

Chapter 3

Findings

In this chapter, we present the interpretation of the findings of this research project. This chapter draws on the work completed in all the project tasks to date, including those which have been previously described in the project technical memoranda and quarterly reports. The chapter is organized into sections on the basis of the research objectives, as presented in Chapter 1, Introduction.

The research culminating in this report has enabled us to piece together the critical elements of a story. This is the recent experience of transit agencies dealing with the dual challenge of (1) changing roles and requirements and (2) decreasing federal funding. The story, related in this chapter, begins with the exploration of the changing environment in which transit operates, in terms of the markets it serves, recent federal policy, and declining federal financial support. The story continues with observations on a variety of elements directly associated with each transit agency's financial and service performance, including non-federal funding sources, expenditures, service output, and performance measures. The goal is to develop an understanding of how transit agencies have fared in the more challenging environment they have been facing.

Using both the aggregate and disaggregate research results, we can trace overall industry trends as well as capture the significant variability in the experience of specific agencies. In other words, there is a substantial distribution of agency experiences around the "average" or "median" trend: some agencies will have fared much better; others will have found maintaining their funding and service to be a real struggle.

The Changing Service Requirements and Federal Funding Environment for Transit in the United States

The history of public funding for transit since the middle of the 20th century has been one of flux. The proportion of support at each of the federal, state, and local levels has varied, as has farebox recovery. Most recently, while total non-farebox transit funding has continued to grow faster than inflation (30

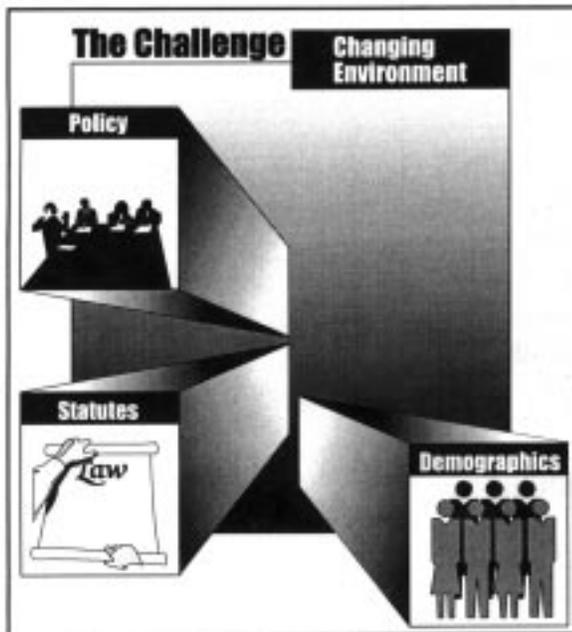
percent from 1989 to 1994, compared with 19 percent inflation), federal funding has largely not increased, and federal operating funds in particular have begun to decrease in nominal terms. At the same time, there have been new financial pressures placed on transit systems, primarily through federal legislation. In this section, we will discuss the changed funding environment facing transit agencies and how their financial operating situation has jeopardized their ability to meet the challenges and service goals.

Changing Roles and New Challenges for Transit

Although every transit agency operates in a unique transportation and political market, public transportation across the nation has been affected recently by changing demographic (and thus demand) patterns, regulations, and statutes. Transit agencies generally support the goals of specific federal regulatory policies; however, there is significant and justified concern that substantial costs are associated with these requirements without additional resources being made available. These changes have created new financial challenges for individual transit agencies as well as the entire industry. The major challenges faced by agencies and their ramifications are discussed below.

- Changing travel patterns are detrimental to the market competitiveness of transit vis-à-vis the automobile.** Travel is growing in market segments that are difficult or costly to serve by transit. Examples include the growth in suburb-to-suburb home-to-work trips, trip-chaining behavior, and the spread of automobile-oriented, low-density suburban developments. Even "edge cities," which combine residential, employment, and shopping activities, are automobile-dependent in design and difficult to serve effectively with transit.

The strongest metropolitan growth is occurring in the West and South, while growth is slowing in the Northeast and Midwest. However, all population growth has occurred in the suburbs. Only one-quarter of job growth is occurring in central cities, the traditional commuting market served by transit. Suburban job destinations have seen the majority of growth, with central city destinations continuing to slow. It is precisely in suburban job markets that transit has the lowest mode share among the markets it competes in: less than 5 percent, versus an 11 percent mode share for central city destinations (mode share measured for all trip purposes and times of day). Low-density suburban residential and work markets are more financially challenging to serve on a per unit basis.



Transit's customer base is weakening. Households without vehicles are a much more captive market for transit. Their number seems to be bottoming out at about 10 percent of all households. Of these households, the majority are single-person, most often elderly and female, and the majority in central cities. Half of vehicle-less households have no workers. Finally, the out-of-pocket costs of commuting by automobile (not including maintenance and depreciation, which commuters tend not to consider a cost of commuting) continue to *decline* in real dollars.

- **Transit has had to comply with new federal regulations such as Buy America requirements and drug and alcohol testing.** Since 1982, the FTA, like most other public agencies, became subject to the Buy America Act and is required to comply for all contracts and purchases, regardless of the amount. In 1995, the FTA relaxed these requirements — reducing red tape and raising the small purchase threshold to \$100,000. The Omnibus Transportation Employee Testing Act of 1991 requires all FTA grant recipients to establish drug and alcohol testing programs by 1996 (1995 for large operators), in the interest of public safety. While the costs to the industry of the Buy America requirements (both in terms of price competition and administrative burden) are not available in the literature, the costs of drug and alcohol testing have been studied.² Including some recent exemptions for non-profit agencies and pre-employment alcohol testing, the costs for the first 5 years (1995-1999) of this program have been estimated at a total of \$338.5 million, or an average of \$67.7 million per year. To put this in perspective, the average annual amount is equal to 9 percent of total 1994 FTA operating assistance.
- **The Americans with Disabilities Act of 1990 (ADA), and the resulting U.S.DOT regulations included significant requirements for public transportation providers (with implications for increases in low cost-recovery services).** These broadly included the following physical, service, and procedural requirements:
 - All new facilities (as well as key stations) and vehicles (or trainsets) must be accessible to people with disabilities;
 - Paratransit service must be offered to complement a fixed-route transit system;
 - Printed communication must be provided in accessible formats;
 - Special fares must be no more than double the basic fare for users of ADA-mandated services; and

- Personnel must be trained to serve passengers with disabilities equitably and to announce major stops.

The ADA requirements expand public transportation's market and bring social and economic benefits at a policy level. These, however, are balanced against the operating and capital budget impacts, where ADA is primarily evident as a series of costs.

One of the more costly provisions, and the one with the most impact on transit agency operating budgets, is the requirement to provide paratransit service for passengers unable to access a fixed-route system. Demand response paratransit service costs far more to provide per person than fixed-route bus service and service provision has increased dramatically in the past decade. For example, in 1994, demand response service cost \$13.16 per passenger (on a nationwide basis) compared with \$1.98 for conventional bus. Given the parity of fares for such services, this makes demand response a rather low cost-recovery service. And, although demand response accounted for less than 1 percent of all unlinked passenger-trips in 1994, ridership has grown rapidly (up 48 percent from 1989 to 1994) and represented 4.2 percent of 1994 operating costs.

Thus far, data on the overall costs of compliance (including capital costs) is based on projections and anecdotal evidence (reviewed in Tasks 1 and 2: Technical Memorandum); some estimates of average annualized costs do exist. The present research shows more clearly the potential significant and continuing impact on transit agency operating budgets. The data indicate that, while demand response usage continues to grow, the economic and market performance of this mode is declining. All three measures examined — cost-efficiency, cost-effectiveness, and service-effectiveness — worsened since 1989. This appears to indicate that demand response service is exhibiting decreasing returns, although whether the problem is service scale, scope, or density is unclear. In addition, these measures do not distinguish between existing and new services. The reason for this situation is not immediately apparent: circuitry of travel paths may be increasing; contract services may be purchased on a per-passenger basis, offering few economies; or many passengers may require personal attention from the driver (*e.g.*, boarding/alighting assistance), thereby limiting the volume of passengers transported per hour.

- **The Clean Air Act Amendments of 1990 (CAAA) and the Energy Policy Act of 1992 will affect transit agencies well into the next century.** The impact of these acts will mainly be felt on the capital expenditure side, as lower emission buses using new fuel types are purchased (mostly liquefied or compressed natural gas). Generally,

these buses are initially somewhat more costly than conventional buses and they may have to be purchased sooner than the fleet replacement requirements warrant. In addition, new fueling equipment or facilities are typically required. On the operating side, there is no information available to track the incremental costs, if any, of using these buses. The CAAA may have other potential impacts as state and local officials try to reduce single-occupant vehicle usage by expanding rail or rubber-tired transit services. These too have not yet been quantified. However, the current trends in the cost and revenue performance of different modes can serve as a guide to the potential impacts of service expansion and to the need for additional public funding support to achieve the aims of the CAAA.

- Most recently, 1996 legislation created a **major shift in federal welfare policy**, such that there are huge new pressures to match current welfare recipients with jobs to enable them to become self-sufficient. States have been given the responsibility for developing programs to reduce their welfare rolls, and individuals face the prospect of limited welfare benefits. Somewhat belatedly in the welfare debate, there was a recognition by the Administration and the Congress that a daunting problem facing this so-called "welfare-to-work" effort was transportation. Many of the targeted population have neither automobiles nor access to the public transportation that would allow them to reach the job markets. For example, while many welfare recipients live in older inner suburbs, jobs are available in the burgeoning retail and commercial markets in newer outer ring suburbs. However, the very-low-density, automobile-oriented outer ring suburbs may not be served by transit. In addition, even if there is transit, it often requires the job-seeker to make a very long commute on a radial line to the center city and then back to the outer ring — a commute that may well be time-prohibitive given parental responsibilities.

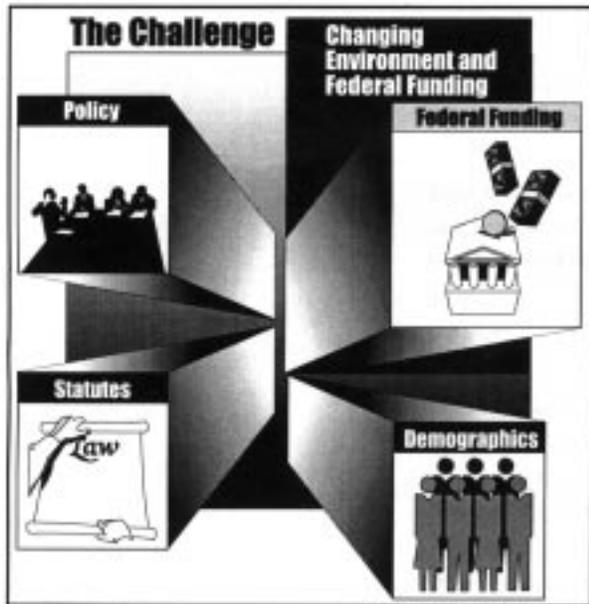
The surface transportation reauthorization legislation expected to be passed in 1997 may include a supplemental level of funding to address welfare-related transportation needs. While we cannot speculate on the sufficiency of these funds to enhance transit services so as to play a larger role in the success of welfare-to-work, it is certain that agencies will be hard-pressed to support the program's transit needs given recent overall trends in funding. It is likely that many transit agencies will begin to review and restructure some of their route networks.

Declining Federal Funding for Operations and Capital Programs

The typical transit agency might be proud to rise to the challenges of the policies outlined in the preceding paragraphs. However, to do so would, in most cases, require additional financial resources. The difficulty for agencies is that they have simultaneously been faced with reductions in traditional federal financial support, in particular for transit operations. The mandates and programs may increase certain agency costs (at least in the near term) while agencies (and their sponsoring states and localities) are finding themselves having to scramble to develop funding sources as the federal government reduces its support.

Total Federal Transit Act appropriations had recovered from a low of \$3.0 billion in 1990 to just over \$4.5 billion in FY

1995, a level not seen since 1983 (in unadjusted nominal dollars), although for FY 1996, levels were again reduced (to \$4.1 billion). However, the actual level of funding provided can be more closely tracked at the level of FTA obligations, which is what the FTA is actually able to distribute based not only on Federal Transit Act appropriations, but on other legislation and on the federal budget.³ Total obligations in the operating funding categories have remained within the same \$800 to \$900 million band since at least 1988. That is, operating funding has not been escalated to track with inflation in operating expenditure categories. If federal operating support had kept up with inflation between 1989 and 1994, FTA operating funds would have been \$930 million in 1994, instead of the \$770 million actually distributed in 1994.



The balance of obligations each year is for the capital programs (planning category funds are a negligible percentage of the total). This capital amount has increased steadily since the early 1990s, although the discretionary portion (as opposed to the formula portion) fluctuates each year as a function of the fund drawdown needs of the specific capital projects. Capital funding has also benefited from the flexible funding provisions enacted with the Intermodal Surface Transportation Efficiency Act (ISTEA). Flexible funds (from the STP and CMAQ programs under ISTEA) have become an important component of total FTA capital funding. They have risen to \$907 million obligated in FY 1995, or 14 percent of the total for that year.⁴ However, even if this funding continues to increase, it is limited to capital assistance.

The following observations are based on the disaggregate analysis of NTD data from 1989 to 1994:

- The analysis confirms that total federal operating funding has been essentially unchanged in nominal dollars, with an increase of 1.1 percent over 5 years, demonstrating a decrease in actual value, compared to the 18.8 percent rate inflation over the same period.
- While for larger transit agencies, federal funding may account for less than 5 percent of total operating funding (including fares), the reliance on federal funds increases as agency size decreases, up to nearly 30 percent. Small agencies are more sensitive to changes in federal funding, and these changes in funding have varied considerably among transit agencies: one-third have lost funding, the median agency gained 8 percent (which is a real dollar loss) and 25 percent of agencies saw at least a one-third increase. Only one-third of large and medium agencies saw federal funding increases; however, these increases were less than inflation.
- Federal funding is the largest source for capital expenditures, although its percentage of the total has declined. Federal funds have increased only slightly (and at a rate slower than inflation), while state and, in particular, local sources have grown rapidly to meet capital needs. (See discussion of Funding from Non-federal Sources below.)
- Federal non-urbanized area formula funds (funds for cities with populations of less than 50,000) have increased. Other federal operating support increased 40 percent, but the amounts were less than \$100 million a year. On the capital side, ISTEA's CMAQ and STP funds are being flexed. While the figure for annual outlays (cash disbursements) is not available, funds obligated have risen to almost \$900 million in FY 1995 (outlays will follow as capital expenditures on multi-year projects are made).

In the past several years, the FTA has been adjusting the definition of allowable operating and capital expenditures in an effort to reduce the effects of diminishing public funding on transit agencies' operations. For example, certain categories of work and materials used in bus maintenance programs are now allowable capital expenditures. Although this "capitalization of operating expenses" has brought some relief, it is a double-edged sword. It may relieve pressure on the operating budget in the short term, but in the long term it may tie up an increasing portion of formula funding for capital investments. In addition, if agencies' capital expenses are bonded, they are financing short-term costs over 30 years with interest.

In conclusion, while federal regulations and policies are creating new challenges for transit agencies, there has not been a concurrent increase in resources— indeed, federal funding has lost value to inflation. This confirms the outcry of "unfunded mandates" and shrinking federal support for transit. While many transit agencies have been able to offset real declines in federal operating support from state, local, and other sources, those that have not will face a worsening cost-revenue situation in the coming years.

Responses to the Financial Environment: Changing Transit Agency Funding, Services, and Performance Characteristics

The environment described thus far has created a feeling in the public transportation industry that there is a looming financial crisis. This perspective is fueled by demographic changes, new statutes and regulations, and insufficient federal funding support. The crisis feeling is compounded by the fact that most of the factors are outside the control of transit agency managers.

The question is: how have transit agencies responded to this financial situation? An agency might seek out new sources of financial support at the state and local levels, where the value of the services they provide are most evident. An agency may seek to reduce the cost of their existing services or increase productivity. An agency may curtail expansion of new services or even cut certain services back, in an effort to balance their budgets. This section examines the evidence for any of these actions.

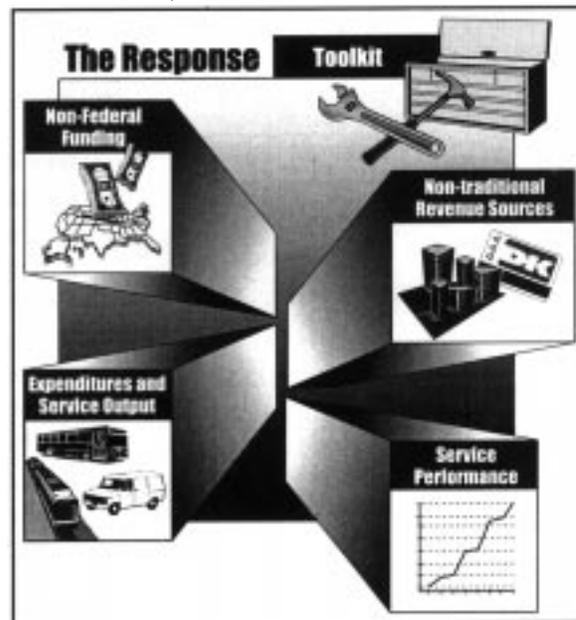
The findings are based primarily on the detailed analysis of the NTD data. The research is not conclusive on the causal relationship; that is, the analysis undertaken for this project does not necessarily imply that the changes in non-federal funding, service levels, and performance measures described below follow from the environmental changes. More detailed econometric analysis would be required to understand the causal relationship. Nevertheless, the findings below are instructive in terms of understanding how agencies have "made ends meet" in the recent environment and how they may adapt in the future.

Funding From Non-Federal Sources and Fares

As federal funding has failed to keep pace with inflation and the needs created by federal mandates have increased, transit agencies have had to look elsewhere for funding. To date, these non-federal sources appear to have filled the funding gap. What is not clear is how much more of the transportation market transit

could capture if sufficient funding were available for better service levels and service quality, at the same or lower fares. Nonfederal funding sources have become the primary source of operating income for most agencies.

- Fares have generally increased at a rate far faster than inflation with larger increases occurring at medium and smaller agencies. This may be due to the fact that federal funding is a larger proportion of total funding at smaller agencies, where the revenue impacts of federal cuts are greater. These fare increases are counter-productive in an era when transit is struggling to maintain market share and to continue to serve lower income groups and people with few mobility alternatives.
- General state and local funding for transit operations has dropped in nominal dollars. Instead, dedicated funding for operations (which includes dedicated taxes and other dedicated funds at the state, local, and agency-jurisdiction levels) increased by 50 percent in the period of analysis, making it the second largest in 1994 behind farebox revenue. This indicates a significant shift of funding responsibility to the communities that benefit from transit because, in most cases, dedicated taxes have to be voter-approved.
- State and local funding for capital expenditures has grown well ahead of both federal funding and the rate of inflation. Again, however, dedicated capital funds (from dedicated taxes and other dedicated sources at the state, local, and agency-jurisdiction levels) have seen a tremendous jump, more than tripling from 1989 to 1994, reaching a magnitude second only to federal capital funding. It would appear that voters and communities have found dedicated funding, when related to specific capital programs, to be a good alternative to federal funding which has declined in real terms.



Expenditures and Service Output

- Transit expenditures have increased only slightly faster than inflation on both the operating and capital sides. Agencies adjust their activities and plans so that their budgets balance (with the notable exception of certain agencies who can smooth short-term funding changes through the use of debt instruments). Thus, it is natural to see that total expenditures have tracked with total

funding. Operating expenditure percentage increases (21.4 percent) have indeed approximately tracked funding percentage increases (22.9 percent) although, in absolute magnitude, reported operating expenditures have consistently lagged reported funding by several hundred million dollars.

- The survey of transit agencies found that, despite the funding concerns and specific agencies' service cuts, service (measured in revenue-hours) was continuing to expand. From 1989 to 1994, the median growth level was 16 percent in light rail, 43 percent in demand response, and 4 percent in commuter rail. Other modes demonstrated lower or zero growth at the median. Clearly, a large part of the expansion was in ADA-mandated paratransit service, although, in some cases, there has been an expansion in rail service along with a realignment of feeder bus routes. At the same time, agencies have had to delay service expansions and investments as a result of the near-term expansion of ADA services. In summary, although the specific experience of different agencies has spanned crisis management to managing difficult funding pressures, transit has, in general, stayed the course.
- It is unclear whether agencies have been able to maintain their market shares and fulfill their missions. The funding pressures make it difficult to continually adapt to changing travel patterns and service quality demands. As a result, transit agencies are less able to be proactive and high-profile in their communities as planning and development continue. Census data (1990 compared with 1980) show that all population and most employment *net* growth is occurring in lower-density suburban locations to the detriment of traditionally center-city-oriented transit systems.⁵
- Transit supply has increased overall and in all regions, measured in revenue-miles and revenue-hours. However, this total belies the important differences among modes. Demand response service increased dramatically — a result primarily of ADA service implementation — and light rail increased as well — as a number of medium-sized cities added or expanded this service, popular with the public and with politicians. On the other hand, heavy rail, commuter rail, and *small* bus systems demonstrated the greatest reduction in service provided. For the former two, this may be tied to reduced ridership and funding in the larger metropolitan areas where they operate and *from* which residential population is shifting. The latter is probably more symptomatic of funding cuts. All told, the medium-sized agencies saw the most consistency in

increased service. Interestingly, this agency type also saw the greatest increase in median fares.

Performance

- It appears that the costlier modes to operate (demand response and light rail) are the modes experiencing growing service. However, these modes appear to be exhibiting decreasing returns to scale: unit cost-efficiency measures (the cost of operating service per revenue-hour of service) are worsening as output increases. For light rail, this may be related to the startup phases of the younger systems. Capital costs are not included in these operating performance measures so that the decreasing average costs normally associated with capital-intensive investments (and which result from the effects of the high initial investment and low marginal cost of transporting each passenger) are not present. Alternatively, new systems brought on line may be starting off with lower cost-efficiency.

Demand response, whose cost-effectiveness (the cost of operating service per passenger served) and service-effectiveness (the number of passengers served per revenue-hour of operations) performance is also worsening, may be subject to the effects of non-optimal networks, dispersed and irregular passenger demand, and growing length of individual passenger trips. These trends are of real concern; it is unclear whether increasing returns to scale will be achievable for demand response services designed to satisfy ADA.⁶ From 1989 to 1994, the average (not median) cost of transporting a passenger on demand response has gone up from \$8.94 to \$13.24, an increase of 48 percent — far ahead of inflation. Similarly, the average revenue-hours per passenger-trip performance measure for demand response has increased 26 percent, from 0.29 to 0.37.

- Light rail, however, is showing improvements in effectiveness. Ridership is growing as new services are being implemented.
- Another significant trend is that larger agencies have not been able to cut service as fast as their ridership losses thus worsening their cost- and service-effectiveness.
- The decreasing availability of public funds does not appear to have had as much of a positive impact on cost-efficiency, cost-effectiveness or service-effectiveness as one would have imagined. This is clear because there have been few distinct improvements in any of these performance measures. This may not be surprising — such

improvements in a public-sector industry rarely happen in a short time. On the other hand, there *have* been some clear changes in certain specific areas that seem to correspond with trends in service provision.

- Additional disaggregate analysis of the NTD in a future project could examine more closely the following postulated transit agency behavior:
 - Cutting low-productivity services,
 - Cutting low-revenue routes, and
 - Cutting service on high overhead modes or cutting overhead costs.

Strategies for Public Transportation Funding

One of the goals of this research project was to explore in greater detail a number of specific strategies that transit agencies have undertaken in response to the increased financial pressures, particularly with respect to funding operations. We have developed 17 case studies of strategies that have proven successful.⁷ The case studies are provided under separate cover in the *Project H-7 Casebook—Funding Strategies for Public Transportation*.

Some of the cases represent innovative approaches used by several agencies; others have been used more often but could be pursued by other agencies. Some of the cases involve revenue enhancement; others get at the operating funding needs issue through operating cost reduction or capital expenditures that allow for lower ongoing operating costs.

The cases can be organized into three groups as follows:

- **Leveraging limited funding.** This group includes new uses of FTA funding (*e.g.*, advanced construction authority and progress payments) and low-cost financing through revolving loan funds and state infrastructure banks. In addition, since the passage of ISTEA, use of flexible highway funding for transit purposes has been increasing.
- **Use of assets to maximize value.** A number of cases show how agencies can use the commercial value inherent in transit rolling stock and real property to generate additional revenue streams. These cases include advertising on vehicles and at stations/shelters, parallel leases along rights-of-way, joint development of residential and commercial spaces at major stations, and concessions for station commerce.
- **Partnerships with the private sector and transit users.** The theme here is partnerships. First, the partnerships may be with the private sector, in the form of suppliers (*e.g.*,

progress payments for vehicle purchases and compressed natural gas suppliers), investors (*e.g.*, cross-border leases), developers (*e.g.*, turnkey facility development and joint development of stations), and retailers (*e.g.*, credit card fare payment using ticket issuing machines). Second, the partnerships may be with groups of users or entire communities that value transit services. This second group includes impact fees, local sales or utility taxes, direct operating support, and the use of passes (*e.g.*, Eco Pass).

These strategies have varying potential for helping to alleviate operating funding pressures: some have a large magnitude (*e.g.*, sales tax) while others are more marginal (*e.g.*, advertising revenue). Some have less direct budgetary impacts (*e.g.*, joint station development) while others may be "only the tip of the iceberg" (*e.g.*, asset value maximization). Finally, some are simultaneously addressing recent federal mandates (*e.g.*, natural gas bus facilities) or policy shifts (*e.g.*, increased use of private sector partnerships).

While researching the case studies as well as during presentations at APTA conferences, we found that many transit agencies of varying sizes were interested in these strategies. It would appear that many of these ideas, if not new for federal and national industry observers, still offer substantial potential to agencies across the country. Although no one strategy will resolve a major funding crisis at a particular agency, each could prove to be a useful tool to address funding needs.

Endnotes

- 1 This discussion is based on data in *Commuting in America*, Eno Transportation Foundation, 1996.
- 2 TCRP J-6, referenced in Tasks 1 and 2: Technical Memorandum, p. 54.
- 3 The actual disbursements are termed apportionments (for formula funds) and outlays (for discretionary funds) and can be still slightly lower than obligations. However, full data were not available at this level of detail.
- 4 Funds are flexed to a specific FTA capital program so that the total FTA capital funds obligated amount mentioned earlier includes flexible funds. Actual outlays of obligated funds will not all occur in the obligation year.
- 5 Eno, 1996, op. cit.
- 6 There may be opportunities for greater efficiency in the case of general public dial-a-ride services. Further research could be done on these returns to scale and efficiency issues.
- 7 We have deliberately left out farebox revenue enhancement strategies which were explored in TCRP Project A-1 [TCRP Report 10](#), "Fare Policies, Structures, and Technologies," Transportation Research Board, Washington, D.C. (1996).

Chapter 4

Implications of the Findings for the Transit Industry

This chapter summarizes the transit funding, service, and economic "picture" and discussing the implications for future funding strategies and ideas for future research.

Summary of the Transit Financial Situation and Transit Service Trends

There have been recent decreases in funding for many transit agencies in the United States. The funding limitations have resulted in tougher choices among competing service priorities for transit managers, including deferrals in projects and service changes and improvements. This has resulted in slower growth than would otherwise have been anticipated but has not stifled growth altogether.

The requirements laid out by ADA have led to a channeling of resources and growth to the demand response mode. Unfortunately, among all of an agency's services, demand response is typically among the lowest in terms of cost-efficiency and cost-effectiveness. This situation is making it increasingly difficult for transit to keep pace with its primary competition — the private automobile.

The insecurity in the annual level of federal operating and capital funding works against proactive service and capital planning, at least for agencies that have had a relatively greater reliance on federal funds. Despite the promise of ISTEA's intermodal approach and flexible funding, an agency in, say, 1992, looking forward, might have had to become more cautious and reactive in its approach, focusing on meeting recently imposed federal mandates. This approach might work against improvements in modes that involve greater financial commitments, such as all aspects of rail and major bus programs, including intermodal stations.

We have found that, despite the real decline of federal funding for operations, the gap between funding and growing nominal operating expenditures has been bridged primarily through a rapid increase in dedicated funding sources. Dedicated

funds are now the largest funding component behind the farebox. However, an often expressed concern is that states and localities, whether through general or dedicated revenue, will not be able to make up further relative declines in federal support.

In response to this concern, one must consider two issues:

- Whether or not the federal government should be providing operating support to transit (*i.e.*, whether it is appropriate for this funding responsibility to be increasingly "devolved" to states and municipalities. This issue is not examined here).
- Whether or not states and localities can afford to take over the federal role. In 1994, federal operating funding amounted to about \$900 million, while state and local operating funding (including dedicated and general funds) reached \$9 billion. The state and local involvement needs to increase a further 10 percent (above the rate of inflation) to cover the federal share. However, the hundreds of state and local entities that are affected have varying abilities to pay, particularly in this era of tightening state and local budgets and may experience significant hardship.

Fares continue to make up, on average, just over one-third of total operating funds. While the majority of agencies have continued to increase fares, only about one-half of the increases have been ahead of inflation. The greatest fare increases were at medium-sized agencies, at both those providing only demand response service and those with light rail, both of which already have low farebox recovery. It is unclear what direct impact fare increases (generally in line with inflation) have had on transit's ability to fulfill equity and mobility goals. However, we do know that automobile out-of-pocket costs have increased well below inflation. This helps to explain why there is a perception that transit is becoming a more expensive mode for the markets it serves.

On the capital side, the federal government still maintains the largest funding role, underpinning capital investment in all modes and settings across the country. Federal capital funding has continued to increase (albeit at a rate slower than inflation) and is anticipated to remain strong in the future.

The long-term demographic changes in the United States have meant a loss of riders in "traditional" modes (*i.e.*, commuter rail, heavy rail, and bus) and larger and older metropolitan areas. The reason is partly because lower-density residential patterns and more dispersed job growth patterns are harder (or at least more expensive) to serve effectively through the mass transportation of passengers. This loss has likely been compounded by the fact that funding pressures and fairly narrow mandates have made it more difficult for transit agencies to

develop the kinds of new services needed to respond to the changing demographics of the populations they serve. Those agencies dealing with the need to reduce service levels or service quality due to funding reductions would clearly have a harder time focusing on service improvements.

Demand response service is, almost by definition, a less efficient mode than higher-capacity, fixed-route/guideway service. Its basic characteristic — reinforced by ADA — is that it serves a more dispersed population that cannot use or has difficult access to a nearby fixed-route, higher-capacity mode. Despite this inherent problem, an increase in efficiency and effectiveness may still be possible.

Light rail service is growing and attracting new ridership at a faster rate than other modes and its effectiveness measures appear to be improving. Nevertheless, cost-efficiency remains a problem. Costs do not appear to be entirely under control, at least with respect to the newer light rail services. These services may still be in an increasing marginal cost phase, as new systems come on line and expand.

In these two modes where the fastest service expansion has taken place, the next 5 years of data and experience may show further significant changes.

Implications for Future Strategies

The findings of this research project do not seem to indicate that there is an imminent, widespread financial crisis in the U.S. transit industry with transit services failing everywhere. Nevertheless, there has been a clear trend of reductions in the real value of federal funding available for public transportation. Transit agencies have responded to this potential crisis by focusing their efforts on finding alternatives to federal operating funding and have channeled much of their limited operating resources into meeting ADA requirements. Agencies that have expanded light rail services have to deal with the budget consequences of a mode that, while successful in carrying passengers, appears to have some youthful problems of relatively low cost-efficiency. This is not to say that no agency has faced a crisis. The aggregate picture often masks the disaggregate one; some agencies have had to cut service dramatically or have been forced to put off service improvements and expansions that would allow them to keep pace with growing travel needs and to maintain their mode share.

For the years since 1994, we observe from published FTA data that federal operating funding has continued at a level under \$1 billion. State and local sources will presumably have made up

the difference, at least covering expenditure increases related to inflation. However, the rate of inflation has generally been low (compared to historical levels in the United States) and the economy has been relatively strong, suggesting that dedicated tax sources, which have become so prominent in funding transit, have been robust. The financial condition may have remained largely stable since 1994, at least for the industry as a whole.

Nevertheless, the past is not necessarily a good guide for the future, and the funding picture may worsen. It would be dangerous to conclude that transit as an industry is doing well despite decreasing federal funding. A more appropriate depiction would be that it has been able to cope with the funding issues and the federal mandates — mainly with the increased support of states and localities. Reliance on dedicated tax-based sources means that the industry will be less sheltered from future economic cycles.

The most recent challenge to transit agencies is the move to full ADA compliance that was intended to be completed in 1997 and the financial effects of which are not yet evident. Indications are that some agencies will need more time to fully implement the required changes and services, including demand response services. From 1994 through 1997, demand response service and expenditures increases will have continued.

The case studies of non-traditional and innovative funding strategies have pointed to several strategic approaches for transit agencies to continue to augment their financial resources in the future. Some of the strategies can provide significant resources for major expenditure elements while others provide smaller-scale (in terms of budgetary impact) rewards.

- Transit agencies should continue communicating more directly with their customers about tying specific services to funding sources. Whether through direct funding of university area services, partnerships with local businesses, or local, regional, and state taxes, transit agencies can go to the users to find out what kind of service they want, provide it, and ask them to help pay for it. The broad shift in operating funding to dedicated sources at the state and local levels also reflects a move closer to the users and beneficiaries of transit service.
- Transit agencies possess a range of assets with substantial value to other, typically private, parties which should be tapped. Such assets include vehicles (for advertising and leasing), stations (for joint development and concessions), and rights-of-way (for telecommunications infrastructure). The accumulated public investment in these assets has the potential to generate private sector benefits, which can be directed back to the transit agencies.

- In addition to leveraging value from their assets, transit agencies should take advantage of other financial leveraging mechanisms, many of which have been available to other public infrastructure sectors for some time. These mechanisms include revolving loan funds and credit enhancement as well as advanced construction authority. Most involve the use of debt financing, especially among larger agencies. In the future, its use could become more widespread and at lower cost. At the same time, agencies will have to take care to not become over-leveraged, putting their future at risk to finance the present.

The implication of our review is *not* that federal operating support need not increase. Indeed, with more substantive funding tied at a *minimum* to the increasing levels of automobile usage and funding, transit services in all settings around the country could be improved and broadened. Transit could play a much larger role in relieving congestion, improving air quality, and providing mobility to both transit-dependent and discretionary transit users. Increasing operating funding from current levels might provide the opportunity to meet such goals.

Ideas for Future Research

The findings of this research project also point to a number of research areas that could produce additional benefits to the industry.

Development of Econometric Behavioral Models

The National Transit Database is a very rich, disaggregate source of information on transit agency funding, service, costs, and performance. Despite some problems, including imperfect reporting, it represents an almost complete sample of U.S. transit agencies.

The findings provided in this report are factual, based on the data analysis, but do not go so far as to develop causal relationships or econometric models. Such models could be used to better understand agency behavior and responses in the recent past as well as to predict future transit agency performance. There is sufficiently detailed information in the database, which could be combined with census data, labor statistics, and other information, to develop complex multivariate models representing transit agencies and their markets. While studies have been performed on transit agency cost structure and cost curves as well as on ridership and revenue elasticity, a future study could attempt to model transit agencies' performance in the broader context of their demographic, financial, and institutional environment.

Case Studies of Best Performers and of Most Troubled Agencies

The case studies focused on identifying non-traditional and innovative funding practices that could find wider application across the U.S. transit industry. Additional case studies could be undertaken with a similar knowledge-sharing objective. These cases would focus on agencies that have fared particularly well or particularly poorly in the recently changing transit market, policy, and funding environment. The objective would be to understand what characteristics about the agencies and specific actions taken by the agencies have led to either result. Lessons could be drawn from this analysis that would be useful to policy-makers and to transit managers.

Criteria for selection of these case agencies could focus on various definitions of success or failure. For example, an agency may have been particularly adept at attracting state and local financial support. Another may have experienced extreme declines in ridership. The National Transit Database could be used to identify case agencies in two ways: first, by identifying agencies with particularly high or low values of key measures, and second, by identifying agencies with particularly high or low values of *changes* in key measures over the period of analysis.

Research on Improving the Performance of Demand Response

Demand response service has been the fastest-growing segment of transit service in the United States, overtaking all rail modes (individually) in vehicle-hours, although remaining a distant second to bus. Its growth has been spurred by the requirement to comply with ADA, specifically the requirement that disabled-accessible transit service be provided to all potential patrons within 3/4 miles of fixed-route service. Demand response service is typically provided by vehicles much smaller than standard buses, with pickups and dropoffs based on the specific needs of the customers within the agency's service area.

The findings of this research project indicate that the cost-efficiency and cost-effectiveness of this mode has been declining (at least through 1994). This is a troublesome fact, given that, by 1997, all agencies will have had to comply with ADA, in most cases implementing some form of demand response service. In addition, the cap on demand response service fares (double an agency's fare for the comparable route service) makes it a mode that has a relatively low farebox recovery ratio. Given these facts, it would seem timely and very relevant to explore the fundamental economics of providing this type of service. What drives the higher cost per unit of providing this service and what can be done to improve cost-efficiency and cost-effectiveness? Can more optimal methods be developed of scheduling pickups

and dropoffs? Can different types of contracts be developed to control costs using purchased service providers? It may even be relevant to discuss certain cases in low-density areas where it may be more cost-effective to provide *only* demand response service rather than using it to supplement fixed-route bus service.

Policy and Economic Research into the Appropriate Federal Role in Transit Capital and Operations

Federal involvement in operating funding for transit has waned, while support for transit capital programs has continued. Lower levels of government, including states, localities, and transit agencies' own jurisdictions (*e.g.*, regional transportation authorities) have stepped in to fill the gap. In some ways, transit begins to look more like other modes of transportation that involve government investment, such as highways and airports/airways. For these modes, the federal role is primarily in allocating general and dedicated revenue for purchasing and maintaining capital assets around the country (*e.g.*, highways and airside safety functions) usually through state DOTs and other local entities. The federal role in actually operating service is minimal.

Transit, however, is not directly comparable to the other modes. Indeed, transit is often looked upon as more of a public service which calls for government support. The real question is, what level of government should that support come from? Should it be state and local government that is most concerned with "purchasing" (through operating support) certain levels of transit service? What is the advantage of capital investment being controlled (at least partially) by Congress, while operating support becomes the unique purview of lower levels of government? The answers can be explored through a policy/institutional analysis lens as well as an economist's lens. The federal transit funding strategy actually pursued in recent years may not reflect sound theory and practice. This research can help us understand the appropriate direction for federal funding policies for the nation's public transportation systems.

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Appendix A

Background

This technical appendix serves as an addendum to the data in the Technical Memoranda for Tasks 1-4. This technical appendix provides detailed information on the additional National Transit Database (NTD) analyses performed in support of the final report.

Data Source

All data was obtained from the NTD (formerly Section 15 reports). The NTD, administered by the Federal Transit Administration (FTA), provides detailed summaries of financial and operating data submitted to the FTA by the nation's mass transit providers.

Period Analyzed

Our analysis covers the period from 1989 to 1994. We used this period because it covers the recent past and is a period during which the industry was undergoing changes in government policy and funding (including ISTEA, ADA, and CAAA). All trends are based on the experiences recorded between the end-years of 1989 and 1994 and did not include trends in the interim years (*i.e.*, 1990 to 1993). Based on our review of the data, the trends in these years were generally consistent with the "1989 to 1994" results, and inclusion of the additional years would not have provided substantial added value. Our review did not include the post-1994 period because these data were not available from the FTA at the time of the analysis.

Use of Nominal Dollars

All financial data and statistics are based on nominal dollars and are, therefore, not adjusted for inflation.

Purpose of Analysis

In the review of the results provided by Tasks 1-4, we determined that it would be valuable to conduct more detailed analysis of a few of the more interesting and relevant measures. In Tasks 1-4, emphasis was placed on the *average* result of a particular measure. While averages are informative to draw general conclusions, we decided to perform additional analysis which would provide information at a more disaggregated level.

To do this, we performed analysis using the SAS statistical program. Analysis was conducted on a number of indicators and measures. We summarized the results of the SAS programming for each measure in a table format, as listed below:

- Passenger Fares — Table A-1
- Operating Revenues/Funding — Table A-2
- Capital Revenues/Funding — Table A-3
- Service Level (*i.e.*, Vehicle Revenue-hours) — Table A-4
- Cost-Effectiveness (*i.e.*, Operating Costs/Vehicle Revenue-hour) — Table A-5
- Service-Effectiveness (*i.e.*, Unlinked Passenger Trips/Vehicle Revenue-hour) — Table A-6

For Passenger Fares, the table provides the following general statistics on total passenger fares per unlinked passenger trips for 1989 and 1994:

1. N — number of systems on which analysis was conducted
2. Mean — average passenger fare (calculated as total farebox revenue/total unlinked passenger trips)
3. Standard Deviation — indicating the spread of the distribution of fares from the mean, either positive or negative
4. Median — value of the central point, where there are an equal number of fares with a value higher and lower than this point
5. Maximum — maximum passenger fare charged
6. Minimum — minimum passenger fare charged
7. % Missing — percent of all systems with no data on passenger fares
8. % Change — percent change between 1989 and 1994 in above categories

For all measures *except* Passenger Fares, the information presented in these charts provides the following general statistics for 1989 and 1994:

1. Number of systems for which selected measure is zero in 1989 only
2. Number of systems for which selected measure is zero in both 1989 and 1994
3. Total Number of systems (N) on which analysis was conducted — this number is the net of items 1 and 2 above
4. Increase in number of users of revenue source (for capital and operating revenue measures only) — indicates number of systems for which measure increased from zero in 1989
5. Magnitude of Change for 25th quartile — indicates percent increase in the selected measure from 1989 to 1994 for the system whose measure falls at the 25th percentile mark of all agencies
6. Magnitude of Change for median — indicates percent increase in the selected measure from 1989 to 1994 for the system whose measure falls at the median of all agencies
7. Magnitude of Change for 75th quartile — indicates percent increase in the selected measure from 1989 to 1994 for the system whose measure falls at the 75th percentile mark of all agencies
8. Number per Direction of Change (Up) — indicates number of systems for which the selected measure increased from 1989 to 1994
9. Number per Direction Change (no change) — indicates number of systems for which the selected measure was the same in 1989 and 1994
10. Number per Direction of Change (Down) — indicates number of systems for which the selected measure decreased from 1989 to 1994

Please find all the tables on the following pages.

Table A-1: Analysis of Fare

Stratum	Year	N	Mean	Std. Dev.	Median	Max	Min	%Miss.	Notes
Overall	1989	405 \$	0.64 \$	0.96 \$	0.41 \$	9.75 \$	0.00	18%	
	1994	388 \$	0.74 \$	1.00 \$	0.49 \$	8.94 \$	0.00	20%	
						% Up	% Down		
	% Change	333	n.a.	n.a.	20%	80%	20%	42%	Mean is skewed by a few very high changes
	Change in Mean		16%						
	Change in Median				20%				
HR/CR	1989	26 \$	1.29 \$	0.13 \$	0.68 \$	6.15 \$	0.31	19%	
	1994	23 \$	1.44 \$	1.14 \$	0.89 \$	4.15 \$	0.19	18%	
						% Up	% Down		
	% Change	20	21%	17%	17%	95%	5%	29%	Only one reduction: -4.5% at NY-PATH. Highest change is +57% at NYCTA.
	Change in Mean		12%						
	Change in Median				31%				
LR	1989	7 \$	0.48 \$	0.16 \$	0.44 \$	0.78 \$	0.32	0%	
	1994	13 \$	0.58 \$	0.14 \$	0.57 \$	0.86 \$	0.39	0%	
						% Up	% Down		
	% Change	13	28%	22%	26%	92%	8%	0%	Only one reduction: -4.3% at St. Louis Bi-State Highest change is +80% at Galveston Island Transit
	Change in Mean		21%						
	Change in Median				28%				
Bus	1989	332 \$	0.57 \$	0.82 \$	0.39 \$	7.58 \$	0.000	14%	
	1994	315 \$	0.62 \$	0.89 \$	0.46 \$	8.94 \$	0.00	16%	
						% Up	% Down		
	% Change	281 \$	41%	214%	19%	78%	22%	25%	Std.dev. reflects impact of several high outliers.
	Change in Mean		9%						
	Change in Median				19%				
DR	1989	34 \$	0.78 \$	1.65 \$	0.47 \$	9.75 \$	0.01	42%	
	1994	32 \$	1.37 \$	1.62 \$	0.83 \$	7.11 \$	0.03	49%	
						% Up	% Down		
	% Change	17	n.a.	n.a.	62%	100%	0%	73%	Too few obs for meaningful results. Highest change is +80% at Galveston Island Transit.
	Change in Mean		75%						
	Change in Median				76%				
Other	1989	6 \$	1.30 \$	1.05 \$	1.28 \$	3.17 \$	0.11	14%	One missing
	1994	5 \$	0.92 \$	0.54 \$	0.88 \$	1.65 \$	0.40	50%	
						% Up	% Down		
	% Change	2n.a.	n.a.	n.a.	100%	0%	80%		Too few obs for meaningful results.
	Change in Mean		n.a.						
	Change in Median				n.a.				

Table A-1: Analysis of Fare (continued)

Stratum	Year	N	Mean	Std. Dev.	Median	Max	Min	%Miss.	Notes
Overall	1989	405 \$	0.64 \$	0.96 \$	0.41 \$	9.75 \$	0.00	18%	
	1994	388 \$	0.74 \$	1.00 \$	0.49 \$	8.94 \$	0.00	20%	
						% Up	% Down		
	% Change	333	n.a.	n.a.	20%	80%	20%	42%	Mean is skewed by a few very high changes
	Change in Mean		16%						
	Change in Median				20%				
Small	1989	299 \$	0.56 \$	0.86 \$	0.38 \$	9.75 \$	0.00	19%	No clear modal pattern.
	1994	278 \$	0.68 \$	0.97 \$	0.45 \$	8.94 \$	0.00	22%	No clear modal pattern.
						% Up	% Down		
	% Change	228	n.a.	n.a.	20%	77%	23%	36%	Skewed by very high outliers.
	Change in Mean		12%						
	Change in Median				19%				
Medium	1989	82 \$	0.89 \$	1.28 \$	0.47 \$	7.58 \$	0.11	18%	Among the highest are suburban/express buses and commuter rail (e.g., Metra).
	1994	82 \$	0.89 \$	1.14 \$	0.58 \$	7.88 \$	0.06	19%	
						% Up	% Down		
	% Change	78	32%	43%	22%	87%	13%	23%	About 25% have over +50%, 5% have over +150%.
	Change in Mean		-1%						
	Change in Median				25%				
Large	1989	24 \$	0.78 \$	0.78 \$	0.54 \$	3.49 \$	0.32	0%	Max: NY Metro-North. Min: SF MUNI.
	1994	28 \$	0.85 \$	0.85 \$	0.61 \$	4.15 \$	0.27	7%	Max: NY Metro-North. Min: San Antonio VIA
						% Up	% Down		
	% Change	27	21%	20%	17%	93%	7%	10%	Dallas DART shows 31% drop. Largest increase of 65% at Minneapolis-St. Paul.
	Change in Mean		9%						
	Change in Median				19%				

Notes: N represents non-missing observations used in calculations.

% Missing indicates percentage of all observations for that year that had missing data, thus preventing calculations.

Since FARE uses unlinked trips, agencies with relatively higher transfers per passenger will show lower FARE. (e.g., NYCTA basic fare is \$1.50, but FARE is \$0.89.)

Greater use of discount passes lowers FARE. (e.g., from 1989 to 1994 e.g., WMATA FARE is \$0.91, with few free transfers.)

The above two comments apply equally in an aggregated manner for the above tables.

A std. dev. larger than mean indicates skewness on high end (because values < 0 are impossible).

HR/CR Agency operates Heavy Rail and/or Commuter Rail, plus others.

LR Agency operates Light Rail, plus others, but no other rail.

Bus Agency operates motor bus, plus others, but no rail.

DR Agency operates demand response exclusively.

Other Agency operates only modes other than those above.

Large Total vehicles in service (i.e., not including spares, etc.) 500 or over.

Medium Total vehicles in service (i.e., not including spares, etc.) 100 to 499.

Small Total vehicles in service (i.e., not including spares, etc.) less than 100.

Table A-2: Analysis of Operating Revenues

		# with funding source				Growth (new user since 1989)	Changes in Each Source						% neither year
		1994 Only	Neither Year	Net Total (N)	For Agency with Funding Source in 1989 and 1994								
					Magnitude of Change			Number per Direction of Change					
					25 th Quant		Median	75 th Quant	Down	Unchanged	Up		
Overall	Fares	49	7	360	14%	12%	31%	61%	13%	0%	88%	2%	
	Other	19	37	360	5%	-62%	-23%	44%	61%	0%	39%	9%	
	FTA (secs. 5, 9)	15	57	344	4%	-8%	5%	26%	44%	0%	56%	14%	
	Other Federal	32	263	121	26%	-100%	-48%	47%	62%	0%	38%	63%	
	State	48	165	203	24%	-9%	29%	63%	28%	0%	74%	40%	
	Local	30	147	239	13%	-1%	27%	76%	26%	0%	74%	35%	
	Dedicated Taxes	43	101	272	16%	-20%	24%	71%	33%	0%	67%	24%	
Small	Fares	44	6	248	18%	12%	30%	63%	14%	0%	86%	2%	
	Other	17	37	244	7%	-70%	-27%	41%	60%	0%	40%	12%	
	FTA (secs. 5, 9)	10	34	254	4%	-7%	8%	31%	36%	0%	64%	11%	
	Other Federal	20	211	67	30%	-100%	-83%	31%	64%	0%	36%	71%	
	State	39	116	143	27%	-9%	29%	53%	27%	0%	73%	39%	
	Local	22	92	184	12%	4%	31%	82%	23%	0%	77%	31%	
	Dedicated Taxes	33	80	185	18%	-25%	26%	78%	34%	0%	66%	27%	
Medium	Fares	5	1	85	6%	15%	34%	55%	12%	0%	88%	1%	
	Other	2	0	89	2%	-49%	-16%	95%	56%	0%	44%	0%	
	FTA (secs. 5, 9)	2	22	67	3%	-10%	-2%	12%	64%	0%	36%	24%	
	Other Federal	10	39	42	24%	-100%	-23%	47%	60%	0%	40%	43%	
	State	6	37	48	13%	-51%	28%	88%	33%	0%	67%	41%	
	Local	2	45	44	5%	-37%	23%	64%	34%	0%	66%	49%	
	Dedicated Taxes	6	20	65	9%	-36%	21%	56%	37%	0%	63%	22%	
Large	Fares	0	0	27	0%	13%	27%	42%	4%	0%	96%	0%	
	Other	0	0	27	0%	-43%	-29%	-1%	81%	0%	19%	0%	
	FTA (secs. 5, 9)	3	1	23	13%	-10%	-2%	5%	70%	0%	30%	4%	
	Other Federal	2	13	12	17%	-96%	-39%	174%	58%	0%	42%	48%	
	State	3	12	12	25%	1%	12%	80%	17%	0%	83%	44%	
	Local	6	10	11	55%	-3%	6%	14%	27%	0%	73%	37%	
	Dedicated Taxes	4	1	22	18%	11%	23%	50%	14%	0%	86%	4%	

Notes: Results above could be misleading: do not interpret to mean all agencies saw drop in all categories.

For an individual agency, one category could drop while another rises.

Also, absolute magnitudes may show increasing overall operating revenues, however a particular category's percentage dropped because another category sky-rocketed or began.

Agencies with only 1989 or only 1994 entry in NTD are excluded from analysis. If agency had source in 1994 only, no % change calculation was possible. The occurrence of such agencies is noted in chart.

There were observations showing a -100% percentage change, indicating cessation of a revenue source.

Mean is not shown for the following reason: every category of funding has outliers that result in a skewed distribution with high mean and meaningless standard deviation

Table A-3: Analysis of Capital Revenues by Size Type
Changes from 1989 to 1994

		Changes in Each Source										
		# with funding source			Growth (new user since 1989)	For Agency with Funding Source in 1989 and 1994						% neither year
		1994 Only	Neither Year	Net Total (N)		Magnitude of Change			Number per Direction of Change			
						25 th Quant	Median	75 th Quant	Down	Unchanged	Up	
Overall	Federal (FTA)	12	3	305	4%	-79%	-8%	211%	52%	0%	48%	1%
	Federal (Other)	38	281	21	181%	-100%	-100%	-100%	81%	0%	19%	83%
	State	41	113	174	24%	-97%	-56%	149%	63%	0%	37%	34%
	Local	57	87	181	31%	-89%	-22%	256%	54%	0%	46%	27%
	Dedicated	88	156	93	95%	-86%	-18%	199%	54%	0%	46%	46%
Small	Federal (FTA)	11	2	212	5%	-84%	-24%	261%	54%	0%	46%	1%
	Federal (Other)	32	205	7	457%	-100%	-100%	-100%	86%	0%	14%	84%
	State	32	89	112	29%	-98%	-65%	114%	63%	0%	38%	38%
	Local	45	54	130	35%	-92%	-19%	280%	52%	0%	48%	24%
	Dedicated	57	128	56	102%	-93%	-37%	88%	57%	0%	43%	53%
Medium	Federal (FTA)	1	1	68	1%	-74%	3%	154%	50%	0%	50%	1%
	Federal (Other)	3	61	7	43%	-100%	-100%	-100%	100%	0%	0%	86%
	State	6	20	44	14%	-93%	-55%	130%	66%	0%	34%	29%
	Local	7	26	38	18%	-73%	-24%	129%	61%	0%	39%	37%
	Dedicated	21	26	24	88%	-66%	0%	342%	50%	0%	50%	37%
Large	Federal (FTA)	0	0	25	0%	-14%	40%	94%	36%	0%	64%	0%
	Federal (Other)	3	15	7	43%	-100%	-100%	141%	57%	0%	43%	60%
	State	3	4	18	17%	-79%	-35%	210%	56%	0%	44%	16%
	Local	5	7	13	38%	-98%	-25%	295%	54%	0%	46%	28%
	Dedicated	10	2	13	77%	-70%	76%	285%	46%	0%	54%	8%

Notes: If agency had source in 1994 only, no % change calculation was possible. The occurrence of such agencies is noted in chart.

There were observations showing a -100% change, indicating cessation of a revenue source.

Mean is not shown for the following reason: every category of funding has outliers that results in a skewed distribution with high mean and meaningless standard deviation.

Federal (FTA) includes all funds from FTA and UMTA. Federal (other) includes other DOT funds and other (non-DOT) federal government funds.

Table A-4: Analysis of Service Levels
Changes from 1989 to 1994

		# with service (revenue-hours)		Changes in Service Levels					
				For Agency with Service Provided in 1989 and 1994					
		1994 Only	Net Total (N)	Magnitude of Change			Number per Direction of Change		
				25 th Quant	Median	75 th Quant	Down	Unchanged	Up
by Mode	Commuter Rail	0	0	-4%	4%	9%	30%	0%	70%
	Demand Response	2	267	5%	43%	120%	20%	1%	79%
	Heavy Rail	0	12	-10%	0%	6%	50%	0%	50%
	Light Rail	0	14	-11%	16%	84%	36%	0%	64%
	Motor Bus - Total	1	349	-5%	5%	20%	38%	2%	60%
	Small	1	266	-7%	3%	18%	41%	3%	56%
	Large	0	83	-2%	8%	23%	28%	0%	72%
	Other	0	30	-8%	10%	247%	33%	0%	67%
	Overall	3	682	-3%	11%	48%	30%	2%	68%
by Agency Size	Small	1	295	-2%	11%	31%	28%	2%	70%
	Medium	0	88	1%	15%	43%	23%	0%	77%
	Large	0	27	0%	10%	26%	26%	0%	74%
	Overall	1	411	-2%	12%	32%	27%	1%	72%

Notes: Analysis by mode considers each agency mode separately; therefore, each mode at each agency is considered a separate and unique observation.

Analysis by size considers each agency once by size only (size is determined by fleet size)

If agency had information in 1994 only, no % change calculation was possible.

There were observations showing a -100% change, indicating cessation of service.

Mean is not shown for the following reason: every category of funding has outliers that results in a skewed distribution with high mean and meaningless standard deviation.

Table A-5: Analysis of Cost-Efficiency Levels
Changes from 1989 to 1994

		# of Agencies with Zero Revenue-Hours		Net Total with \$ and Rev-Hrs in Both Years (N)	Changes in \$/Revenue Hour Levels					
					For Agency with Service Provided in 1989 and 1994					
		1989 Only	1994 Only		Magnitude of Change			Number per Direction of Change		
					25 th Quant	Median	75 th Quant	Down	Unchanged	Up
by Mode	Commuter Rail	0	0	10	-4%	10%	23%	30%	0%	70%
	Demand Response	2	1	265	2%	23%	58%	24%	0%	76%
	Heavy Rail	0	0	12	2%	16%	29%	25%	0%	75%
	Light Rail	0	0	13	3%	20%	31%	15%	0%	85%
	Motor Bus - Total	1	1	346	11%	20%	32%	9%	0%	91%
	Small	1	1	263	11%	20%	34%	8%	0%	92%
	Large	0	0	83	8%	18%	30%	10%	0%	90%
	Other	0	0	29	-5%	21%	58%	34%	0%	66%
	Overall	3	2	675	7%	20%	38%	16%	0%	84%
by Agency Size	Small	1	0	294	7%	19%	32%	14%	0%	86%
	Medium	0	0	88	6%	15%	28%	13%	0%	88%
	Large	0	0	27	6%	14%	24%	11%	0%	89%
	Overall	1	1	409	6%	18%	31%	14%	0%	86%

Notes: Analysis by mode considers each agency mode separately; therefore, each mode at each agency is considered a separate and unique observation

Analysis by size considers each agency once by size only (size is determined by fleet size)

If agency had information in 1994 only, no % change calculation was possible.

There were observations showing a -100% change, indicating cessation of service.

Mean is not shown for the following reason: every category of funding has outliers that results in a skewed distribution with high mean and meaningless standard deviation.

Table A-6: Analysis of Service-Effectiveness Levels
Changes from 1989 to 1994

		# of Agencies with Zero Revenue-Hours		Net Total with S and Rev-Hrs in Both Years (N)	Changes in Passenger Trips /Revenue Hour Levels					
					For Agency with Service Provided in 1989 and 1994					
		1989 Only	1994 Only		Magnitude of Change			Number per Direction of Change		
					25 th Quant	Median	75 th Quant	Down	Unchanged	Up
by Mode	Commuter Rail	0	0	10	-21%	-8%	12%	60%	0%	40%
	Demand Response	2	3	263	-25%	-10%	10%	63%	0%	37%
	Heavy Rail	0	0	12	-15%	1%	11%	50%	0%	50%
	Light Rail	0	0	14	-6%	11%	14%	36%	0%	64%
	Motor Bus - Total	3	2	342	-13%	-3%	10%	56%	0%	44%
	Small	3	2	259	-13%	-2%	12%	53%	0%	47%
	Large	0	0	83	-13%	-6%	5%	65%	0%	35%
	Other	0	1	28	-21%	-2%	25%	50%	0%	50%
	Overall	5	6	669	-20%	-5%	11%	58%	0%	42%
	by Agency Size	Small	2	2	291	-17%	-5%	10%	59%	0%
Medium		0	0	88	-19%	-7%	1%	73%	0%	27%
Large		0	0	27	-15%	-8%	-3%	85%	0%	15%
Overall		2	3	406	-17%	-6%	8%	64%	0%	36%

Notes: Analysis by mode considers each agency mode separately; therefore, each mode at each agency is considered a separate and unique observation

Analysis by size considers each agency once by size only (size is determined by fleet size)

If agency had information in 1994 only, no % change calculation was possible.

There were observations showing a -100% change, indicating cessation of service.

Mean is not shown for the following reason: every category of funding has outliers that results in a skewed distribution with high mean and meaningless standard deviation.

Appendix B

Summary of Relevant Findings on Commuting Patterns in the United States

This brief appendix highlights key points on changing demographic and employment patterns in the United States. The findings, presented below in bullet-point format, are drawn from the text of *Commuting in America II*, a report published by the Eno Transportation Foundation in 1996, subsequent to the completion of the literature review which was part of Tasks 1 and 2 of this Research Project. The Eno report uses the 1990 census to observe changes in commuting patterns (by mode) since the 1980 census, along numerous dimensions, including population growth and migration trends, household characteristics, demographic groups, job markets, and mode characteristics. The report provides additional information to support the findings of this Research Project, specifically with regard to the changing demand for transit in metropolitan versus suburban markets, and in different regions of the country.

The data below refer to 1990, except for observations on growth and change, which relate to the period 1980 to 1990. Where appropriate, page number references to the Eno report are given in square brackets.

- All metropolitan growth has been in the suburbs; none at all in the central cities. Suburban share of metropolitan population grew to 62 percent, and grew to 47 percent of total national population (non-metro is the third group). Central city share is down to 29 percent; non-metro is at 24 percent. [p. 18-19]
- Western metro areas growing much faster than eastern - some medium eastern even declining. [p.20]
- West and South have highest growth rates. Northeast and Midwest (the other two of four regions) grew, but at slower rates. Evidence of lessening (although still strong) of shift to sunbelt that has dominated growth since 1950s. [p.21-22]

- Immigrants represent 40 percent of total growth in the decade, and 80 percent are labor-force additions, adding immediately to transportation demand. They are located in 55/45 central cities/suburbs, and many start without vehicles. [p.22-4]
- Suburbs house half of all workers, and over 1/3 of all jobs (central city about 1/3). Growth in job locations was as follows: suburbs 49 percent (for same-metro-suburb residents), 16 percent other suburbs, 15 percent Central City, 8 percent other C.C. (i.e. commuting to other nearby metro area), 12 percent non-metro. All the high-growth metro areas were in the South and West.
- Household structure, workers per household, workers per family and vehicle ownership per household trends all point to the following key points:

[p.29-33]

- 70 percent of workers live in households of 2+ workers. Thus it is less likely for workers to be close to work, and carpooling w/in households.
- Vehicles per household up to 1.66, while persons per household declining. But rate of growth of vehicles is slowing; evidence for nearing saturation. Vehicles per worker is up to 1.3; i.e. majority of workers have vehicle available.

[p.34-37]

- Households without vehicles continues to decline, to 11 percent in 1990; however, decline is slowing. (Thus for non-work trips, less and less likely to use transit.) In absolute numbers, vehicle-less households has been constant around 10 million, including 5.3 million workers.
- Of the vehicle-less households, they tend to be single-person households, most often elderly and women. Half of vehicle-less households have no workers. In metro areas, population growth was ahead of vehicle growth, but nationally was opposite. Most vehicle-less households are in central cities (59 percent), 18 percent inner suburbs, 11 percent in small urban areas, rest in rural and farm.
- Hard to separate vehicle commuting costs from vehicle costs for all purposes. However, major component of per mile cost is fuel. Gas and oil cost per mile has declined from 9 cents (in high cost 80-82 period) to 5.5 cents in 1992 (in *constant* 1990 \$). In terms of adding additional costs of commuting to this, commuters typically do not consider depreciation, etc. What about tolls and parking? Both are significant issues in the largest metro areas, but nowhere

else. We do know that 23 percent of all vehicle-miles households are for commuting. [p.38-43]

- (There were no transit-specific data on the cost of travel time differences between modes.)

[Following taken from section starting p.70 on Commuting Patterns and Trends]

- 50 percent of workers live in suburbs, 28 percent in central cities, and 22 percent in nonmetropolitan areas.
- Of central city commuter residents, 75 percent work in central city, 19 percent in suburbs.
- Of suburban commuter residents, 27 percent work in central city, 62 percent in suburbs.

[4 bullets below, *which are direct quotes*, refer to growth from 1980 to 1990, with final 1990 figure given.]

- Suburb-to-suburb commuting, with 44 percent of metro commuting, accounted for more than 58 percent of the growth.
- Commuting from central city to suburb, which had an 8 percent share in 1990, accounted for 12 percent of the total increase in metro commuting.
- Commuting from central city to central city, which represents 28 percent of all commuting, accounted for only 10 percent of the overall increase in commuting.
- The "traditional" commute (suburb to central city), with 16 percent of total, accounted for about 20 percent of the growth in commuting.
- Of the above categories, the two with central city destinations grew slower than in previous years, while the two with suburban destinations grew faster than previously.
- However, orientation to central city is still a function of metropolitan area size. Separating out areas with populations below one-half million, one finds that the central city destination is still dominant. The larger the metro area, the greater the share of suburb-to-suburb commuting, with the exception of areas over 3 million, where the central city destinations reach 45 percent. The suburb-to-central city share remains constant across all sizes.

[Below starting p.80 on Modal shares by flow pattern.]

- 56 percent of central city workers are central city residents, 74 percent of suburban workers live in the suburbs (of that metro area).
- For central city destinations, drive-alone private auto is dominant, with *at least* 60 percent of mode share in all

origin categories. Transit has more than just a few percentage points only for central city and other-metro-area origins.

- Among central city destinating transit riders excluding commuter rail, about 80 percent live in the central city area. Only between 10 and 15 percent commute from suburbs. On the other hand, for commuter rail (and regional Amtrak) passengers to central cities, 80 percent live in suburbs of the same or another metro area (40 percent each).
- For suburban job destinations, transit has under 5 percent of the mode share.
- About 40 percent of transit users to suburban job destinations live in the central city, and about half commute from suburbs.
- Transit's largest mode share is for commuting to central city destinations: 11 percent.

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation