3. KEY RESEARCH FINDINGS

Public transportation plays a significant role in providing mobility to the transportation disadvantaged. While most Americans drive an automobile, people who are young, old, poor or disabled often rely on public transportation as their lifeline. The title of this research, "Using Public Transportation to Reduce the Economic, Social and Human Costs of Personal Immobility," presupposes that public transportation will exist. However, in these days of declining funds, it is important to recognize the fundamental premise of availability which underpins this research; therefore, the first and most obvious finding of this research is that public transportation must be **available** if it is to be used to address immobility. This, and the other seven findings of the research, are summarized below, followed by a discussion of each of the points based upon the literature review, stakeholder interviews, case studies, and economic analyses of the 11 practices investigated.

SUMMARY OF KEY FINDINGS

1. Retaining basic public transportation services is critical to improving the mobility of the transportation disadvantaged.
2. Public transportation practices directed at reducing personal immobility are economically beneficial.
3. Public transportation agencies that are able to develop new alliances with nontraditional partners will have the best results with transportation practices addressing welfare-to-work, employment and health care.
4. Opportunities exist for blending a wide array of different human and monetary resources to address immobility.
5. Public transportation practices bundled with other support services most effectively address immobility issues related to welfare-to-work, employment, and health care.
6. Public transportation agencies can provide leadership in economic development, thereby reducing the costs of immobility.
7. Today's mobility issues, particularly in access to jobs, demand regional approaches.
8. Simple ideas and programs can yield significant mobility improvements.

1. Retaining basic public transportation services is critical to improving the mobility of the transportation disadvantaged.

One danger in addressing specific mobility problems--such as services to meet welfare reform or provide access to health care--is the temptation to focus on the immediate transportation need without considering the health of the basic

system. For example, in the recent transformation of welfare to workfare, there was an assumption on the part of many state and local governments that public transportation was available to meet the new demands. The absence of a transportation discussion in the federal welfare bill and the lack of specific dollars for transportation support services is evidence of this assumption. However, government officials learned what transit operators had been trying to tell them for years--that funding reductions had taken their toll on what public transit could deliver in many systems around the country.

The AC Transit case study on service reductions is strong confirmation that these cutbacks hurt the very population that the government is now trying to help into the job market. AC Transit was forced by budget shortfalls from reduced state and federal funds to cut 1,000 weekday platform equivalent hours, thereby saving $4.8 million. However, a survey conducted during the AC Transit study revealed that 7.4% of the riders lost $2.2 million in job income as a result of the cuts, and 4.2% were continuing to lose income one year later because they had not found other employment, amounting to an additional $8.5 million a year. The total annual costs to the community from the service reductions were $48.1 million.

Over a year after the reductions were implemented, the District responded to residents in an isolated pocket of its service area by adding back hourly service from 8 p.m. to 1 a.m. Of the approximately 3,000 people living in the area, more than half were on public assistance and did not have access to a car. To help residents travel to jobs with evening or night hours, a set-aside in the budget for experimental programs was used to fund approximately seven months of service. The District is pursuing new welfare-to-work funds through the county Department of Social Services and private funding from employers served by the route in order to continue the route in the new fiscal year. External funding will also be needed to respond to similar pleas from other constituencies, according to the Manager of Service Development.

The results of the AC Transit case study demonstrate the importance of fixed-route service to the community and the impact when it is reduced. **Urban bus service is enormously productive, and its curtailment even in low-patronage, off-peak hours can create added travel costs and income losses that exceed by several times the dollar savings to transit agencies from the service reductions.**

The case studies in this research are replete with examples of customized services that are **dependent** on the existence of a strong core system--one that operates 20-24 hours a day, seven days a week. The system must provide reliable service over a span of hours and days that meet the needs of the local economy. For example:

- SEPTA's Horsham Breeze route to a suburban business park is an extension of reverse commute bus routes and rail service from the central city. The shuttle runs six days a week from 6:12 a.m. to 11 p.m. and meets two daily, 21-hour per day mainline routes.

- MDTA's Medicaid Metropass Program could not exist if basic service levels were not available to meet the needs of Medicaid patients.

- MTA's Immediate Needs Transportation Program is able to grow and serve more people because of its increasing use of bus tokens. If basic bus service were not available at the days and hours needed, the program would not be attractive to the 600 participating social service agencies.

- About 48% of MTA's Blue Line TeleVillage users arrive by transit. The availability of transit services helps create this "virtual" mobility.

- The private entrepreneur who operates the Numero Uno Supermarket Shuttle relies on transit access from MTA lines to bring his customers to the store.

- The Marion County Department of Social Services worked with PDRTA to expand an existing route into a 24-hour service in order to link welfare recipients with entry-level jobs.

- The heart of the concept for the Fruitvale BART Transit Village is its location at a hub well-served by public transportation.

- The City of Fremont's Travel Training Program increases mobility for the elderly and persons with disabilities by training them to ride a fixed-route system that already exists.

This finding, **retaining basic public transportation services is critical to improving the mobility of the transportation disadvantaged** is listed first because the research team believes it the most important. Investment in a basic level of transit services will have the broadest impact on reducing personal immobility for the transportation dependent.

2. Public transportation practices directed at reducing personal immobility are economically beneficial.

Society benefits when individuals can access more parts of society. The programs in these case studies save society money by helping to:

- avoid medical institutionalization of the indigent;
- prevent crime by providing job training for employment and food for the hungry;
- reduce the demand on more expensive and oversubscribed paratransit services;
- provide an option to a costly ambulance ride for medical care;
- increase the purchasing power enjoyed by transit riders with access to jobs or to broader market choices; and
- relieve other agencies funded by tax dollars of transportation responsibilities and, thereby, increase their productivity.

Although these benefits are not easily quantified, they should not be overlooked. If transit agencies could incorporate them into new measures for evaluation, transit's true value to society would be startlingly apparent.

In order to quantify the benefits of these programs in more traditional terms, an economic analysis was performed for seven of the eleven transportation practices studied. Four of these involved surveys developed by the research team, and the other three were based on data gathered from the transportation organization. The results show a high ratio of benefits to costs, supporting the finding that public transportation practices directed at reducing personal immobility are economically beneficial.

Below is a table summarizing the results of the economic analyses.

Case Study	Annual Benefits	Net Annual Costs	Benefit/ Cost Ratio (a/b)	Net Annual Benefits (a-b)
	a	b	c	d
Completed Analyses				
PDRTA, Myrtle Beach	$2,176,570	$79,430	27.4	$2,097,140
SEPTA Horsham Breeze	1,563,361	213,192	7.3	1,350,169
MDTA Metropass	7,619,000	1,580,000	4.8	6,039,000
MTA Immediate Needs	13,951,000	5,400,000	2.6	8,551,000
OATS, Missouri	13,939,330	6,009,825	2.3	7,929,505
Fremont travel training	52,150	26,956	1.9	25,194
AC Transit service cuts	4,759,000	48,100,000	0.1	-43,341,000

As can be seen by the benefit/cost ratio, SEPTA's Horsham Breeze Shuttle has a very high rate of return. For every $1 invested in this reverse commute service, there is a benefit of $7.30. Even more astonishing is PDRTA's benefit/cost ratio of 27.4, made possible because PDRTA has so successfully minimized its out-of-pocket costs through fares and employer contributions. Transit's role in helping control health care costs is illustrated by MDTA's Metropass program, which saves over $6 million a year in federal and state Medicaid dollars. In the case of Immediate Needs, for the annual $5.4 million invested by MTA, there is a positive economic benefit in the community of almost $14 million and a benefit/cost ratio of 2.6. Not surprisingly, service cuts have a negative effect on the community. When AC Transit cut 1,000 weekday platform equivalent hours, the annual economic losses to AC Transit riders were more than $48 million, compared with only $4.8 million in annual savings to AC Transit.

Chapter 4 provides guidelines for conducting the type of economic analysis on which these findings are based.

3. **Public transportation agencies that are able to develop new alliances with nontraditional partners will have the best results with transportation practices addressing welfare-to-work, employment and health care.**

The transit industry has been in partnership with state and federal governments over the years to fund transportation services. However, almost all the operations spotlighted in the case studies were new services developed with nontraditional partners, such as:

- social service agencies
- community-based organizations
- volunteer groups
- businesses, and
- local governments.

Illustrations of these nontraditional partners can be highlighted from the case studies. For example, PDRTA works hand-in-glove with the **Department of Social Services (DSS)** to provide service to entry-level jobs for people transitioning off welfare, and MDTA introduced its Metropass program with the full involvement of the regional **Medicare** administrator. One element of both these successful working relationships is a vested interest shared by both parties. For example, the Medicaid Program Administrator in Miami had an interest in reducing the transportation costs for her program; MDTA had an interest in avoiding additional ADA paratransit trips that would have been required if Medicaid had stopped taking responsibility for these same trips. The Metropass

was born from these shared vested interests. Medicaid was also willing to share control over its clients and database to make the program succeed.

A prime example of a willingness to share control is OATS, where volunteers prepare monthly schedules, promote ridership, and raise matching funds. The outcome is a sense of ownership among the **County Committee members,** who donate 76,000 hours worth $524,000 per year to the success of the operation. The MTA and BART case studies represent other examples of willingness to share control with nontraditional partners. MTA provides general oversight and policy direction to the Immediate Needs Transportation Program, which is entirely run by two community-based organizations, **First African Methodist Episcopal (FAME) Renaissance program and the International Institute of Los Angeles (IILA).** Similarly, BART has been willing to share control by relinquishing the lead on development around one of its stations to the **Spanish Speaking Unity Council.** Like FAME and IILA, the Unity Council is another community-based organization with a history of respect and competency among residents and other institutions.

Fundamental to shared control is a climate of trust between the transit agencies and their partners. OATS trusts its volunteers with key functions of the service, and BART and MTA have a corresponding trust with their community-based partners. In Chesterfield County, South Carolina, building trust was one of the most important functions of the first two years of the Coordinating Council, according to the participants. Their director cites "a significant increase in cooperation of staff at the direct service level" as a result of the time they spent building trust.

Another issue the Chesterfield County Coordinating Council had to address was forming a consensus on a common agenda. Although the members agreed with the goal of coordination, they were reluctant to take the steps to make coordination happen. Only when they were able to agree that sharing each agency's resources was their best path to coordination were they able to overcome their parochial concerns. In contrast, BART and the Unity Council share the common goal of economic development at the Fruitvale BART station, a goal which serves both the immediate constituency around the station and BART's broader mission of diversifying revenues and increasing ridership. The partnership between PDRTA and DSS works so well because of their joint agenda to provide transportation to jobs.

A key ingredient in a successful partnership is the ability to listen to the partner's needs and respond flexibly. SEPTA's ability to address the employment needs of private sector partners, such as **United Parcel Services** and **Prudential**, created a win-win opportunity for all parties. The small vehicles and flexible funding package SEPTA offered to create the Horsham Breeze shuttle

responded to the image the business park tenants wanted and the share of the service for which they were willing to pay. The resulting partnership realizes economies of scale that would not be possible with a single public or private entity working alone.

Local governments can also make good partners for a transit agency. For example, MTA has located the management of the Blue Line TeleVillage with the **City of Compton** and plans to form similar partnerships with the cities of El Monte and Inglewood to generate the community buy-in that is necessary for the long-term funding and usage of other televillages. AC Transit and BART funded a partnership with the **City of Fremont** to conduct peer travel training for ADA-eligible seniors and persons with disabilities.

The travel training case study illustrates another element of a successful partnership: an action orientation with scheduled, short-term results. Every rider trained in the six-session course who takes a fixed-route trip instead of a paratransit trip saves the transit agencies $25. Riders themselves save $1.90 per trip. Thus, the savings from the training not only occurred immediately but continues over the long run. In Miami, MDTA and the Medicare Program Administrator also adopted an action agenda, by challenging the status quo. The excellent, short-term results from their pilot program with 126 people have snowballed to 3,600 people, saving Medicaid $503,000 a month and MDTA a potential $10 million a year.

Important elements of agreements with nontraditional partners, as illustrated above by the case studies, can be summarized as follows:

- a vested interest shared by all parties;
- a willingness to share control;
- a climate of trust;
- consensus on a common agenda;
- an ability to listen to the partner's needs and respond flexibly; and
- an action orientation with scheduled, short-term results.

Dramatic changes are occurring in the delivery of health care and reform of the welfare system that directly impact transit properties. These case studies identify transit operators that are ahead of the curve in meeting these societal and political shifts in priorities. By designing services in conjunction with their nontraditional partners, they have been able to respond effectively to these external influences and meet the needs of the transportation disadvantaged.

4. Opportunities exist for blending a wide array of different human and monetary resources to address immobility.

This finding is a byproduct of the partnerships discussed in the previous item. These partnerships have expanded transit's resources by providing new funding sources or alternative methods of administering services. The result has been additional services that increase mobility for the transportation disadvantaged.

Two agencies studied particularly stand out for their creative packaging of funds: OATS and the Spanish Speaking Unity Council, which is leading the Fruitvale BART Transit Village development. Below is a list of the wide range of funding sources that have been garnered in support of their transit projects:

OATS REVENUE BUDGET	FRUITVALE BART TRANSIT VILLAGE
Special Billings/Contracts (24.8%)	Federal Highway Administration
Cities and counties	Federal Transit Administration
Medical centers and HMOs	City of Oakland Community Development Block Grant
Dialysis clinics	
Retirement housing	City of Oakland bond measure
Universities	U.S. Dept. of Housing and Urban Development
Chamber of commerce	
Local school districts	U.S. Environmental Protection Agency
Social service agencies	City of Oakland Enhanced Enterprise
Medicaid transportation	Community Fund
Rider Contributions (5.7%)	City of Oakland redevelopment funds
Group Travel (2.8%)	Alameda Co. Congestion Management Agency
Local Cash (2.1%)	
Non-Transit Resource (0.3%)	U.S. Dept. of Commerce
Missouri Dept. of Mental Health (3.2%)	Ford Foundation
Missouri Elderly and Handicapped	Hewlitt Foundation
Transportation Assistance Program (0.4%)	Loans and lines of credit
U.S. Area Agency on Aging (40.6%)	
U.S. Dept. of Transportation (20.2%)	

Add to this list the additional funding sources from partnerships that have been developed by other case study agencies: businesses and the county (SEPTA); the state Department of Social Services (PDRTA and CCCC); other contracts, such as Amtrak (PDRTA); the school district (CCCC); and Medicare (MDTA).

Besides direct funding, transit agencies can leverage their own funds by tapping human resources available from partners. Volunteers donate 76,000 hours valued at $523,000 a year to OATS budget. The 600 social service agencies that participate in MTA's Immediate Needs Transportation Program provide an in-kind contribution by helping MTA fulfill its mission of increasing mobility for Los Angeles County residents.

5. **Public transportation practices bundled with other support services most effectively address immobility issues related to welfare-to-work, employment, and health care.**

Chapter 2 discussed the characteristics of the transportation disadvantaged and previous public policies that attempted to address immobility. One conclusion that can be drawn is that immobility is an indicator of other social issues that typically cannot be addressed by transportation alone.

This research uncovered a number of examples of how transportation agencies have worked with others to bundle services. Here again, these practices are an outgrowth of effective **partnerships.**

Bridges to Work is one of the most systematically organized programs. The design is based on collaborative planning with job training and placement organizations, transportation providers, community-based organizations, human services agencies, and regional planning institutions. The program, which is being tested in Baltimore, Chicago, Denver, Milwaukee, and St. Louis, consists of:

- *Metropolitan Placement* to help inner-city residents locate job openings, particularly in the suburbs;
- *Targeted Commute* to connect inner-city residents to previously inaccessible employment locations; and
- *Support Services* to mitigate demands created by a commute to distant job locations, including extended child-care arrangements, a guaranteed ride home in an emergency, and conflict resolution with co-workers.

Similarly, most of the case studies validate this emphasis on support services that are packaged with transportation. For example:

- The City of Fremont's Travel Training Program recognizes that persons who are elderly or disabled may need the support of peer training to develop the confidence to ride AC Transit and BART fixed routes.

- The Department of Social Services in Marion County, South Carolina includes PDRTA's rural commute routes with other assistance it offers to Family Independence Act recipients, along with job placement, family living skills classes, child care subsidies, and post-placement counseling.

- The Chesterfield County Coordinating Council and the MTA Immediate Needs Transportation Program have at their heart the integration of transportation and social services to address human needs holistically.

Recognition of the importance of support services extends to other aspects of economic development and welfare-to-work programs. The federal government, for example, instituted the Empowerment Zone and Enterprise Communities initiative in 1994, an economic development program which is also designed to address social problems, including immobility. Besides over $1 billion in funds, the selected communities are eligible for other supporting programs, such as tax-exempt facility bonds, employer wage credits, certain tax deductions, and assistance in overcoming regulatory barriers. This program recognizes that a strategic vision for change must encompass multiple aspects of a community, such as economic opportunity, sustainable development, community-based partnerships, and stimuli for private sector investments. Transportation is a mandatory component in each community's strategic plan.

In the area of welfare reform, the South Carolina Department of Social Services (DSS) is an example of a comprehensive approach which includes both assistance to the client, as described in the paragraph above on Marion County, and incentives for the employer. These incentives include: (34)

- Work Experience Program, an unsalaried, apprenticeship program that allows employers to observe and train prospective employees at no cost;
- Work Supplementation Program, which allows employers to hire interns at minimum wage and be reimbursed at $1.10 per hour;
- Family Independence Employer Tax Credit equal to 20% of the eligible employee's wages per month for the first year and declining to 10% by the third year;
- New Jobs Tax Credit of $1,500 to $4,500 per job per year for up to five years;
- Job Development Training Fee equal to 2-5% of a new employee's state withholding taxes for 15 years, which can be used for transportation as well as training, training facilities, real estate, infrastructure or to meet environmental regulations; and

- Job Retraining Fee, a retention of up to $500 in state withholding taxes for each production employee to be retrained for a maximum of $2,000 per employee over five years.

The Enterprise Communities initiative and the South Carolina DSS program are cited to illustrate how current thinking places importance on an inclusive approach to addressing societal problems. In their book, *Auto, Transit, and Cities*, J.R. Meyer and J.A. Gomez-Ibanez explain the failure of early reverse commute programs:

> "When compared with racial discrimination or lack of skills and education, employment decentralization and inadequate or expensive public transportation appeared to be relatively minor causes of unemployment (or underemployment) among low income central city residents."(35)

In other words, although transportation is an essential component in solving immobility, it will not resolve the problem in and of itself, because the origins of immobility are entangled in demographic, geographic and cultural causes as well. Transit staffs need a new set of skills and knowledge to integrate these socioeconomic factors into their service planning and delivery. By bundling transportation solutions with packages of support services, public transportation providers will attack the problem more comprehensively, with a higher likelihood of success.

6. Public transportation agencies can provide leadership in economic development, thereby reducing the costs of immobility.

The suburbanization of jobs has followed the suburbanization of residences. As of 1990, the suburbs account for 60% of the metropolitan work force. Today, just one-quarter of the American people live in central cities, and the largest proportion of people--half the population--live, work, and shop in urban areas outside the central city.(36) At the same time, poverty and disadvantage are concentrated in the former central cities.(37)

Transit agencies have responded with operational improvements designed to address this jobs/housing mismatch. The two reverse commute routes studied for this research are good examples. PDRTA takes employees from rural South Carolina to jobs in the tourist industry at Myrtle Beach, a commute of one to two hours. Although International Paper is building 50,000 homes near Myrtle Beach, prices are out of the range of these riders, necessitating this continuing commute for entry-level workers. SEPTA's Horsham Breeze allows employees to transfer from main line routes originating in Philadelphia to a shuttle route looping around a jobrich suburban business park. The average commute is one hour and 28 minutes one

way. Prudential's decision to locate its telephone center in a suburban business park instead of downtown Philadelphia is illustrative of the suburbanization of jobs, the cause behind the mismatch of potential employees with job locations.

What the long-term prospects for these routes will be cannot be known at this time. Will workers become discouraged by such long bus commutes and purchase an automobile as soon as possible? Auto ownership may become more feasible when these employees have work experience which allows them to advance to higherpaying jobs. Whatever ill effects may occur for transit ridership or road congestion, auto ownership under today's land use patterns will definitely increase the personal mobility of these workers. Thus, the reverse commutes will have given these employees an opportunity for entry into the personal mobility enjoyed by most Americans.

On the other hand, increased auto ownership by these current employees may not affect the viability of the reverse commute routes if the experience of United Parcel Service (UPS) in Horsham Township is any evidence. UPS has an extremely high employee turnover rate and is constantly recruiting new applicants, who will need the bus service. Burger King in Myrtle Beach has jobs that go begging, and is willing to subsidize the PDRTA routes to enlarge its labor pool. Even assuming a change in current land use policies occurs, the jobs/housing imbalance cannot be corrected in anything but a long time frame. Therefore, it is likely that such operational strategies as those implemented by PDRTA and SEPTA will continue to be needed for economic development as long as the economy remains strong.

Two California transit agencies spotlighted in these cases studies are involved in long-term land use changes that can have a more permanent impact on economic development. The Fruitvale BART Transit Village is being built at a rail station. Its central feature will be a large pedestrian plaza surrounded by small retail uses, multi-family dwellings, and public services. The design responds to immobility by moving the services to the people who need them and clustering the development around a transit hub. Similarly, MTA's Blue Line TeleVillage moves services to the people, but through technology. Located at the City of Compton's transit hub, the TeleVillage allows residents and employees to access many services electronically, without the need to travel.

Both of these case studies are examples of transit as part of a larger economic development strategy. A 1996 TCRP report entitled *Transit and Urban Form* discusses the relationship between mobility and economic development: "Reduction in accessibility and service quality accelerates the economic decline of city neighborhoods and business districts." The report goes on to list characteristics of regions with successful transit-oriented development, including these characteristics related to economic development:

- regional growth that channels development to station areas;
- transit stations located in areas where the market supports development;
- regional policies that focus growth in transit corridors and limit it elsewhere;
- station-area policies and programs to support private sector investments and transit-friendly development; and
- long-term commitment. (38)

Public transportation can have an important role in economic development, both through operational improvements and through land use strategies. However, it cannot substitute for sound land use decisions.

7. Today's mobility issues, particularly in access to jobs, demand regional approaches.

Another outgrowth of the jobs/housing mismatch discussed above is the need for transit agencies to enlarge the sphere of influence used in their planning, perhaps even beyond their own service areas. This need surfaced during interviews with staff at the Employment Development Department (EDD) conducted in the AC Transit case study. EDD representatives indicated that 67% of their caseload of people looking for jobs live in Oakland, which lacks enough jobs to meet the caseload's demand. The jobs are in the southern portion of the county and adjacent counties, which are very poorly connected by public transportation to Oakland. In Chesterfield County, South Carolina the same type of problem was identified for access to health care. Only one of the five hospitals that patients need to go to is in the county.

Nationally, only 6% of welfare recipients have cars.(39) Yet, most new job growth is occurring in the suburbs, largely inaccessible by public transportation. Clearly, the nation cannot rely on transit alone to solve this piece of welfare reform. It will take a great deal of collaboration on the part of governments, businesses, non-profit agencies, churches, metropolitan planning organizations, and other leading institutions to help knit together a plan that addresses immobility across jurisdictional and institutional boundaries.

The case study on the Chesterfield County Coordinating Council (CCCC) shows how difficult this coordination can be, even in a small rural area. Before coordination could be undertaken, CCCC members had to confront turf battles, dissolve resentment between agencies, and build trust and rapport. The barriers to coordination were similar to those found in other recent TCRP studies conducted by Crain & Associates(40) and in the literature search for this research. Some of the underlying issues hindering regionalism include:

- lack of understanding about other institutions' goals and services;
- reluctance to share scarce resources for fear that the agency's own programs will suffer;
- worry that the bigger or more powerful agencies will overpower the desires of the smaller or less powerful agencies;
- suspicion that revealing costs will reflect unfavorably without taking into account basic differences among the agencies;
- inability to change inhibiting federal, state and local regulations;
- concern about inappropriate measures of success applied to nontraditional services;
- fear of job loss;
- competition for funding, prestige, control, and personal recognition; and
- pressure in the political environment to promote local interests over regional goals.

Clearly, society should not expect quick fixes leading to regionalism that can overcome decades of separateness and autonomy. Yet, despite these barriers, there are examples of agencies moving forward across regional lines with coordinated services.

Oftentimes, the regional approach is part of a larger corporate strategy of mobility management. MTA's Immediate Needs Transportation Program, using taxis as well as buses, serves facilities in all of Los Angeles County, even though other fixed-route operators exist in some of the outlying cities. MTA program staff expect that Immediate Needs will become part of a three-tiered strategy in the agency's Long Range Transit Plan. High frequency, high capacity buses would comprise tier one; 40-foot buses along fixed lines with flexible routing in the neighborhoods would comprise tier two; tier three would be a community-based network, including point deviation routes, late night taxi service, Immediate Needs, and the currently contracted Americans with Disabilities Act program. The program would become part of a portfolio of services available to the nine million people of Los Angeles County.

Similarly, PDRTA and OATS, serving 11 and 87 counties respectively, look at the various components of their services as pieces of a corporate vision embracing mobility as a goal. In discussing its rural commute services, PDRTA states, "PDRTA is accepting the critical responsibility of providing the coordinated, efficient, and specialized transportation network which will allow these people to have access to job opportunities."(41) The fact that PDRTA crosses into the service area of another operator in order to bring its residents to jobs in Myrtle Beach demonstrates that transit connections between residential areas and workers *can* be designed regionally instead of locally. And OATS' mission is to "provide reliable transportation for transportation disadvantaged Missourians so they can live independently in their own communities."(42) Both these statements exhibit the

core institutional state of mind that looks for opportunities, the characteristic of a mobility management agency.

The Job Oasis Worker Mobility Project in Chicago is a multi-agency partnership that not only *coordinates transportation* within a region but also *coordinates services* across disciplines. Managed by the nonprofit Suburban JobLink, Inc., it provides a mix of fixed-route, subscription and vanpool services for unemployed and inner-city residents on Chicago's West Side to jobs in suburban industrial parks around O'Hare Airport. Support services include job placement and job retention services, referrals to child care, and a guaranteed ride home program. Partners include the PACE Suburban Bus Company and key Chicago and county employment and training councils.

County lines and transit service area boundaries are artificial barriers for people who need to cross them to get to the jobs and services they need. The same tailored approaches described above for job-access transportation are also necessary for the design of transportation to regional services, such as hospitals and clinics, food banks, and crisis centers. Given the patterns of land use and demography that now exist in the United States, **regional** approaches are essential to address the economic, social, and human costs of immobility.

8. Simple ideas and programs can yield significant mobility improvements.

Many of the programs studied in this research began with simple ideas which have yielded significant results:

- OATS is a shoestring operation that makes things happen through extensive use of volunteers and creative blending of a wide variety of funding sources.
- MDTA designed the Metropass as a pragmatic approach for transporting Medicare clients who are able to ride fixed-route transit.
- MTA provides oversight to the Immediate Needs Transportation Program, run by community-based organizations with a wide network of social service agencies, and based on existing taxi and bus services.
- The City of Fremont's Travel Training Program teaches persons who are elderly or disabled to ride fixed-route transit through the use of peers.
- The CCCC created a new fixed route system in rural South Carolina by layering it onto existing dial-a-ride services. Bus stops for the general public are designated along dial-a-ride routes that are consistent, such as from a board-and-care home to a sheltered workshop.

Including these simple, independent programs into the overall strategy of a company will reinforce the mobility management ethos of the organizations, which

emphasizes moving people rather than the mode of transportation. Including them can also be more effective than considering them as adjuncts to the agency's mission, by assuring the programs greater funding security and integration within the organization.

None of these programs are elaborate concepts; none required costly capital investments. Yet, as Finding 2 illustrates, the net annual benefits range from thousands to millions of dollars. The following chapter is a Methodologies Guide. It discusses how these numbers were derived and describes the steps to perform an economic analysis of transit projects.

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4: GUIDE FOR ECONOMIC ANALYSIS OF TRANSIT PROJECTS

OVERVIEW

This chapter explains the guiding principles and procedures that were used in conducting economic analyses for the accompanying case studies of the consequences of immobility. Drawing on the case studies for illustration, the guide outlines the approach to economic analysis in enough detail for the average well-informed person with some grounding in economic theory first to understand the approach, and second to replicate the approach either for past, for ongoing, or for future projects. The aim is to provide enough structure for finding and calculating transit costs and benefits that no important costs or benefits will be overlooked or underestimated. This process requires both creative imagination and economic rigor.

There are a number of purposes for which economic analysis can be utilized. Perhaps most importantly, the results of the economic analysis process described in this chapter can be used by policy makers in making informed transit investment decisions by comparing the transit benefits and costs of a specific proposed project. For proposed projects where quantified benefits clearly outweigh the costs, the economic analysis can be utilized to build support for budgets that provide sufficient public transportation funding overall. The recommended steps for economic analysis described below can be applied by transportation practitioners to:

- Determine if a proposed transit mobility project has sufficient benefits to justify the costs of the project. The methodology provides a means for determining who is benefiting from a proposed project, and how those benefits can be valued.

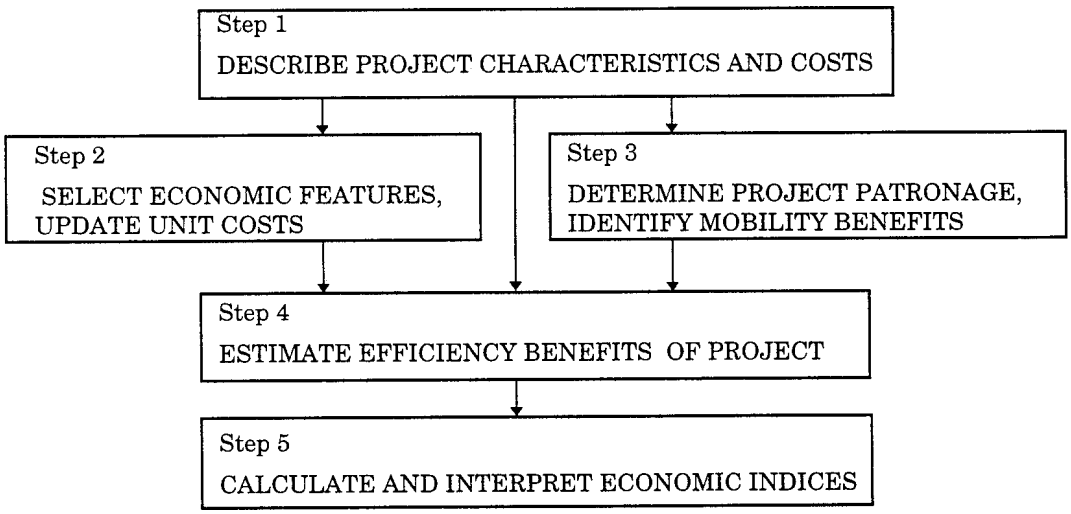
- Evaluate ongoing projects to determine if a project has been successful in economic terms. The practitioner can determine if proposed modifications to a transit project would increase benefits relative to the costs of the proposed changes.

- Provide a basis for comparing alternative projects. For example, for a local sales tax measure, the economic merits of a transit project that improves mobility for the transportation disadvantaged can be compared with the economic results of a highway investment.

- Analyze the impacts of transit service reductions on the transportation disadvantaged. The economic costs of such reductions can be compared to cost benefits of the service cutbacks.

Five sequential steps are recommended for these types of economic analysis, as shown graphically in Figure 4-1.

Figure 4-1: Recommended Steps for Economic Analysis



In step 3, *mobility benefits* refer to benefits from transit trips that would not be made without the availability of transit. *Efficiency benefits,* in step 4, result from the shift of trips from automobiles to transit, which typically improves the efficiency, safety, and environmental performance of the highway transportation system. Each of these five steps is explained in turn below, and special terms are defined in the accompanying glossary. Both the definitions and the steps of the economic analysis process are adapted from the current US guidebook on transportation user benefits(43) plus a recent comprehensive paper on the subject by the Victoria Transport Policy Institute.(44)

STEP 1: DESCRIBE PROJECT CHARACTERISTICS AND COSTS

The principal items of information needed for initiating an economic analysis of a transit improvement project are summarized below and discussed in turn.

- Sponsor and purpose of project.
- Implementation period and project lifetime.
- Locations served and operating plan or plans.
- Investment cost.
- Annual maintenance and operating cost.
- Alternatives to be considered.

GLOSSARY OF KEY TERMS

Transit or bus operating costs The cost of implementing and operating a transit improvement, including drivers' wages, vehicle operation and maintenance, managerial labor, and vehicle rental or depreciation.

User costs The sum of relevant transit and highway user costs on a specified improvement. *Transit user costs* generally consist of fares, any costs of getting to a transit stop or terminal, and the value of time accessing, waiting for, and riding on the transit vehicle. *Highway user costs* are the sum of vehicle running costs, the mileage-related cost of owning a motor vehicle, and the value of travel time. *User benefits* are usually net savings in user costs.

Mobility benefits Benefits from transit trips that would not be made without the availability of transit.

Efficiency benefits Benefits resulting from the shift of trips from automobiles or other modes to transit, which typically improves the efficiency, safety, and environmental performance of the transportation system.

Incremental or marginal costs The net change in dollar costs directly attributable to a given transit or highway improvement, decision, or proposal compared with some other alternative, usually the existing situation or "do nothing" alternative, but possibly some other, lower-cost alternative.

Analysis period or study period The number of years chosen for consideration and study of incremental benefits and costs in an economic analysis. The year of implementation is usually designated year 0 (zero). The year operations commence is year 1, and subsequent years are year 2, year 3, etc.

Discount rate An annual percentage figure that represents the rate of interest that money invested in an improvement could earn over the analysis period if invested in other opportunities (the *opportunity cost* of capital), or not spent, or in the case of governments, not even raised in taxes or not borrowed.

Internal rate of return An interest rate that would return the estimated benefits of the project from investment of the cost of the project.

Benefit / cost ratio Present or annual value of project benefits divided by present or annual value of project costs, recommended as the best single figure of economic merit for public transportation projects.

Net present value Present or annual value of benefits minus present or annual value of costs.

Present value The translation of costs or benefits that occur in different time periods to a single equivalent amount at a single instant, usually the beginning of year 1 of the analysis period, at the specified discount rate.

Equivalent uniform annual value, or simply annual value The translation of costs or benefits into a series of equal annual payments at the chosen discount rate for the project.

Compound interest factors Multipliers for determining present values and equivalent annual values from annual or periodic cash flows, which can be found in any standard text for *microeconomics or engineering economy*, the two academic disciplines that guide this type of economic analysis. Or, buy a pocket financial calculator.

Sensitivity analysis An evaluation of alternative assumptions about the numbers in an economic analysis that are most crucial or uncertain, to demonstrate what the effect will be on the economic merit of the project.

Equity Substantially equivalent treatment of persons in the same circumstances, and appropriately different treatment of persons in different circumstances.

First, the sponsor: who all is paying for the project, and who is implementing it? To what end or purpose? To the extent possible, the economic analysis should measure benefits that are related closely to the purposes of the project. On the other hand, your inquiries could help clarify the purpose of the project in terms of the benefits that you can measure, especially mobility and efficiency goals.

Next, how much time will be required to implement the project, if it's not already begun? Then how many years of legal authorization or funding is assured? Is the funding level, indexed to inflation, or demand driven, and how is it likely to change during the life of the project?

What does the operating plan call for in terms of urban, suburban, and rural locations served, frequency or timing of service, speed or schedules, fares, capacity, and any other important variables? If there is more than one plan (for example, expanding capacity by either 10% or 15%), consider the plans in order of increasing cost and what exactly any *added* features (in this example, the extra 5% capacity) cost and produce, in revenues and benefits, so that *each separable increment of cost can be evaluated separately*.

Does investment cost include the price of vehicles? If so, it is usually more convenient to treat vehicle costs as annual depreciation or rental, hence part of operating costs. Are there any non-transportation costs that should be considered? For example, any relevant job training costs should be included in project costs if the monetary benefits of jobs resulting from a new transit service are being evaluated.

How should you document annual maintenance and operating cost? Encourage the sponsoring agency to 1) fully disclose and carefully identify or estimate *all* operating costs associated with particular projects, and 2) clearly specify the proportion of total operating cost met by different funding sources, such as fares, charter service revenues, business subscriptions or donations, and government sources. This is especially important because *only the government or "public" cost of the project*, net of fares and other commercial revenues, should be counted as project costs. For future projects, you will of course have to rely entirely on estimates of future costs and revenues. These estimates should be guided by experience with similar projects, either by the sponsoring agency or elsewhere.

Lastly, to what alternatives should the project under study be compared? Usually the alternative chosen for comparison with the primary alternative is the status quo, appropriately called the "do nothing" alternative. One important variation is comparison with a lower-cost and mutually exclusive alternative, with which both the incremental costs and benefits of the primary alternative should be compared. Another variation is to consider a higher-cost alternative that would

have to be undertaken if the basic project is terminated. Then the difference between the two costs is the saving or benefit from the project.

Table 4-1 presents both information on the alternatives used in the case studies and some key reference information about the economic analyses for the case studies that is useful for understanding their similarities and differences. For example, average trip length varied over a range of 5 to 40 miles; and the average number of users for the service studied varied from 106 to 43,639. The setting of the studies was diverse, with two rural, two suburban, and three urban locations. Transit dependence (percentage of users whose only alternative was transit) was only measured by surveys in the PDRTA and SEPTA case studies, where respondents with no auto alternative were 71.8% and 63.3%, respectively. Similar rates were suspected but not documented for the other case studies.

Table 4-1
Selected Case Study Data

Case Study	Average One-way Miles	Average Users	Setting	Dependence Percentage	Comparison Alternative
PDRTA, Myrtle Beach	40	380/day	Rural	71.1%	Status quo
SEPTA Horsham Breeze	19.3	444/day	Suburban	63.3	Status quo
MDTA Metropass	n.a.	3,492/mo.	Urban	n.a.	Paratransit
OATS, Missouri	5.9	25,298/yr.	Rural	n.a.	No OATS
MTA Immediate Needs	5-11	13,762/mo.	Urban	n.a.	Status quo
Fremont travel training	n.a.	106/yr.	Suburban	n.a.	Paratransit
AC Transit service cuts	n.a.	43,639/day	Urban	n.a.	Status quo

n.a. = not available

The last column of Table 4-1 shows *what alternative was used for comparison with the system or prospect under study.* In four cases, it was the status quo, or "do nothing" alternative--for PDRTA, Horsham Breeze, Immediate Needs, and AC Transit service cuts. In other words, the *benefits* of the project stemmed from the comparison between doing nothing and the existing transit system configuration. In contrast, the MDTA Metropass and Fremont travel training case studies were comparing the existing fixed route service (or training for its use, in Fremont's case) with the alternative of serving the same population with more expensive paratransit service.

The existing OATS system was compared with an alternative *without OATS,* in which some passengers switched to rides in autos, usually with others; some switched to riding other, more expensive paratransit substitutes for essential OATS service; and many trips, called "missing," were simply not made. The OATS economic analysis was the most complex modeling of the comparison alternative

undertaken in these case studies, while MDTA and Fremont travel training were the simplest, with the others in between.

STEP 2: SELECT ECONOMIC FEATURES, UPDATE UNIT COSTS

The economic features of the study that need determination are:

- The length of the analysis or study period.
- The discount rate.
- Treatment of inflation, risk, and uncertainty.
- Choice of present value or equivalent annual value.

Fifteen years is recommended as the usual analysis period for transit projects, based on the maximum prospective life of buses before replacement. Highway project study periods should be keyed to the length of the traffic projections, usually 20 to 25 years. Rail and other major transit construction projects could base their study periods on the expected useful life of the resulting facility if traffic projections are available that far out. Normally a single year, called the *study year,* is designated for detailed projections or modeling of project outcomes. Then the study year outcomes are expanded or converted to equivalent annual values--see below--to represent the results over the entire analysis period.

The recommended discount rate is 4%, to represent the long-term average cost of capital with no allowance for inflation or risk.

Because inflation is ignored in the recommended discount rate, any future costs or benefits should be *priced at current rates.* Because risk is ignored, any unusually risky projections of costs or benefits should adopt one of three strategies: 1) specify a *range of possible outcomes* rather than only the average or most-likely value, or 2) specify a *higher acceptable threshold value* for the economic index (for example, a minimum benefit/cost ratio of at least 2.0 rather than 1.0), or 3) include a *sensitivity analysis* that reveals the effects of possible variations in the underlying assumptions. A sensitivity analysis is usually preferred, as it provides the reader with quantitative information that he or she can use to assess the effects of a specified range of uncertainty. For example, see the last section of the economic analysis for the OATS case study.

Usually it is more convenient in transit studies to convert all costs and benefits to equivalent annual costs or benefits, because they almost all originate as annual amounts anyway. The main exceptions would be vehicle acquisition costs, which can readily be restated as average annual depreciation or rental charges. For projects of short duration, such as the five-year Fremont travel training study, present value can be a logical choice.

Note that vehicle costs have been ignored in these case studies, for two reasons. First, vehicle costs are relatively minor on an annual basis, typically around 10% of full operating costs. Second, the cost of vehicles is sometimes difficult to relate to individual projects through a transit agency's accounting system because vehicle costs are not usually included in the operating budgets. And, in the taxi voucher and bus coupon distribution activities of the Immediate Needs program, vehicle costs are not even relevant.

Updating unit cost factors is a routine but important part of economic analysis. Any users of the factors in this report should either consult a current source for the prices or utilize the *ratio of relevant price indexes* in the year of their study compared with the index for the specified year for the cost factor. A summary of illustrative cost factors, most of them used in the case studies, is presented in Table 4-2.

Table 4-2
Illustrative Unit Cost Factors

Item (& Case Study)	Value	Year	Source
1. Automobile operating & ownership costs (OATS)	$.41/mile	1997	AAA, *Your Driving Costs*, adjusted to a 10-year vehicle life.(45)
	$.31/mile	1997	Same source, adjusted further to delete time-related costs(46)
2. Value of travel time (AC Transit & OATS)	$5.15/hour	1997	Current US minimum wage
3. Average annual cost of one suburban parking lot space (Horsham Breeze)	$264	1996	KPMG, Commuter Choice Initiative, June 1996, p. 36
4. Average Medicare costs for:			*Medicare State Summary,*
Hospital stay	$13,296	1996	1996, Health Care Financing
Skilled nursing stay	$2,240	1996	Division, Office of Information
Ambulance trip (Immediate Needs)	$117	1996	Services, Enterprise Data-Based Group, Division of Information Distribution
5. Average cost of visit to doctor by Medicare patients (OATS)	$84	1993	Dr. Gregg Meyer, New England J. of Medicine, 12/18/97, p. 1819
6. Job training costs per student hour (Immediate Needs)	$11	1997	Telephone poll of selected job training providers in Los Angeles

For item 1, auto operating and ownership costs, the higher cost of $.41/mile is the total estimated cost of owning and operating a motor vehicle. This figure is appropriate for *transit-dependent riders who have given up their car to ride transit*--or vice versa, who would have to buy a car or another car if they stopped riding transit. The second, lower cost factor of $.31/mile(47) is appropriate for *transit*

riders who have a car that they could use, because that cost factor includes only mileage-dependent costs, as explained in reference 46. Please note that:

- The 1997 IRS allowance of $.31/mile for business travel on income tax returns coincides with the lower cost factor, whether fortuitously or intentionally.

- These cost factors are about four to six times the typical cost of about $.07/mile for fuel that is misperceived by many drivers as their total cost of driving.

- The average cost per vehicle mile of parking and tolls should be added to these figures if local data are available for such costs.

For item 2, the value of travel time, higher values than $5.15/hour can be used if there is evidence that the average income levels of your transit riders would justify the increase. Significant benefits attributable to travel time valuation should generally be identified separately in the summary of project costs and benefits. The value of travel time is not an economic cost for people who are not losing work time and wages due to their travel time, but repeated studies have shown that in their choices of modes and routes, *travelers behave as if they value travel time* at some fraction of their average hourly income; 80% is a representative figure for highway travelers.(48)

Transit riders' value of travel time depends on the level of comfort and convenience provided. For example, if bus or other transit travel is comfortable, riders will be willing to spend from 30% to 100% longer on a transit trip than if they were driving alone, the higher figure representing the alternative to driving in congested peak-period conditions.(49) This is equivalent to experiencing benefits of $1.80 to $7.80 an hour for transit trips with the same travel time by auto, if travel time is valued at $12/hour.

The other illustrative unit cost factors are less widely used, but should be self-explanatory. Table 4-4, in step 4, also presents several factors for estimating the value of efficiency benefits.

STEP 3: DETERMINE PROJECT PATRONAGE, IDENTIFY MOBILITY BENEFITS

Patronage--the number of riders using the service day by day and month by month throughout the study period--is usually available directly from transit agency records and on-board surveys for past projects, and from use estimates for prospective projects. In some cases, you may have to translate available data (such

as transit tickets and vouchers distributed--see economic analysis for MTA Immediate Needs case study) into patronage or conduct your own survey of current usage. In other cases, monthly or seasonal variations in patronage may need to be modeled in deriving annual patronage counts (see economic analysis for PDRTA, for example).

A key twin question for the economic analysis comes next, which can require more effort to answer than all of the other steps combined: *how and by how much* do patrons or other beneficiaries actually benefit, in dollars and cents, from the project? It has already been proposed that benefits be divided for convenience into two categories, to distinguish between those arising from trips that would not be taken without transit service (mobility benefits) and those arising from trips by passengers shifted from automobiles (efficiency benefits). In this step 3 are presented examples of both types, with a detailed explanation of efficiency benefits reserved for step 4.

In some cases, mobility and efficiency benefit data can be derived or inferred from information available in transit agency records. This was true for three of the seven case study economic analyses: Fremont travel training, OATS, and Metro-Dade Transit Agency. In the other four cases--AC Transit service reductions, PDRTA bus service to Myrtle Beach, MTA Immediate Needs program in Los Angeles, and the Horsham Breeze--transit passenger surveys were designed, pretested, administered, and analyzed to obtain the needed benefit information. Readers can consult those four case studies for accounts of the surveys and survey results. *Detailed guidelines recommended for surveys of user benefits are provided at the end of this chapter.*

Table 4-3 shows the *type of benefits* documented for each case study, using the broad mobility and efficiency categories as the first level of discrimination. The three types of mobility benefits identified are described below the tabulation.

Table 4-3
Illustrative Benefits
(thousands of dollars)

	Annual Mobility Benefits			Annual Efficiency Benefits				
Case Study	Job Benefits	Medical Benefits	Shop., Other	Parking Benefits	User Benefits	Social Program Savings	Employer or Provider Savings	Total
PDRTA, Myrtle Beach	$2,116						$61	$2,177
Horsham Breeze	1,506			23	$34			1,563
MDTA Metropass						$7,619		7,619
MTA Immediate Needs	5,066	$4,552			4,333			13,951
OATS, Missouri	1,652	3,272	362		2,542	5,588	523	13,939
Fremont travel training					6	46		52
AC Transit service cuts	(8,900)				(39,200)		4,759	(43,341)

- *Job benefits* resulted from enabling formerly unemployed or underemployed passengers to reach their job sites. Known costs of job training of passengers for this purpose in the Immediate Needs program were first deducted from these benefits. The negative benefits in the case of AC Transit were from job losses due to the service cutbacks. For OATS job benefits include the value of missing employment, business, and education trips.

- *Medical benefits* resulted primarily from the avoided costs of more intensive care, as by continuing to see one's own doctor, but also from being able to stay mobile and thereby care for oneself at home, from getting bused to nutrition programs, and from getting meals delivered at home. In the OATS case study, the average Medicare cost of doctors' visits was used as an estimate of the minimal value of missed trips to doctors in the absence of the OATS service. Total medical benefits for OATS were the value of missed medical, nutrition, and meal delivery tickets.

- *Shopping and other benefits* stemmed from assigning an estimated value of $4 per round-trip shopping journey (for 93% of the $362,000 total), and a nominal $2 per recreational and "other" trip, to missing OATS trips of those types.

One type of expected benefit, for savings in unemployment, welfare, and food stamp payments, was estimated from survey results in the PDRTA case study to be $313,000 annually. However, this saving in federal and state costs is offset by the

loss to recipients of that same amount when they start working. Therefore, this government saving is noted but not counted in total project benefits, even though it seems counterintuitive to leave it out.

STEP 4: ESTIMATE EFFICIENCY BENEFITS OF PROJECT

Efficiency benefits accrue to highway users as a byproduct of the millions of daily trips taken on transit vehicles, mainly through the resulting reductions in vehicle miles driven on highways. The efficiency benefit estimates for the seven case studies summarized in Table 4-3 are considered next.

- *Parking benefits* valued at $23,000 annually in the Horsham Breeze case study came from potential savings in avoiding the costs of providing parking to employees who drove prior to implementation of the shuttle service.

- *User benefits*, mainly from savings in transportation costs, were found for the Horsham Breeze, Fremont travel training, and OATS case studies. The $39.2 million user loss for AC Transit was the result of added travel costs, chiefly for taxis, necessitated by the transit service cuts. A sizable $4.3 million user benefit for the Immediate Needs program represents the value of transit tickets and taxi vouchers distributed free by MTC to program participants. *Please note that any new fares paid by transit users in the project under study represent added costs to users that need to be deducted from their benefits.*

- *Social program savings* from avoided paratransit expenses for three of the case studies are listed as an efficiency benefit because they represent *savings to the social welfare agencies* that would, in the absence of the service being evaluated, have had to provide paratransit or other special transportation for their clients at higher cost.

- *Employer benefits* of $61,000/year from improved access to the labor force were estimated in the PDRTA case study as equivalent to the payments that Myrtle Beach employers make to PDRTA for timely bus service to their sites.

- *Provider savings* of two types were found. The first was savings to OATS of $523,000 from the value of its dedicated volunteer labor force, which is unlikely to be available to small, scattered transit and paratransit operators. The second was savings of $4.8 million to AC Transit as a result of their service cutbacks.

The types of efficiency benefits just illustrated are repeated in the more comprehensive list in Table 4-4, which includes typical current unit values for most types of benefit. Examples have been provided above for benefit types 1 through 5

from the case studies (parking, user, social program, employer, and provider benefits). Benefit types 6, 7, and 8 (congestion delay reductions, reduced environmental burden, and roadway related savings) tend to occur for transit projects that aim to relieve peak-period traffic on highly congested roads. None of the case study projects had this aim, but many transit projects do, especially in high-traffic urban corridors.

Table 4-4
Types and Values of Efficiency Benefits

Type of Benefit	Typical Unit Values
1. Parking benefits, from reduced parking fees or more efficient use of land devoted to parking.	Parking fee estimates for rural areas, up to $1/day; suburban areas, up to $2/day; cities, $3-4/day; CBDs, $6-8/day. Average annual cost of 1 suburban space, $264 (see Table 4-2, item 3).
2. User benefits, mainly from lower cost of transit versus single-occupant autos.	Auto cost of $.31 or $.41/vehicle mile (from Table 4-2) versus fares for the transit service under study.
3. Social program savings, from reduced or avoided paratransit costs.	Single-ride paratransit averaged $15/trip in Dade County; $25 in Fremont, CA; and $19 in Missouri (OATS) case studies.
4. Employer benefits, from improved access to labor force	Varies with local circumstances.
5. Provider savings, from reduced operating costs or donated services	Varies with local circumstances.
6. Congestion delay reductions due to removal of transit users' autos from roads.	$.10 to $.30/vehicle mile for peak-period congestion conditions, depending on severity.
7. Reduced environmental burden, especially air and water pollution.	$.042/vehicle mile for air pollution + $.01 for water pollution = $.052/vehicle mile.
8. Roadway related savings, from decrease in highway facility construction, operating, and maintenance costs.	$.05/vehicle mile shifted to transit in short term to $.10 long term.

Sources: For #1, 6, 7, and 8, Todd Litman, op. cit.; for #2 and 3, this study (as noted in table)

In Table 4-4, the typical unit values shown can be used in the absence of local information on the values for that benefit. For this purpose, as in Table 4-2 earlier, the unit values should be updated as necessary from the 1997 values shown. For the seven case studies, the typical unit values cited in Table 4-4 were used for benefit types 1, 2, and 3 (parking, user, and social program benefits). Benefit types 4 and 5 were calculated from local information.

A recent study by Donald Camph(50) has examined a very similar list of efficiency benefits on a national level, finding about $36 billion in total benefits versus $15.4 billion for the public costs of transit in 1955. The resulting benefit/cost ratio of 2.3 makes a strong case for substantial funding of transit from highway fuel taxes, because efficiency benefits are returned principally to highway users or taxpayers (in the cases of social program savings and provider savings, for example). A complementary study by David Lewis and Michael O'Conner(51) found a mobility benefit for US transit riders of $34 billion in 1993, which is 2.2 times the public cost of transit. *In total, according to these two sources, national mobility and efficiency benefits of public transit are about $70 billion annually, for an overall benefit / cost ratio of 4.5 to 1.*

STEP 5: CALCULATE AND INTERPRET ECONOMIC INDICES

An economic index is the culmination of an economic analysis, the single measure that summarizes for the reader the economic value of a project, first in relation to its own internal costs, and second in relation to other projects, which can be either variations of the examined project in scale or approach, or entirely separate enterprises. There are three principal indices to choose from:

- Internal rate of return
- Net annual benefits (benefits minus costs)
- Benefit/cost ratio

The internal rate of return is an interest rate that would earn the estimated benefits of the project from investment of the cost of the project, assuming reinvestment of all interim benefits (until the final study year) *at the internal rate of return for the project.* This may be a tenable assumption for private sector projects where a business actually has such opportunities for reinvestment, but it is unrealistic for public sector projects where, as proposed in Step 2 of this analysis process, the preferred annual discount rate is 4%.

Net annual benefits, or benefits minus costs, reveal the total excess value created by a project. They are therefore useful in comparing the overall value to society of different projects or project portfolios. However, net annual benefits should not be used as a criterion for project *selection*, because choosing projects with the highest net annual benefit first may exhaust the budget with costly projects that have a lower return per dollar than the set chosen *in order of highest payoff first*--in other words, in *order of declining benefit / cost ratios*, the highest ratio first, then the next highest, and so forth. For this reason, the ratio of benefits to costs is recommended as the primary economic index, with two cautions:

- If projects contain mutually exclusive alternatives, each increment of cost should be evaluated separately on the basis of that increment's benefit/cost ratio.

- Other than economic criteria may dictate the final choice of projects.

To illustrate these two principals, if a *new transit service to area A* costing $100,000/year in public funding and offering benefits of $400,000/year has the option of increasing its initial service levels by $100,000/year with added benefits of $200,000 (incremental B/C ratio of 2.0, total B/C ratio of 3.0) versus *starting an independent service to area B* for the same $100,000 with benefits of $250,000 (B/C ratio of 2.5), it is perhaps obvious that the *economic* preference would be for enlarging the service to Area B, because *only the incremental B/C ratio of 2.0 is relevant in deciding how to spend the added $100,000.*

Now let's switch the assumptions and find that *service to area B* has benefits of only $200,000 while the *increase in service to area A* would bring benefits of $300,000, a substantial excess over the service to area B. Then the *economic* criterion favors area A, but the transit agency's decision may still go to starting area B service, based on the principle of *equity*--treating clients in similar circumstances similarly. Other noneconomic considerations that may influence project selection include the competence of the transit agency to undertake a project, assurance of continued funding availability, environmental benignity, and public acceptance.

Benefit/cost ratios also have the advantage of familiarity in public sector economic analysis, especially in transportation studies where the economic standard that project benefits should at least equal project costs (a benefit/cost ratio of 1.0 or more) is well accepted. The California State Department of Transportation has long required that benefit/cost ratios be calculated for all highway construction projects included in the State Transportation Improvement Plan, and projects with a ratio of less than 1.0 would have to be extraordinarily attractive in some other way to gain approval.

Transit projects are often more complex to evaluate than highway projects, because they can include such a diversity of beneficiaries and the benefits in transit studies are not as predictable or easily defined as they are in the standard traffic stream of vehicles on highways. Nevertheless, when the studies are properly conducted, *the relative economic merits of transit projects can validly and usefully be compared with the economic results of highway investments via benefit / cost ratios.* These comparisons should be invited by transit operators in situations such as the division of transportation taxes, because the benefit/cost ratios of transit improvements are frequently higher than those of highway projects, which are often in the range of 1.0 to 2.0.

Table 4-5 presents a summary of economic indices from the case studies that can also be used to illustrate the preferred nature of benefit/cost ratios for project comparison and selection. Projects are listed in order of declining benefit/cost ratios. The Immediate Needs study, though fourth in the list, leads in net annual benefits with $8.6 million. However, the total net annual benefits of the first three projects, with higher benefit/cost ratios, is $9.4 million. These results demonstrate that, based on economic criteria alone, if these first three projects were alternatives to the Immediate Needs program, choosing them first on the basis of their benefit/cost ratios would also maximize net annual benefits.

Table 4-5
Economic Indices for Case Studies

	Thousands of Dollars			
Case Study	Annual Benefits	Annual Costs	Benefit/Cost Ratio (a/b)	Net Annual Benefits (a/b)
	a	b	c	c
PDRTA, Myrtle Beach	$2,177	$79	27.4	$2,097
SEPTA Horsham Breeze	1,563	213	7.3	1,350
MDTA Metropass	7,619	1,580	4.8	6,039
MTA Immediate Needs	13,951	5,400	2.6	8,551
OATS, Missouri	13,939	6,009	2.3	7,930
Fremont travel training	52	27	1.9	25
AC Transit service cuts	4,759	48,100	0.1	(43,341)

The economic criteria in Table 4-5 verify the substantial economic merits of the projects evaluated, with one exception. The exception is the case study of AC Transit service cuts that show only a 0.1 return on investment. Actually, the tables are turned here somewhat, because the AC Transit *investment cost* consists of sacrifices by transit riders, to bring the *benefits* of lower operating costs to AC Transit. That only 1/10 of the amount sacrificed by riders was returned in lower costs to AC Transit is unfortunate, but AC Transit knew of no less painful way to eliminate their budget deficit. The AC Transit results are a powerful economic argument for expanding rather than contracting urban transit bus service.

It is also noteworthy that *these highly favorable economic results came from public transit systems that primarily serve the relatively poor, underemployed, handicapped, and less mobile segments of society,* whereas US transit as a whole (which also shows a high ratio of benefits to costs) serves a broader range of wealth and mobility in its clientele, especially on rail systems. This suggests that *the economic productivity of public transit is not very dependent on the income levels served, and could greatly benefit the economy by further appropriate expansion in*

low income areas Equally important are public policies that help to create more equitable financing opportunities for public transit, such as the following(52):

- Allow transit improvement and transportation demand management projects to compete with highway projects for transportation funding, based on their economic performance.

- Base automobile insurance and state vehicle registration fees more on annual miles driven.

- Encourage employers to give equivalent financial benefits to non-drivers when they offer free or subsidized parking to their employees.

SURVEY GUIDELINES
(Referenced in Step 3)

1. *Clearly define your survey objectives.* A critical first step is determining the type of benefits on which you would like to gather information. List the type of benefits you would like to quantify, and determine the type of output you would like to have in order to conduct the analyses. This will enable you to construct the survey instrument.

2. *List the information to be included in the survey instrument.* Typical information might include the trip purpose, fare paid, trip distance and/or travel time enroute, the days of the week such a trip is usually made, how such trips were made before this service existed (or how they would be made without it), the time and cost that would be involved in alternative transportation, and any other financial results of having to find alternative transportation, such as loss of income (at what monthly wage level?) or shopping opportunities (at what average monthly cost?). The effect on unemployment or welfare payments is another type of financial effect that could be explored, as is the effect on access to transportation for other types of trip purposes.

3. *Convert the desired information into a questionnaire that is clear, simple, and as short as possible.* Examples of questions are contained in the sample questionnaires following each of the four case studies that included rider surveys: AC Transit, PDRTA, MTA Immediate Needs, and Horsham Breeze.

4. *Define your survey sample.* Will you be conducting a random sample or will you be conducting a census of all users? If you are conducting a random sample, as a rule of thumb you should plan on about 400 questionnaires to achieve a 95% confidence level with a margin of error plus or minus 5%. If you would like statistically valid results on subpopulations, you will need to collect additional surveys; about 400 per subpopulation is a conservative estimate.

5. *Decide on the method of distribution for the survey, based on the size and location of the target survey population.* Usually the simplest approach with the best return rate is an on-board written questionnaire, completed and returned by the time riders exit the transit vehicle. Other options with a lower response rate are a telephone or direct interview survey, or mailback surveys. Account for the expected return rate in deciding how many surveys to distribute.

6. *Conduct a pretest of the survey.* Prepare a draft questionnaire, distribute copies with instructions--ideally to at least 5% of the desired sample size--and collect the results.

7. *Review the results of the pretest carefully for questions that respondents clearly did not understand.* For example, in the PDRTA survey, the pre-survey was not tested due to time constraints. Respondents were asked: "What time did you get on this bus?" and "What time did you get off this bus?" in order to quantify the average in-bus travel time from their origin to destination. Although the question clearly asks about this bus, about 40% of the respondents answered the question for their bus to their destination and their return bus from their destination to their home. The question was not understandable to respondents and needs some rewording; for example, "For the trip you are making now, what time did you board the bus you are on now?"

8. *Plan for survey administration.* This includes the survey date or dates, bus departure and arrival times and/or bus run numbers, number of survey forms and survey workers needed over what time period, written and oral training instructions, etc. Good organization, supervision, and training of survey workers is very important.

9. *Collect and tabulate the survey results.* For tabulation, use the statistics software package your agency utilizes. Spreadsheets can also be utilized for data entry, but are a bit clumsy when it comes to performing repeated or complex computations with the data.

10. *Summarize the survey results in a short, easily understood text.* Use tables or graphs as necessary and preserve any important computations of benefits and costs.

CHAPTER REFERENCES

(43) *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements,* American Association of State Highway and Transportation Officials, Washington, DC (1977).

(44) Litman,T., *Defining and Quantifying Public Transit Benefits*, Victoria Transport Policy Institute, Victoria, BC, Canada (1997). Summarizes the Institute's *Transportation Cost Analysis*, a compendium of transportation cost and benefit estimating guidelines, which is also available as software for transit and highway benefit/cost studies.

(45) The AAA figures assume a four to six year vehicle life of 60,000 miles for an "average" car, based on business reimbursement standards for employees in late model cars, thereby overstating annual depreciation and other "ownership" or time-related charges for the normal lifetimes of automobiles (because ownership costs tend to decline with the age of a vehicle). Based instead on a 10-year, 100,000 mile life for the 1977 cost of about $18,000 for a six-cylinder Ford Taurus (the close equivalent of AAA's average car) gives annual depreciation of $1,800. The AAA finance charges add $307 when spaced over 10 years rather than 4. Average AAA insurance costs of $847/year and average license, registration, and tax costs of $216/year would likely decline by at least 15%, to $720 and $184, respectively, for a 10-year vehicle life. This brings adjusted ownership costs to $3011/year, or $.301/mile, which added to operating costs of $.108/mile ($.066 for gas & oil, $.028 for maintenance, and $.014 for tires) = $.409 or $.41/mile. The unadjusted AAA costs for an average car in 1997 are $.448 for motorists driving 15,000 miles/year for 4 years, and $.550 for a car driven 10,000 miles/year for six years.

(46) Time-related costs are deleted in order to obtain the cost per mile of driving a car that is already owned. The time-related costs are finance charges ($307); license, registration, and taxes ($151); and the time-related component of depreciation. The estimated time-related component of depreciation is $569, calculated as 31.6% of annual depreciation of $1,800 (calculation of time-related depreciation is based on Robley Winfrey's approach and data in *A Manual on User Benefits Analysis of Highway and Bus-Transit Improvements*, op. cit., page 181). The sum of these three deductions is $1,027, or $.103/mile for 10,000 miles, and $.103 subtracted from the adjusted cost per mile of $.409 derived in the preceding footnote leaves $.306, rounded to $.31/mile in Table 3-2.

Note that although insurance is normally regarded as an ownership cost, the insurance cost component of $762/year or $.076/mile that varies with miles driven is left in this $.307/mile figure. That is because 1) the incidence and associated costs of accidents are very dependent on the number of miles driven--insurance rates even vary somewhat with miles driven; 2) many auto accidents go unreported, or are uninsured, or result in costs below the deductible amount; 3) insurance seldom compensates the substantial time lost in settling claims and treating injuries; 4) even the reimbursed costs of motor vehicle accidents are a real added social cost that should somehow be included in comparisons of transit and automobile costs because transit travel is many times safer than automobile travel as measured by accident rates or costs per passenger mile; and 5) an insurance cost estimate of $.076/mile is well below the estimated total cost of accidents of $.12/mile and within the currently estimated range of $.037 to $.087/passenger mile for the safety benefits of transit compared with autos (Litman, op. cit.). If you disagree with this reasoning, just 1) subtract insurance costs of $.076 from total costs of $.306 to obtain $.230 or $.23/mile, and 2) remember to include separately the safety benefits of transit if they are relevant to your study.

(47) More specifically, $0.31/mile would represent a reduction of 63.7% in the annual AAA depreciation cost of $3,272 for 1997.

(48) *Microcomputer Evaluation of Highway User Benefits*, Final Report for NCHRP Project 7-12, October 31, 1993, p. A-48.

(49) Waters, W. *The Value of Time Savings for the Economic Evaluation of Highway Investments in British Columbia,* British Columbia Ministry of Transportation and Highways, Victoria, BC (March 1992) cited in Litman, op. cit., p. 7.

(50) Camph, D.H., *Dollars and Sense: The Economic Case for Public Transportation in America,* for The Campaign for Efficient Passenger Transportation, Washington, DC (July, 1997). Compared with the list in Table 3-4, Camph adds one type of benefit, for the macroeconomic effects of oil importation cost savings, and omits employer benefits and provider savings. Using averages of the ranges of estimates calculated by Camph, $17 billion or about 47% of the $36.2 billion in transit efficiency benefits came from item 7, congestion benefits; $8.4 billion from item 1, parking benefits; $3.5 billion from item 2; $1.6 billion each from items 3 & 4; $1.5 billion from item 8; $1.4 billion from item 9; and $1.2 billion from oil importation cost savings.

(51) Lewis, D. and O'Conner, M., *Economic Value of Affordable Mobility*, Paper 971367, Transportation Research Board annual meeting, January, 1997. The approach used by Lewis and O'Conner for estimating the mobility benefit is

called *consumer surplus.* This is the excess value created when the price of a commodity, here a transit trip, is reduced and the demand for the product increases accordingly. Consumer surplus is the sum of the value to users of the commodity in excess of what they would be willing to pay for the commodity. For example, as the price of a trip declines from $4 to $2, if demand increases from 100 to 200 trips, a consumer surplus of ($4-$2)/2 × 100 trips or $100 is created because all new riders except the last one would have been willing to ride at a higher cost than $2 per trip--an average of $4-$2/2 or $1 more. In theory, it would be possible to use consumer surplus for estimating individual transit improvement benefits. However, substantial information would be needed about the price elasticity of demand for transit (the percent change in trips divided by the percent change in prices), which averages -0.3 but varies with the starting price of the transit service and the income of the population served.

(52) Additional policies to promote equity for transit are espoused by the Victoria Transport Policy Institute (Litman, op. cit.), which references the following research results in support of the first two policies listed here: 1) *Least-Cost Planning: Principles, Applications and Issues,* US Department of Transportation, (July 1995), and 2) "Distance Based Vehicle Insurance as a TDM Strategy," *Transportation Quarterly* (Summer 1997).