survey data also showed that the fare that respondents would be willing to pay is between 40 and 50 cents. The respondents strongly favored discounts to students traveling to and from school, retirees, handicapped, and children accompanied by an adult.

In analyzing preferences for vehicle design, the survey concluded that the vehicle should be air-conditioned, provide more personal space per passenger than is common in today's transit vehicles, provide for personally controlled microclimate, and have convenient parcel storage areas close to each seat.¹⁴⁶ Additionally the vehicle design should provide for easier entry-exit configurations than those found on current buses. The study noted that a review of current commercially produced vans and small buses indicated that a vehicle meeting these needs is not available yet.

This section has discussed the major monitoring results in studies of various demand-responsive systems. A further critical evaluation of these systems was presented in Chapter 4 of this report. In this task, demand-responsive systems are evaluated in terms of operational, financial, administrative, and political feasibility, to determine the basis for their implementation in small urban areas, including Tompkins County, New York.

12.4 Monitoring Study of the CENTRO System in Syracuse, New York

12.4.1 Purpose of Study

The objectives of the monitoring study of the Syracuse Transit System were to evaluate the effectiveness of public transportation system improvements and to establish levels of satisfaction or dissatisfaction with available service through qualitative evaluation of patronage. Fulfilling these objectives will help in identifying the major problems inherent in public transportation operations in general and provide the basis for recommending measures for improvements.

The Central New York Regional Transportation Authority (CENTRO) initiated numerous public transportation improvements since it took over mass transit operations from the former Syracuse Transit Corporation in 1971. One major area of improvement was the purchase of equipment. 97 new air-conditioned buses were purchased, as well as four specially equipped buses designed to serve the elderly and handicapped. To enhance the operational characteristics of the new buses, two-way radio systems were installed along with a new automatic fare collection system. New stainless steel and plexiglass bus shelters and new bus stop signs were installed along major routes. Route and schedule changes included the establishment of shorter headways, especially during peak periods, by utilizing computer programs designed to improve scheduling operations and inventory efficiency.

CENTRO initiated reduced rates for senior citizens and a reduced fare for transit riders using the system during off-peak weekday periods in the downtown area.

Marketing facets of the program included an advertising campaign asking energy-conscious citizens to "Ride it Out" and many promotional programs designed to appeal to shoppers and the general public.

In order to monitor the effects of these improvements, an on-the-bus survey was conducted in which a page long questionnaire was handed out to transit riders. The survey was conducted on November 6, 1974 between 3 P.M. and 7 P.M. and yielded 270 responses, 85% of which were complete. A copy of the survey is shown in the appendix.

The first three questions were of the "check one answer" type, asking about the destination of the bus trip currently being taken and the frequency of bus use. The latter question was included in order to obtain a comparison between frequency of use and level of satisfaction of the user. An additional question asked the respondent if he or she thought the system had either deteriorated, remained the same, or improved over the last three years. If the respondent checked that the system had improved, he was asked to write down the improvements he had noticed. The purpose of this question was

to determine the user's true perceptions of the improvements.

The next set of questions attempted to establish how the improvements affected ridership. This was accomplished by asking the rider if he became a patron of the transit system because of the improvements made, and whether the changes caused the rider to increase his usage of the transit system (or decrease, or not affect his frequency of ridership). Unfortunately, one could only infer that the improvements noted in the previous question accounted for increased frequency of usage. In addition, a question was asked on how long the respondent had used the bus system. This question was included as a check to the accuracy of the responses because the improvements were implemented over a period of two to three years. Also, this question could be used to classify net satisfaction and perceived improvements with length of use of the system.

The interviewee was then presented with a list of transit changes, and was asked to check if the features had improved, worsened, or remained the same. This question was used to discover if the respondent noted changes in aspects of service other than those written down by the respondent in the previous question. In another question the same service characteristics were relisted, to be rated on a scale ranging from "very satisfied" to "very unsatisfied." This was included to determine the rider's level of satisfaction with certain areas of CENTRO's service. By cross-classifying this question with the previous question it can be determined, given that something has improved in the eyes of the user, how satisfied the user is with that improvement.

Finally, questions are asked on the age, sex, and income of the respondent. These questions were included to enable the interpretation of results by certain socio-economic characteristics of the riders.

12.4.2. Analysis of Results

The majority of respondents indicated "home" for their trip destination, as can be expected from a survey conducted from 3 P.M. to 7 P.M. 53% of the riders use the transit system once or twice a day, and the riders are predominantly female (62.5%), young (37% of the respondents were between the ages of 17 and 25), and in a low income bracket (46% of the people earned a gross income below \$9,000 per year).

As seen in Fig. 12.1, 52% of the respondents thought the transit service had improved, even though only 14% of those surveyed became patrons of the transit system because of the improvements made. (Fig. 12.2) This can be attributed to the fact that 64% of the patrons have been riding the bus for over two years, or before many of the improvements were initiated. As shown in Table 12.1, these long-term riders overall noticed

Length of Bus Use	Total No. of Respondents	% Who Thought Service Improved
Less than 1 month	7	57.1
1 month to 6 months	31	48.4
6 months to 1 year	14	42.9
1 year to 2 years	34	41.2
More than 2 years	163	54.6
No response	7	71.4

Table 12.1

Results of Cross-Tabulation of Length of Bus Use With
Those Who Thought Transit Service Had Improved

Figure 12.1

Perceived Changes in Transit Service Quality

Figure 12.2

Patronage Changes Due to Perceived Service Improvements

improvements more than those who had been using the transit system for a shorter period of time. Also those who use the bus very frequently (more than twice a day) and somewhat infrequently (one to four times a month) noticed improvements more than riders who use the bus once or twice a day. However, over half the total ridership sees the service as having improved and over one out of every four riders increased their use of the bus system because of improvements made by CENTRO. Only a negligible portion felt the service had deteriorated. These results are shown in Figures 12.1 and 12.3.

The most perceived improvements noted by the riders were: buses run on schedule, new buses, frequency of service, the courtesy and dress of the bus drivers, and extended routing. These results are shown in Table 12.2. Advertising was the least perceived improvement noted by respondents, accounting for 1/3 of 1% of the answers.

When service characteristics were listed to be rated on a satisfaction scale, those characteristics that ranked highest were: new buses, cleanliness, bus signs, buses on schedule, and courtesy of bus drivers. Every characteristic listed drew "very satisfied" and "somewhat satisfied" accumulated ratings of over 55% as shown in Fig. 12.4. The largest negative responses (Fig. 12.5) were elicited by the following categories: bus runs on schedules, availability of bus shelters, and availability of schedule information, with percentages of 13.5%, 11.4%, and 10.2% respectively. Riders indicated that they were neither satisfied nor unsatisfied with the number of transfers needed; CENTRO's advertising, low-fare downtown buses, and bus fares. The percentages for categories that evoked neither satisfied nor unsatisfied rating is shown in Fig. 12.6. The low perception in such areas as advertising and low-fare buses downtown show that a large fraction of riders are not aware of these changes.

An additional question asked respondents to check service characteristics as either improved, worsened, or not changed. The responses indicated that the service characteristics that were checked as "improved" were also ranked "satisfied", to a large degree. Overall, over 80% of the riders are to some degree satisfied with the transit system as a whole, while only 6.5% are dissatisfied.

12.4.2 Conclusions

The changes in service that were initiated by CENTRO have been shown to be improvements, as demonstrated in the Analysis of Results section. Changes in buses, frequency of service, reliability of buses running on schedule, courtesy and uniforms of drivers, and extended routing were shown to be the most effective types of improvements in terms of riders' perceptions of improvements. Emphasis on extended routing and the

Figure 12.3

Change in Frequency of Use Due to Perceived Improvements

Figure 12.4

Cumulative Percentage of Positive Responses to Transit Improvements

Figure 12.5

Cumulative Percentage of Negative Responses to Transit Improvements

Figure 12.6

Indifferent Responses to Transit Improvements

reliability of the bus schedule should be maintained as it has been shown to be highly valued by ridership.

The relatively high dissatisfaction rating of availability of bus shelters and availability of schedule information shows that more bus shelters should be constructed along major routes. Some of these shelters could be used as passenger information centers. Marketing techniques should be used in designing and distributing bus schedules and also in advertising services that are relatively unknown by the riders, such as the low-cost downtown fares, the park-and-ride service, and the Call A-Bus system. Justification for this advertising can also be made on the basis that advertising itself ranked very low as a perceptible improvement in the transit system.

Fares were shown to be satisfactory to a majority of respondents and coupled with the fact that over one-third of the riders are at low income levels, it is recommended that fares remain unchanged.

Although the survey cannot show that the recommended changes will lead to increased ridership, this implication is justified by the increase in ridership incurred when improvements were made in the areas of extended routes and scheduling, new buses, and other service improvements.

12.5 Recommendations for Small Urban Areas, Including Tompkins County, New York

12.5.1 Fares

Fares should not be raised from their present level. There is a current awareness that raising fares will not raise more revenues for the system but will in fact reduce revenues due to a resultant drop in patronage. The trend of decreasing ridership has existed in many urban areas and a boost in fares will only worsen the downward spiral. There is a strong resistance now to once again hiking fares in recognition and in fear of a further (possibly dramatic) loss of riders. Also, a recent reversal in transit ridership would be endangered. If a city has sufficient funding to support an experimental free fare or lowering of fare, it should do so for an extended period of time (at least a number of months and into overlapping seasons). Promotional fares should be used for promotional purposes only. Their expressed purpose is to provide greater exposure and experience with respect to public transportation services, with the expectation that people will continue to use the services if its quality finds wider acceptance with the public.

"Free" transit constitutes a misnomer, since the absence of fare revenue will have to be compensated for by subsidies out of other revenue generating operations (taxes) by the respective municipality.

Larger cities would probably find it easier to fund a fare reduction and be able to withstand the initial losses in revenue that may be encountered much better than a small urban area would, with the limited budgets associated with such city transit systems. However, if money is available for a fare reduction experiment (state, local, or federal grants, perhaps) then it is suggested that it be tried with the intention of possibly making it a permanent reduction. The trial time must be long enough to draw meaningful conclusions. Seasonal differences should be noted too, in those places where seasonal variations in weather and population are significant.

It is recommended for Ithaca, New York, that the present 25¢ general fare remain unchanged. Even though reduced fares have often increased ridership in the cities studied, revenues frequently have decreased as ridership failed to increase sufficiently to counteract the affects of reduced fares. It can be concluded that at this time the Ithaca System could not tolerate a reduction in fares.

i. Senior Citizens Fares

Many cities have introduced a senior citizens fare rate (usually half the normal rate) in an attempt to draw from a portion of the population that are still willing to travel but i) may not own an automobile, or ii) are on a fixed income and cannot afford constant use of the transit system at its regular fare. Some large cities have their elderly rates only during off-peak hours and weekends, so as not to overburden an already overburdened system with more passengers during the peak hours. The popularity of senior citizen fares in Ithaca (increases in the number of passes sold have been recorded every year since 1971, when senior citizens fares were started) show that these fares should be maintained.

ii. Student Rates

Public school students comprise a substantial portion of the population who make ten school trips a week and do not have access to a car (unless they are driven) and usually have low fixed incomes (allowances). Offering the reduced fare might make the parent who drives the child to school each day think again about making such a trip when a cheaper and more convenient system exists. The fare could, once again, be half the normal fare and could be extended into the summer time for children involved in summer camps or city sponsored programs. One further note: Although Denver now includes college students in their student fare setup, it is possible that in smaller urban areas the college population may be a substantial part of the city population and loss of revenue involved in cutting their fares may run the system out of business and may cause hard feelings among townspeople toward the bus system, something that must be avoided. For these reasons high school students

tickets should still be sold by Community Transit System in Ithaca, New York.

iii. Children's Rates

The concern is not so much with adding a large number of preschoolers to the ridership ranks, but it is with parents who will be accompanying them. With the child allowed to ride free, mothers may be persuaded to use transit for everyday shopping or doctor trips and this may attract the family for social or recreational trips.

iv. Shopper's Pass

The fare rate is designed to attract shoppers and other mid-day travelers to the system who usually make many stops and previously felt that the automobile was the most convenient and cheapest way to make their trips. Setting a fare rate at around three times the normal one-way fare should look attractive to those wanting to make three or more trips and would also be a convenient boarding ticket for those making just three trips. In a small urban area the ticket should be an all-day fare since this would not overburden the system (as might happen in New York City, and, therefore, their rate is only for non-rush hours.) There may be some morning work travelers who may buy the ticket and use it on lunch-hour breaks, or on their way home.

v. Subscription Service

This is the selling of special weekly and monthly tickets, perhaps at a discount price. The purpose is to encourage more workers to use the bus by giving them an easy and convenient way to pay. In Ithaca this idea could be supplemented by having major employers sell the tickets, or by having merchants in the Downtown Businessman's Associations or Booster Club (if one is established) sell the tickets.

vi. Rates for the Physically Handicapped

Attracting ridership from this group may be difficult due to the design of present buses and depending on the type of disability, but if anything may act as a possible attraction, it will be fare reductions in conjunction with suitable service provisions.

These fares are obviously discriminating, but the object is to be seen as a "beneficial discriminator" and not as a haven for "freeloaders" at the expense of the average rider. In establishing rates for the handicapped, city officials must establish the definition of handicapped and set the rate.

12.5.2 Special Transit Services

i. Park-And-Ride Service

This service would connect a large parking area and downtown areas of high employment. Since traffic patterns are not as well known in small urban areas, surveys should be conducted in key employment centers to determine if park-and-ride service is desirable and at what cost people would be willing to use it. Also recent origin-destination surveys should be carefully studied to determine the best locations for parking facilities, and at which employment centers to make stops.

ii. Shopping Shuttles

Bus service would be run directly between established shopping areas (malls, lesser shopping centers, and the downtown shopping center); allowing the shopper to leave the car at the first shopping stop and not having to use it again until going home; or not having to use the car at all if a connection can be made at one of the shopping areas with a regular bus in the system.

iii. Recreational Bus Runs

This should include having a bus run during certain morning and afternoon hours during good-weather seasons to nearby state parks, zoos or lakes, etc., that do not already lie on existing routes and may not even be situated within the city boundaries. This would be especially applicable to the Ithaca area. An important variation of this would be to run special buses to different local sporting events (including skiing areas, stadium events, lake events, etc.) and including the price of admission along with the price of the bus. Such a venture would obviously involve close cooperation between transit management and sporting event sponsors. A third recreational use for the bus would depend upon actual city geography. Special Transit service could be provided to hikers, birdwatchers, and cyclists, transporting them to certain trails. This type of service has many possible routes and schedules and could be varied throughout the months.

iv. Charter Service

When buses are available during non-service hours, chartering may be a profitable undertaking for small urban areas. There is a large enough potential market (civic groups, fraternities, etc.) for this to be a serious possibility as a number of transit system operators have experienced. The money earned from chartering experiences could be used for funding a reduced or free fare, for buying new buses, or for expanding an advertising campaign. In the Ithaca area chartering may be feasible, but under Federal law, Section 164, the

Community Transit System may not engage in charter bus operations outside the area in which regularly scheduled bus service is provided. A further study of the profitability, feasibility, and legality of this type of operation is indicated.

12.5.3 Informational Aids

i. Maps and Schedules

When designing maps and schedules, the most important item is simplicity. Complicated schedules, with footnotes and up and down reading (Greyhound schedules are a good example of this) must be avoided at all costs. The reasons are clear; once a degree of difficulty is introduced into the basic maps and schedules of the system, one runs the risk of frustrating potential users. A frustrated reader might never become a rider at all.

In designing maps and schedules, colored coding should be used so that routes are more clearly identifiable as separate runs, especially when more than two routes overlap the same streets. Route descriptions and numbers on maps should be coordinated with those found on buses and bus stops. Arrival time should be given for at least those points mentioned on buses and signs. Service informations should also be included on maps and schedules, including fare descriptions and the system telephone number.

Two types of maps and schedules should be printed: a pocket size folding handout with combined route and schedule information; and larger cardboard display maps and schedules, for the purpose of being posted on buses, in bus shelters, stores, and in public places close to bus routes.

ii. Bus Stop Signs

The bus stop signs within an urban area should be distinctive, easily discernible from all other city signs (such as "no parking" signs). Bus stop signs should bear the system colors in conjunction with a logo representing the system. The actual design of the sign should include:

- a. Instead of the words "bus stop", a clear and simple picture of an actual bus should be painted attractively in the system colors on the sign. It does not necessarily have to be an actual design of the system's bus but must be easily recognizable as a bus and should be pleasing to the eye.
- b. Every sign should include on it at least the number of the bus (corresponding to the number found on buses, maps and schedules) that will be

stopping at that particular stop. (This can be done by using attractive and long-lasting decals, or replaceable slots, etc. The point is that bus routes may eventually change and, therefore, it would not be convenient to replace the entire sign each time.) Sign posts at certain busier stops should include both the route number and a basic description of the route and schedule. This description should show key endpoints, midpoints, and times of arrival. It would be preferable for every sign to have such comprehensive information, but the costs involved suggest that small urban areas only provide such information in a number of busy stops.

- c. Every bus stop sign should include on it an information telephone number clearly printed, and referred to as "schedule information" or "transit information number", or some other title which will make the rider aware that such a number exists, and, in fact, that riders are encouraged to use it.
- d. Each sign should be a double sign, visible to approaching riders from either side of the sign.
- e. The bus information (route, schedule, etc.) should not be posted so high off the ground that elderly persons or children cannot read it, nor should it be too low from the sidewalk (and also too small) as to be easily blocked from view by a waiting passenger. The larger the sign, thus the larger the print and the more efficient each bus stop is to the majority of actual and potential riders of the system.

iii. Bus Shelters

The installation of inexpensive bus shelters is recommended in exposed areas of relatively high ridership. Bus shelters are a service to passengers during times of poor weather (e.g. rain, snow, wind) and with proper lighting (either provided in the shelter or by nearby street lighting) becomes a safe waiting place during the night hours. More and more cities are installing inexpensive, modular type shelters. These shelters act as a constant reminder to the passenger, and to non-users also, that the bus system is "people oriented", always providing for the passengers' needs whenever possible.

Coordinated with the bus shelters should be:

- a. current map and schedule information for the entire system;
- b. service information, including fare information, system telephone number, special bus runs, etc.;
- c. possible inclusion of the usual public services found in an urban area, such as:
 - (1) mailbox;
 - (2) public phone;
 - (3) newstand.

Once again, this would connect the bus system in general to public services and public conveniences. Further specifications for bus shelters are discussed in Chapter 2 of this report.

iv. Destination Markers

The route description on the front of the bus should include basic information, clearly and simply printed so that it can be read easily from a good distance. The route information should include end-point designations, with important key stops in between. In addition, a route designation number that corresponds to the number found on maps, schedules, and bus stop signs should be displayed.

On the rear of the bus, or on the sidewalk side of the bus should be placed a clearly identifiable marker that shows the route number of the bus; the same number found on maps, signs, schedules, and the front of the bus. Passengers approaching from the rear or side will be able to identify the bus (providing they know the number of their bus).

v. Special Information Phone

In a small urban area a thorough display of the system information number on buses, bus signs, and printed materials would provide the public with an adequate information source to answer any type of question about the bus system (it would be especially helpful, in this age of numbers, if the phone number could be a very simple one to remember. (For example, "Need information? Dial 'Transit'--872-6748).

12.5.4 Route and Schedule Changes

Improved routes and schedules have been shown to be one of the most important types of improvement needed to

increase ridership and overall satisfaction of a transit system. Travel demands are estimated by careful analysis of origin-destination surveys, evaluation of modal-split techniques, and investigation of routes and schedules of existing transit services. In Tompkins County, the need for expanded routes and schedules has been demonstrated by the research completed in the first year's tasks. As alternate transportation systems are evaluated, care must be taken to insure that these systems can meet the needs of the community by adequate routes and schedules. In Chapter 4 general recommendations are proposed that outline routing and scheduling criteria that each alternative system should adhere to.

12.5.5 Equipment Change

When buying new buses, a new step-high system for easy entering and exiting from a bus should be considered, making it much more convenient for older riders, handicapped riders, and shoppers with their arms full to board and leave a bus. This modification would remove a constant stigma from the bus and give the impression that the buses are more "people oriented".

Seating design should stress comfortable seating and adequate spacing between seats. If this means eliminating some seats from the bus in lieu of wider seats and increased leg and storage room, then the priority should still remain with better seating arrangements for those who will get the seats, while providing adequate numbers of poles, straps or seat handles for those passengers who will be standing.

Adequate lighting should be provided for early morning and evening service, both inside the buses and on the outside route identification markers.

Air conditioning and heating are features that any new bus should have. This is no longer considered a luxury in mass transit, but an important necessity in order to lure automobile users from cars having the conveniences of climate control.

The older buses that will remain in the system should be repainted in the new system colors, improved as to existing inside and outside lighting, and renovated as to the inside decor through constant repair and possibly a new interior decoration scheme, including seating changes if this is in order.

12.5.6 Marketing

Recommendations for advertising and promotional strategies suitable in small urban areas including Tompkins

County, New York, is given in Chapter 11 of this report. The recommendations are based on extensive study of marketing techniques used in transit systems across the United States, as well as employing general theories of marketing. Attitudinal surveys of transit users and non-users conducted in the Ithaca area, and the experiences of transit companies provide the justification for implementing the recommended strategies.

12.5.7 Demand-Responsive Systems

The political and economic feasibility of a demand-responsive system should be studied in depth before recommendations can be made on the suitability of such a system in small urban areas. Research providing the basis of such a decision is described in Chapter 9. Integrated demand-responsive systems are evaluated. Elements of these designs comprise variations in equipment, operating times, and joint systems operation. Also, a number of alternative strategies relating to service quality improvements, better scheduling and routing patterns, etc., will be studied and evaluated.

12.6 Monitoring a Specific Demand Corridor-North East Transit System, Ithaca, New York

12.6.1 Purpose of Study

Based upon research completed in the first-year tasks of the project, the North-East Transit System (NET System) began operation in September 1974, providing service to residents in the Southern Lansing and Cayuga Heights area by connecting this area with the Cornell University campus in Ithaca, New York. Three buses, owned by a private operator, provide three to four runs during the morning and afternoon peak periods and one run during midday. Necessary subsidies are provided by the two major owners of the South Lansing apartment complexes and by Cornell University. The cash fare is 30¢, while tokens are sold at 25¢ per ride.

One of the basic problems common to all mass transportation systems is the determination of those factors which will have the greatest influence in attracting additional ridership. In this report many service changes, implemented during the first year of operation of the NET system, have been monitored to determine their affect on ridership such as routing and scheduling, frequency of service, marketing efforts, and capital stock (new buses, bus shelters, signs). This section of the report monitors changes in a specific local demand corridor served by the North-East Transit System of Ithaca, New York.

The NET system began operation in September of 1974 as a result of a survey of area residents conducted in February of 1974. This survey was used to estimate the demand for public transit. Due to the low levels of ridership experienced on some routes in the early stages of the system, a second survey was carried out in November 1974, which attempted to determine what the users of the system believed were the major deficiencies. As a result of this survey a number of changes were made. First, a more extensive information availability campaign was begun. Posters describing the system and its attributes were put up throughout Cornell University and in the apartment complexes. Pamphlets were distributed throughout the area, clearly illustrating the bus routes and schedules.

The second change was altering the routing and scheduling of the system, thus decreasing the travel time for bus passengers.

The presence of route identification on all buses was the third change made. A large letter indicating the transit route was placed in the window of the bus.

Finally, the fare structure was altered somewhat. While the price of one ride remained at 30¢, one now had the option of purchasing a ticket book containing twenty tickets for \$5.00 or 25¢ per ticket.

The purpose of the monitoring efforts of this study is to measure the impact of these changes as perceived by users and non-users of the system. This is done by determining whether or not the changes were perceived as improvements, and if so, if they had any effect on ridership. An attempt was also made to solicit comments and suggestions for further changes which would improve the quality of service of the NET system. This involved the design and distribution of a questionnaire that attempted to reveal changes in ridership which may have occurred as a result of changes in the system. A copy of the questionnaire is included in the appendix.

The first question to be answered in the monitoring survey was "Who uses the North-East Transit System?" The answer to this question comprised the gathering of relevant demographic and socio-economic data, such as the age and sex of respondents, numbers of licensed drivers and cars in the household, and number of persons in the household. Travel pattern information was obtained by determining the respondents' place of employment, primary means of transportation to employment or school, number of trips per week, the means of transportation used, and primary means of transportation for any other regular weekly trips to Cornell.

The next goal was to discover why the ridership level was not as high as the original survey had predicted. To determine this, the respondent was asked if he or she anticipated using the transit system when it was first proposed. Then the respondent was asked if he or she uses the present transit system. The purpose of these questions was to reveal the perceptions of non-users of the transit system.

Respondents were also asked if they had observed any changes in the bus service since it had started. If the respondent noted that the service had improved, he or she was asked to identify the aspects that improved. If the respondent thought the service had deteriorated, he or she was also asked to write down the specific aspects that had changed. In addition, if the respondent answered that he or she noticed changes, the person was asked how the changes affected his or her use of the transit system. These questions determined if the changes made were improvements. The respondent then was presented with a list of specific service characteristics, and asked to check if each had changed for the better, changed for the worse, or remained the same. This was necessary to obtain transit-user and non-user perceptions of service changes, and later could be cross-tabulated in order to determine which changes were noticed marginally, and how the changes affected ridership.

Finally, respondents were asked to numerically rank their satisfaction with different aspects of service and overall satisfaction with the system. Different service characteristics were listed to be rated on a scale from one to seven. One meant "very unsatisfied"; seven meant "very satisfied". This semantic differential scale provided a means of comparing satisfaction or dissatisfaction with the service before and after changes had been made.

12.6.2 Analysis of Results

The socio-economic characteristics gathered in the survey were cross-tabulated with users and non-users of the system, in order to define the characteristics of these groups. As shown in Table 12.3, the majority of users are Cornell students, comprising 56.7% of the users of the transit system. Cornell aides and clerical workers comprise another 21% of the users and almost 7% of the users are non-Cornell employed. The remainder of the ridership is divided between Cornell faculty, Cornell administration, and the unemployed. The majority of users are male (64%), and 61.5% of the users are between the ages of 23 and 30 years old. All users of the system have at least one driver's license and one car in their household, but the majority of users have two drivers' licenses and two cars in their household. Monitoring the characteristics

of the present users may be useful in planning future changes in the NET system.

	Number	Percent
Cornell Student	59	56.7
Cornell Faculty	6	5.8
Cornell Aide	14	13.5
Cornell Clerical	8	7.7
Cornell Administration	4	3.8
Cornell Maintenance	1	1.0
Non-Cornell	7	6.7
Cornell Unclassified	3	2.9
Unemployed	0	0.0
No Response	2	1.9
TOTAL	104	100.0

Table 12.3
Summary of User Occupations

In identifying persons who first anticipated using the transit system, 92 people indicated that they had first anticipated using the bus and are not now using it. This figure represents about half of the non-users that responded to the survey. The major reason for not using the bus is the scheduling and frequency, followed by a closely related category termed "inconvenience". These factors accounted for 66.2% of the reasons given for non-usage of the transit system. A tabulation of all the answers given by non-users is shown in Table 12.4.

Two questions were used to determine if the changes made in the transit system were improvements. Question 17 asked respondents for any changes that were observed in the system since it was started in September, 1974. The major area where service had improved were routing, travel time, and scheduling. In Question 19, when respondents were presented with a list of service characteristics to rate as improved, worsened or not changed; routing, travel time and scheduling also drew the most responses as having improved. Approximately three times the number of changes were recorded when a list of service characteristics was presented to respondents.

In this question all the service characteristics that had changed except for fare structure, were more readily noted as having improved. It is believed that the increase in these three categories is due to the respondents' remembering the changes when it was suggested that such a change was made. The responses for both of these questions are shown in Tables 12.5 and 12.6.

	<u>First Reason Given</u>	<u>Second Reason Given</u>	<u>Percent</u>
Scheduling and frequency	40	3	46.7
Inconvenience	14	4	19.5
Travel time too long	3	3	6.5
Fare too high	4	5	9.7
Lack of information	6	1	7.6
Routing	5	4	9.7
Doesn't go to Cornell	7	1	8.6
Rides bicycle	0	0	0
Already has a car	6	2	8.6
Needs a car	2	0	2.1
Unreliable service	0	0	0

Table 12.4

Non-Users who had Anticipated Using the Bus Service
When it was First Proposed

In order to discover how specific changes affected ridership, the improvements given for questions 17 and 19 were cross-tabulated with those respondents who indicated they use the transit system more. The results of these cross-tabulations are given in Tables 12.7 and 12.8. In both tables, routing, travel times, and scheduling appear to be the most important factors leading to an increase in ridership.

In analyzing the overall satisfaction of respondents in specific areas, and with the transit service in general, a method was devised to calculate the amount of deviation of each characteristic from the average response for that characteristic. This method was used to find the distribution of responses for each characteristic, because taking the average response for each characteristic would obscure the actual distribution of responses.

<u>Service Characteristics</u>	<u>No Response</u>	<u>Service Improved</u>	<u>Service the Same</u>	<u>Service Worsened</u>
Routing	216	23	89	0
Walking distance to and from bus stops	239	0	89	0
Travel time on bus	222	17	89	0
Scheduling	206	31	89	2
Availability of schedule information	235	4	89	0
Schedule clarity	238	1	89	0
Cleanliness of buses	239	0	89	0
Fare structure	239	0	89	0
Route identification on buses	236	3	89	0

Table 12.5
Perceived Changes in Transit Service
(No List Presented to Respondents)

<u>Service Characteristics</u>	<u>No Response</u>	<u>Changed Better</u>	<u>No Change</u>	<u>Changed Worse</u>
Routing	231	59	43	0
Walking distance to and from bus stops	234	8	89	2
Travel time on bus	230	50	51	2
Scheduling	232	38	52	11
Availability of schedule information	229	33	66	5
Scheduling clarity	232	34	63	4
Cleanliness of buses	236	4	93	0
Fare Structure	235	5	93	0
Route identification on buses	233	39	57	4

Table 12.6
Perceived Changes in Transit Service
(List Presented to Respondents)

Apartment Complex	Routing		Walking Distance		Travel Time		Sched- uling		Availability of Info		Schedule Clarity		Clean Buses		Fare Structure		Route ID	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lansing West	1	20	0	0	0	0	4	80	2	40	1	20	0	0	0	0	0	0
Lansing East	0	0	0	0	1	25	3	75	0	0	0	0	0	0	0	0	0	0
Lansing North	3	25	0	0	1	8	2	17	0	0	0	0	0	0	0	0	0	0
Winston Court	5	63	0	0	1	13	5	63	0	0	0	0	0	0	0	0	1	13
Village Apartments	4	50	0	0	5	63	4	50	0	0	0	0	0	0	0	0	0	0
Gaslight Village	1	100	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0
University Park	0	0	0	0	0	0	2	100	0	0	0	0	0	0	0	0	1	50
Totals	14	35	0	0	8	20	21	53	2	5	1	3	0	0	0	0	2	5

Table 12.7
Improvements Indicated (No List) by Those who Use the Bus More Often

Apartment Complex	Routing		Walking Distance		Travel Time		Sched- uling		Availability of Info		Schedule Clarity		Clean Buses		Fare Structure		Route ID	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lansing West	3	60	2	40	2	40	4	80	4	80	3	60	0	0	0	0	2	40
Lansing East	3	75	1	25	2	50	2	50	1	25	2	50	0	0	0	0	1	25
Lansing North	4	33	0	0	4	33	3	25	3	25	3	25	2	17	0	0	3	25
Winston Court	6	75	1	13	7	88	5	63	3	38	2	25	0	0	0	0	6	75
Village Apartments	8	100	0	0	8	100	5	63	4	50	3	38	0	0	0	0	3	37
Gaslight Village	1	100	0	0	1	100	1	100	1	100	1	100	0	0	0	0	1	100
University Park	1	50	0	0	0	0	2	100	0	0	1	50	0	0	0	0	1	50
Totals	26	65	4	10	24	60	22	55	16	40	15	38	2	5	0	0	17	42

Table 12.8
Improvements Indicated (With List) by Those who Use the Bus More Often

The first step was to determine the average value of the responses to Question 21. For the questionnaire shown below the average value is $(4+4+4+1+4+2+7+2+7+3+4)/11 = 3.8$. Next, the two integers which bounded the average value of the responses were "blocked out". On the sample questionnaire shown in Table 12.10, the blocked out numbers are 3 and 4. The deviations of the responses in each of the categories from the blocked out numbers were then determined. In the sample questionnaire, the deviations are shown in Table 12.9. After the deviations were determined for each questionnaire in the data set, they were tabulated.

<u>Category</u>	<u>Deviations</u>
Hours of Service	none
Frequency of Service	none
Reliability of Schedule	none
Comfort of Vehicle	-2
Travel Time on Bus	none
Routing and Scheduling	-1
Availability of Information	3
Comfort While Waiting for Bus	-1
Courtesy of Driver	3
Fare	none

Table 12.9
Response Deviations

Three distinct categories seem to exist in the results (see Table 12.11). There were a large number of negative deviations (unsatisfied responses) with few positive deviations in the categories of hours of service, frequency of service, and comfort while waiting for the bus. There were a large number of positive deviations with few negative deviations in the categories of reliability of schedule, travel time on bus, and courtesy of driver. There were a sizable number of both positive and negative deviations for the categories of comfort of vehicle, routing and scheduling, availability of information, and fare.

	<u>Very Unsatis.</u>		<u>Neither Satis. Nor Unsatis.</u>			<u>Very Satis.</u>	
Hours of Service	1	2	3	4	5	6	7
Frequency of Service	1	2	3	4	5	6	7
Reliability of Schedule	1	2	3	4	5	6	7
Comfort of Vehicle	①	2	3	4	5	6	7
Travel Time on Bus	1	2	3	4	5	6	7
Routing and Scheduling	1	②	3	4	5	6	7
Availability of Info	1	2	3	4	5	6	⑦
Comfort While Waiting for Bus	1	②	3	4	5	6	7
Courtesy of Driver	1	2	3	4	5	6	⑦
Fare	1	2	③	4	5	6	7
Overall Satisfaction	1	2	3	④	5	6	7

Table 12.10

Sample Response to Illustrate Calculation of Response Deviations

	<u>Deviation</u>					
	-3	-2	-1	+1	+2	+3
Hours of Service	14	25	31	9	1	-
Frequency	6	18	35	15	1	-
Comfort While Waiting for Bus	14	33	37	7	1	-
Reliability	-	4	7	50	16	2
Travel Time	-	-	15	39	13	4
Driver Courtesy	-	-	1	53	32	9
Comfort of Vehicle	6	13	24	26	6	1
Routing and Scheduling	4	5	22	18	8	3
Availability of Information	3	9	16	24	11	1
Fare	3	12	19	27	11	2

Table 12.11

Summary of Response Deviations

12.6.3 Conclusions

Based on the results of the questions about satisfaction with aspects of the system and reasons for non-use of the system, the major part of any improvement efforts should concentrate on hours and frequency of transit service and obtaining bus shelters. Improvements might also be desired in the areas of vehicle comfort, routing and scheduling, information availability and fares. No effort seems to be necessary in the areas of reliability, travel time, and driver courtesy.

The monitoring efforts of the survey showed that changes in routing, travel time, and scheduling were the most important factors leading to the increase in ridership which was experienced soon after the formation of the NET system.

Although the survey cannot show that a change in the hours of service and frequency will lead to an increase in ridership, this implication can be made based on the strong dissatisfaction of the users in those areas and the fact that the changes made in routing, travel time, and scheduling were at least partially responsible for the increase that was observed after these changes were made.

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APPENDIX

	<u>Improved</u>	<u>No Change</u>	<u>Worsened</u>
a. cleanliness of the buses	☐	☐	☐
b. new buses	☐	☐	☐
c. buses run on schedule	☐	☐	☐
d. bus fare	☐	☐	☐
e. courtesy of the bus drivers	☐	☐	☐
f. low-fare buses in downtown	☐	☐	☐
g. CENTRO's advertising	☐	☐	☐
h. usefulness of bus stop signs	☐	☐	☐

	<u>Improved</u>	<u>No Change</u>	<u>Worsened</u>
i. availability of schedule info.	☐	☐	☐
j. walking distances to and from bus stops	☐	☐	☐
k. number of transfers needed	☐	☐	☐
l. availability of bus shelters	☐	☐	☐
m. other (please specify) _____			

8) How satisfactory do you consider the service of the CENTRO bus system?

a. Very satisfactory	d. Somewhat unsatisfactory
b. Somewhat satisfactory	e. Very unsatisfactory
c. Neither satisfactory nor unsatisfactory	

9) Please indicate how satisfied you are with the following aspects of the Syracuse bus system.

	very satisfied	somewhat satisfied	neither satisfied nor unsatisfied	somewhat unsatisfied	very unsatisfied
a. cleanliness of the buses	☐	☐	☐	☐	☐
b. new buses	☐	☐	☐	☐	☐
c. buses run on schedule	☐	☐	☐	☐	☐
d. bus fare	☐	☐	☐	☐	☐
e. courtesy of the bus drivers	☐	☐	☐	☐	☐
f. low-fare buses downtown	☐	☐	☐	☐	☐
g. CENTRO's advertising	☐	☐	☐	☐	☐
h. usefulness of bus stop signs	☐	☐	☐	☐	☐
i. availability of schedule info.	☐	☐	☐	☐	☐
j. walking distances to and from bus stops	☐	☐	☐	☐	☐
k. number of transfers needed	☐	☐	☐	☐	☐
l. availability of bus shelters	☐	☐	☐	☐	☐
m. other (please specify) _____					

10) You are... a. Male b. Female

11) Your age is... a. Under 17 e. 46-55
 b. 17-25 f. 56-65
 c. 26-36 g. over 65
 d. 36-45

12) What is the gross (i.e. before taxes) income of your family?

a. under \$3,000/year	e. \$12,001 - \$15,000/year
b. \$3,001 - \$6,000/year	f. \$15,001 - \$20,000/year
c. \$6,001 - \$9,000/year	g. \$20,001 - \$25,000/year
d. \$9,001 - \$12,000/year	h. over \$25,000/year

NET - SURVEY (SPRING 1975)

1. Name of your apartment complex _____
Building _____ ☐
2. How many people are there in your household (including yourself)? _____ ☐
3. How many adults (people over 16 years old) are there in your household? _____
4. How many licensed drivers are there in your household? _____
5. How many motor vehicles are available to your household? _____
6. Please indicate your age: ☐ 16-22 ☐ 23-30 ☐ 31-45 ☐
☐ 46 and above.
7. Please indicate your sex: ☐ Male ☐ Female ☐
8. Are you a student at Cornell? ☐ Yes ☐ No ☐
If yes, in which school are you enrolled? _____ ☐
9. Are you an employee of Cornell? ☐ Yes ☐ No ☐
If yes, what is your job title? _____ ☐
In which building do you work? _____ ☐
10. If you work or go to school somewhere other than Cornell, please indicate the name and address of your school or place of work. _____ ☐
(If you are not employed outside your home and you are not a student, then please go to question 13.)
11. What is your primary means of transportation to and from work or school? (Please circle one.)

1. Drive myself	6. Passenger in vehicle of friend or relative ☐
2. Drive & take campus bus	7. Walk
3. Bus	8. Bicycle
4. Hitch-hike	9. Other (specify) _____
5. Car pool	
12. How many times per week do you go to work or school using the above means of transportation? _____ ☐
13. Do you make any regular weekly trips to Cornell other than to go to work or school? ☐ Yes ☐ No ☐
 - a. If yes, how many? _____ ☐
 - b. What is the primary means of transportation for this trip(s)? (Please circle one.) ☐

1. Drive myself	6. Passenger in vehicle of friend or relative
2. Drive & take campus bus	7. Walk
3. Bus	8. Bicycle
4. Hitch-hike	9. Other (specify) _____
5. Car pool	
14. Are you aware of the buses (called North-East Transit System-NET) operated by Swarthout and Ferris that run between Cornell and your apartment complex? ☐ Yes ☐ No ☐
(If no, you have completed the questionnaire. Please return it by one of the means indicated in the introductory letter.)
15. When you first heard of the proposal for a bus system between South Lansing and Cornell, did you anticipate using it? ☐ Yes ☐ No ☐
16. Do you use the present bus system? ☐ Yes ☐ No ☐
If no, we would like to know your reasons for not using it. _____

17. Since the bus service began in September 1974, have you observed any changes in the service?

☐ Yes, the service has improved in the following aspects:

☐ No, the service has remained the same.

☐ Yes, the service has deteriorated in the following aspects:

18. If you observed any changes in the bus system, did it affect your use of the system? (Please check one.)

☐ Yes, I started using the bus.

☐ Yes, I started riding the bus more often

☐ No, I have not changed my use of the bus

☐ Yes, I stopped riding as often

☐ Yes, I stopped riding altogether

19. Please indicate any changes you think have occurred in the NET bus system with respect to the following service aspects:

	Changed For Better	No Change	Changed For Worse	
1. Routing	☐	☐	☐	☐
2. Walking distance to and from bus stops	☐	☐	☐	☐
3. Travel time on bus	☐	☐	☐	☐
4. Scheduling	☐	☐	☐	☐
5. Availability of schedule info.	☐	☐	☐	☐
6. Schedule clarity	☐	☐	☐	☐
7. Cleanliness of buses	☐	☐	☐	☐
8. Fare structure	☐	☐	☐	☐
9. Route identification on buses	☐	☐	☐	☐

20. How long have you been a user of the NET bus system? /
mo. wk.

21. The following table represents a satisfaction scale ranging from 1 (very unsatisfied) to 7 (very satisfied) for several bus service characteristics. Please circle the number representing your level of satisfaction or dissatisfaction for each of these characteristics

	very unsatis.		neither satis. nor unsatis.		very satis.	
hours of service	1	2	3	4	5	6 7
frequency of service	1	2	3	4	5	6 7
reliability of schedule	1	2	3	4	5	6 7
comfort of vehicle	1	2	3	4	5	6 7
travel time on bus	1	2	3	4	5	6 7
routing and scheduling	1	2	3	4	5	6 7
availability of info.	1	2	3	4	5	6 7
comfort while waiting for bus	1	2	3	4	5	6 7
courtesy of driver	1	2	3	4	5	6 7
fare	1	2	3	4	5	6 7
overall satisfaction	1	2	3	4	5	6 7

22. Any additional comments about the NET system would be appreciated. (Use separate sheet if desired.)

REQUEST FOR FEEDBACK TO The DOT Program Of University Research

DOT-TST-77-29

YES	NO	
☐	☐	Did you find the report useful for your particular needs?
If so, how?
☐	☐	Did you find the research to be of high quality?
☐	☐	Were the results of the research communicated effectively
by this report?
☐	☐	Do you think this report will be valuable to workers in the
field of transportation represented by the subject area of
the research?
☐	☐	Are there one or more areas of the report which need
strengthening? Which areas?
☐	☐	Would you be interested in receiving further reports in this
area of research? If so, fill out form on other side.

Please furnish in the space below any comments you may have concerning the report. We are particularly interested in further elaboration of the above questions.

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