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Increasing Transit Ridership: Lessons from the Most Successful Transit Systems in the 1990s

June 2002

Brian Taylor
Peter Haas
and
Brent Boyd
Daniel Baldwin Hess
Hiroyuki Iseki
Allison Yoh

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16. Abstract

This study systematically examines recent trends in public transit ridership in the U.S. during the 1990s. Specifically, this analysis focuses on agencies that increased ridership during the latter half of the decade. While transit ridership increased steadily by 13 percent nationwide between 1995 and 1999, not all systems experienced ridership growth equally. While some agencies increased ridership dramatically, some did so only minimally, and still others lost riders. What sets these agencies apart from each other? What explains the uneven growth in ridership?

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Mineta Transportation Institute
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San Jose, CA 95192-0219
Tel (408) 924-7560
Fax (408) 924-7565
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This study was a joint endeavor of faculty and students at the Institute of Transportation Studies at the University of California, Los Angeles (UCLA) and the Mineta Transportation Institute at San José State University (SJSU). Research funding was provided entirely by the Mineta Transportation Institute, and the authors are grateful for this support.

The research was jointly conceived by Daniel Hess (Ph.D. student in the Department of Urban Planning and a graduate student researcher in the Institute of Transportation Studies at UCLA) and Brian Taylor (Associate Professor of Urban Planning and Director of the Institute of Transportation Studies at UCLA) with assistance from Peter Haas (Professor of Political Science and Education Director of the Mineta Transportation Institute at SJSU). The project was managed by Brian Taylor with assistance from Peter Haas.

The Executive Summary was written by Allison Yoh (Ph.D. student in the Department of Urban Planning and a graduate student researcher in the Institute of Transportation Studies at UCLA) and Brian Taylor. “Overview: Understanding Transit Ridership Growth” was written by Brian Taylor. “Previous Research: What Do We Know About the Factors Affecting Transit Use?” was researched by Brent Boyd (M.A. student in the Department of Urban Planning and graduate student researcher in the Institute of Transportation Studies at UCLA) and written by Brian Taylor, with assistance from Brent Boyd and Hiroyuki Iseki (Ph.D. student in the Department of Urban Planning and a graduate student researcher in the Institute of Transportation Studies at UCLA). “The Big Picture: Recent Trends in Transit Patronage” was analyzed by Brent Boyd with assistance from Hiroyuki Iseki and Brian Taylor, and written by Brian Taylor with assistance from Brent Boyd. “The Bright Picture: Analyzing Transit Systems With Significant Ridership Gains During the 1990s” was analyzed by Brent Boyd with assistance from Hiroyuki Iseki and Brian Taylor, and written by Brian Taylor with assistance from Brent Boyd.

The survey instrument used to collect data for the analysis in “Survey of Successful Transit Systems: What Do the Experts Think Explains Ridership Growth?” was developed by Daniel Hess with assistance from Brent Boyd and Brian Taylor. The survey sample was drawn by Brent Boyd with assistance from Heidi Strasser (B.A. student in the Department of Sociology and staff assistant in the Institute of Transportation Studies at UCLA); the survey was distributed by Peter Haas with assistance from Mineta Transportation Institute staff. The survey results were analyzed by Daniel Hess and Allison Yoh. The chapter was written by Daniel Hess, Allison Yoh, and Hiroyuki Iseki, with assistance from Brian Taylor.

The survey instrument used to collect data for “Explaining Transit Ridership Increases: Case Studies of National Leaders” was developed by Allison Yoh and Peter Haas. The survey sample was jointly selected by the Brent Boyd, Peter Haas, Hiroyuki Iseki, Brian Taylor, and Allison Yoh. The interviews were conducted by Peter Haas, Brent Boyd, Peter Weshler (gradute student and research assistant at SJSU), and Allison Yoh. The chapter was written by Peter Haas. “Summary and Conclusions” was written by Allison Yoh and Brian Taylor.

Appendix A was researched and written by Brent Boyd with assistance from Hiroyuki Iseki. Appendix B was researched and written by Brent Boyd with assistance from Hiroyuki Iseki. Appendix C was prepared by Brent Boyd.

The entire report was edited by Camille Fink (M.A. student in the department of Urban Planning and graduate student researcher in the Institute of Transportation Studies at UCLA), with assistance from Brian Taylor and Heidi Strasser. The report was assembled and formatted by Mineta Transportation Institute staff and by Norman Wong (B.S. student in Civil and Environmental Engineering and staff assistant in the Institute of Transportation Studies at UCLA).

The authors thank the two anonymous referees of this study for their helpful comments and suggestions on an earlier draft. We also wish to thank the hundreds of transit managers and planners who took the time to share their thoughts and opinions in our written and interview surveys; without their help this project would not have been possible. Finally, our thanks to Trixie Johnson, Research Director at the Mineta Transportation Institute, for her able oversight and assistance with this project.

EXECUTIVE SUMMARY

This study examines trends in U.S. public transit ridership during the 1990s. Specifically, we focus on agencies that increased ridership during the latter half of the decade. While transit ridership increased by 13 percent nationwide between 1995 and 1999, not all systems experienced ridership growth equally. While some agencies increased ridership dramatically, some did so only minimally, and still others lost riders. What sets these agencies apart from one another? What explains the uneven growth in ridership?

To answer these questions, this research study incorporates a wide array of methodological approaches, including:

- An analysis of nationwide transit data and trends
- A survey of officials from agencies that increased ridership in the late 1990s
- Case studies based on in-depth, open-ended interviews with transit officials from 12 agencies that were particularly successful at attracting new riders during the study period.

Through this multipronged approach, we identify factors both *internal* and *external* to transit systems that influence ridership growth. Internal factors are things like service levels, fares, and so on. External factors include job growth, traffic congestion, and the like. Although a wide array of factors clearly influence transit patronage, our analysis finds that the most significant factors influencing transit use are external to transit systems. This finding was consistent throughout our review of the research literature, our analysis of nationwide data, our survey of successful transit systems, and our detailed interviews with transit managers. In our data analysis, we found extraordinarily strong correlations between ridership and three external factors related to economic activity. Table 1 shows, for example, that the correlation between inflation-adjusted wage rates during the late 1990s and transit ridership is 0.96. Such external factors, of course, are largely beyond the control of transit managers.

We also find that while transit agencies experiencing ridership growth are dispersed throughout the nation, such agencies are disproportionately clustered on the West Coast.

Table 1: Correlation Coefficients of External Factors and Transit Ridership: 1995-1999

	Unlinked Trips	**Unlinked Trips/ Person**
External Factors		
Unemployment Rate	-0.70	-0.16
Real Hourly Wage ($2001)	0.96	0.70
Real GDP ($2001)	0.79	0.24
Real GDP per Person ($2001)	0.82	0.29
Source: Calculation of National Transit Database data by the authors		

In our survey of and interviews with transit agency managers, many cited external factors as the primary determinants of ridership growth. However, our respondents did attribute ridership gains to some program initiatives and policy changes. Accordingly, this study documents the approaches deemed by agency managers as being most successful in the face of dynamic environments and transit's declining share of travel. Among transit agencies studied, we found the following:

- Transit systems that have been successful at increasing ridership are concentrating their efforts on producing effective service for the most responsive areas and groups of riders.
- Ridership productivity is easiest to maximize in traditional transit territory (that is, dense corridors, central city areas, suburb-to-city alignments, and areas with relatively low levels of automobile ownership).
- Transit fares may be less important to ridership levels but are still significant, especially for particular market segments.
- While niche marketing is not new to the transit industry, more agencies are targeting market segments to increase ridership.
- Transit agencies' abilities to form partnerships with communities, businesses, universities and schools, social service agencies, and local government clearly garner support and interest in meeting the needs of changing demographics and development patterns.
- Above all, transit systems with the greatest increases in ridership appear to tailor their services and product mix to meet customer needs.

Although we were not able to uncover a “magic bullet” that promises ridership growth for all transit systems, the results of this multipronged study should ring true to experienced transit managers and analysts: While transit use is largely a function of factors outside of the control of transit systems, flexible and creative management makes a difference.

OVERVIEW: UNDERSTANDING TRANSIT RIDERSHIP GROWTH

The 1990s were a volatile decade for the U.S. public transit industry. Many systems lost riders during the recession years of the early 1990s, although a few added riders. During the economic boom of the late 1990s, transit ridership nationwide increased steadily, but not all systems increased equally; some posted dramatic ridership gains, while others actually lost riders. Many industry insiders have theories about which have been the most successful transit systems and why, but there has been little systematic examination of the question. This study systematically examines recent trends in public transit ridership to increase our understanding of why some public transit systems have been successful at attracting new riders, while others have not. We use a variety of methodological approaches—an analysis of nationwide transit data, a survey of the managers of most of the transit systems that increased patronage during the late 1990s, and in-depth case study analyses of 12 systems that were particularly successful at attracting new riders during our study period. In the pages that follow, we identify the factors responsible for stimulating ridership growth. We examine both internal factors—such as changes in service, fares, and marketing—and external factors—such as population and employment growth—thought in the research literature to influence the use of public transit.

Nationwide, about two-thirds (227) of the federally subsidized public transit systems[1] increased patronage[2] during the economic boom years of the late 1990s (1994 to 1999), a period in which transit ridership nationwide increased by 13 percent. Why did some systems gain riders and others lose riders? Was it happenstance? Were the systems fortunate to be in the right place at the right time? Did the successful transit systems establish new services or fare structures that attracted new riders, or do population and employment growth alone explain the ridership increase? This study addresses these questions.

We find in this research that large increases in transit ridership are driven by several factors, including heavy public spending on transit, a strong economy, stable or declining fares, innovation among transit systems and projects, and growing congestion on roads and highways. Respondents to the survey and interviews conducted for this study reported that the ridership increases resulted from both internal factors (such as fare decreases or freezes, service expansion, and the introduction of new and specialized services) and external factors (such as population and employment growth, increasing suburbanization, and growing public support.) Trends such as suburbanization, advances in telecommunications, and chained trip-making require that transit systems refashion how they configure and deliver their services. To accommodate these trends, transit systems have attracted new riders by becoming more flexible and creative in their service planning and marketing approaches.

A wide array of factors clearly influence transit patronage, but perhaps the most consistent finding from our review of the research literature, our analysis of nationwide data, our survey of successful transit systems, and our detailed interviews with transit managers is that the most significant factors influencing transit use are external to transit systems—such as economic growth and traffic congestion—and thus are outside the control of transit managers. This is not to say that good management and planning do not matter—they clearly do. In analyzing our survey and interview data, we focus on those internal factors that operators of transit services identified as the most effective in attracting and maintaining customers.

The remainder of this document is organized into six chapters and four appendices. The next chapter, “Previous Research: What Do We Know About the Factors Affecting Transit Use?” reviews the findings of previous studies on the factors influencing transit ridership, organized by the principal methodological approaches used in the research. “The Big Picture: Recent Trends in Transit Patronage” draws on national data collected by the Federal Transit Administration to offer an overview of recent trends in transit use. “The Bright Picture: Analyzing Transit Systems With Significant Ridership Gains During the 1990s” then uses these same data to focus more specifically on an analysis of the 227 transit systems that increased patronage in the late 1990s, in an effort to understand the internal and external factors most closely associated with ridership growth. “Survey of Successful Transit Systems: What Do the Experts Think Explains Ridership Growth?” presents the results of a survey of the managers of 103 transit systems nationwide that explored their views of the keys to increasing patronage. “Explaining Transit Ridership Increases: Case Studies of National Leaders” complements the survey findings by presenting the results of in-depth case study interviews of managers and senior staff at 12 transit systems selected to represent the broad array of transit systems that added riders during the 1990s. Finally, “Summary and Conclusions” summarizes the results of this three-pronged analysis of transit ridership.

PREVIOUS RESEARCH: WHAT DO WE KNOW ABOUT THE FACTORS AFFECTING TRANSIT USE?

Public transit ridership is influenced by a variety of factors, both internal and external to the transit system. Internal factors are those under the purview of transit managers and policy boards, such as the level of service provided, fare structures and levels, service frequency and schedules, route design, and service area size. Transit operators can adjust the level of service provided and the fare charged in an effort to attract paying customers in the most cost-effective manner possible. External factors, in contrast, are those outside of a transit agency's control—such as population and employment growth, residential and workplace location—and factors that influence the relative attractiveness of transit, such as gasoline prices and parking costs. Changes in these external factors can powerfully influence ridership. For example, regional population growth can increase transit ridership by increasing the absolute number of potential transit users. Because public transit tends to capture a relatively large share of commute trips to jobs in central business districts, downtown employment growth can be correlated strongly with both the level of transit service and transit patronage. In contrast, sharply increasing unemployment rates and overall reductions in consumer spending can significantly decrease both transit ridership and revenue (Fleishman, et al. 1996; Taylor and McCullough 1998).

Which internal factors and which external factors are most important in influencing transit use? In this chapter, we seek to answer this question by systematically reviewing the previous research on the factors influencing transit ridership, with a focus on understanding their relative significance. The studies reviewed here are categorized into four groups by methodological approach taken:

- Literature reviews and case studies
- Interviews and surveys
- Statistical analyses of a transit agency or region
- Cross-sectional statistical analyses.

The studies in each of the four categories are discussed in turn below and summarized in Appendix A.

LITERATURE REVIEWS AND CASE STUDIES

A literature review conducted by the European Commission on Transportation Research (1996) provides an extensive list of variables that should be considered in evaluating the success of transit ridership enhancement projects (see Table 2). The authors begin by categorizing the variables as either direct or indirect strategies. Direct strategies are those that transit agencies can pursue to increase efficiency and effectiveness of transit operations and are roughly equivalent to the internal factors discussed above. These strategies include changes in the fare levels, service quality and quantity, marketing, facilities, and technologies employed in the provision of service. Indirect strategies are generally broader public policies that influence ridership, but over which transit agencies generally do not have control.

This study concludes that most direct strategies have little impact on public transit's modal share, and thus need to be implemented in concert with indirect measures to successfully influence transit use. More specifically, the authors conclude that increasing both service frequency and transit stop density of bus stops in combination with road pricing would increase transit patronage more than any other combination of public policy actions.

An Urban Mass Transportation Administration (UMTA) report conducted by Sale (1976) examines the factors influencing transit ridership growth by analyzing the techniques used to increase ridership by more than 5 percent on transit systems in seven U.S. cities between 1971 to 1975. Sale finds that most ridership gains are in large part attributable to service expansion—especially the route expansion in rapidly growing metropolitan areas. In addition to service expansion, Sale notes three other important factors that have a significant effect on transit mode share in the short term: strong public and political support, resulting in the availability of substantial and stable financial resources; stable or declining fare levels; and higher motor vehicle fuel prices due to the energy crisis (Sale 1976).

Cervero (1993) conducted a literature review to examine the characteristics of rail-station-adjacent housing and commercial projects thought to influence transit ridership. He finds transit use varies significantly by proximity to transit lines and stations. He cites a study of Washington, D.C., showing that the share of trips by rail and bus declines by approximately 0.65 percent for every 100-foot increase in distance of a residential site from a Metrorail station. Ridership also declines steadily as distance between stations and offices increases. These findings imply that increasing service network densities to

Table 2: Direct and Indirect Strategies for the Evaluation of the Successes of Transit Ridership Project in the Study by European Commission Transportation Research (1996)

DIRECT STRATEGIES		
PRICING Fare Levels Ticketing Regimes/Fare Structure Ticketing Technology Subsidy Regime **PRIORITY MEASURES** Link Priority/Right-of-Way Junction Priority **OTHER** Park-and-Ride Integrated Approach	**SERVICE PATTERN** Extensiveness of Routes Distance to/from Stops Service Frequency/Travel Time Operating Hours Fleet Size **REGULATORY REGIME** Market Regulation Operational Regulations Quality Regulations	**SERVICE QUALITY** Vehicle Characteristics Bus/Rail Stop Quality Interchange Quality Quality/Number of Staff **INFORMATION** Information Provision Publicity/Promotion
INDIRECT STRATEGIES		
CAR OWNERSHIP Taxation of Car Ownership Restrictions on Car Ownership **CAR USE, GENERAL** Fuel Tax Restrictions on Car Use Car Vehicle Specification	**CAR USE, AREA-SPECIFIC** Traffic Calming Access Restrictions Road Pricing Parking Availability Cost of Parking Parking Enforcement	**OTHER** Information on Traffic Conditions Land use Planning Telecommuting/Tele-Shopping Flexible Working Hours Increase in Road Capacity Improvements to Non-Motorized Modes

decrease the average distance from residences and workplaces to transit stations and stops would significantly increase transit use.

SURVEYS OF AND INTERVIEWS WITH TRANSIT MANAGERS

In some studies, transit system managers were interviewed to find out what factors they thought had the greatest influence on ridership. Although perceptions are just that, managers of transit systems are in a good position to consider the relative influence of various factors on patronage.

The Transit Cooperative Research Program Research Results Digest (1995, 1998) provides results of two extensive interview studies. Each interviewed the managers of about 25 to 50 transit agencies, producing similar findings. The transit agencies were selected on the basis of increasing ridership, and the interviews were conducted by telephone. Most transit managers interviewed attribute ridership increases to a various combination of strategies, programs, and initiatives in five general categories: (1) service adjustments, (2) fare and pricing adaptations, (3) market and information initiatives, (4) new planning orientation, and (5) service coordination, consolidation, and market segmentation.

The respondents frequently mention the use of deep discount fare policies to help increase ridership as well as efforts to make passes more widely available in communities, strategies from the second category (fare and pricing adaptations) and the fifth category (service coordination, consolidation, and market segmentation). Deep discount fare policies stratify transit markets into segments based on two primary factors: frequency of use and sensitivity to cost (Fleishman 1993). Such policies generally offer a per-ride discount for the purchase of a multiple-ride pass or transit card, aiming to induce potential riders with low usage and high price sensitivity to increase overall transit patronage.

The interviews also indicate a consensus among transit managers that external factors, such as population change, new development, and regional economic conditions, probably have a greater effect on ridership than system and service design initiatives. One conclusion of the 1995 study is that because mode choice decision is strongly influenced by vehicle ownership and the private vehicle is overwhelmingly preferred by many travelers who have the choice, then strategies that target transit service alone have little chance of being very effective.

Some transit systems have found that they can increase their ridership by selling discounted transit passes in bulk to large groups. University students are a group that is willing to purchase transit, and since they are more likely to ride during off-peak periods than the general transit-riding public, transit systems do not need to increase service to accommodate university students. Brown, Hess, and Shoup (2001) report the results of a survey of university transit pass programs at 35 U.S. universities. The university typically pays the transit system an annual lump sum based on expected student ridership, and students show their university identification to board the bus. University administrators report that transit pass programs reduce parking demand, increase students' access to the campus and the community, help recruit and retain students, and reduce the cost of attending college. Transit system officials report that university transit pass programs increase ridership, fill empty seats, improve transit service, and reduce the operating cost per rider. Increases in student transit ridership ranged from 71 percent to 200 percent in the first year of university transit pass programs, and annual growth in subsequent years ranged from 2 percent to 10 percent. The universities' average cost for transit pass programs is $30 per student per year. The authors report that the 35 university transit pass programs examined during the 1997-1998 school year provide fare-free transit service for 825,000 people, but since this is only 6 percent of the 14 million students enrolled in U.S. universities, the opportunity for growth is enormous.

STATISTICAL ANALYSES OF A TRANSIT AGENCY OR REGION

The studies in this group use statistical methods, such as correlation and regression analyses, to examine the relationships between transit ridership and potentially influential factors. Compared to studies in the previous two groups, these statistical analyses can not only identify the factors thought to affect ridership, but also attempt to measure the level of influence in a comparative fashion. The common approach of these studies is to use multiple regression analysis to analyze the combined effects of a variety of factors on transit use.

Using the data in Portland, Oregon, Liu (1993) constructs a variety of regression models to explain the variation in transit ridership each decade from 1960 to 1990. To test the widely held notion that declining transit use is largely a function of increasing personal income, auto ownership, and suburbanization of residence and job locations, Liu produces a model to estimate per capita transit trips as the function of the following factors:

1. Per capita transit capacity
2. Per capita passenger car registrations
3. Per capita transit subsidies
4. Per capita income
5. Percent of population residing in the central city
6. Metropolitan area population
7. Motor vehicle fuel prices
8. A time-trend variable for a period 1929-90

9. Annual total transit miles
10. Average passenger fare
11. Total employment in the Portland metropolitan area
12. The effects of World War II.

He finds that per capita income, auto ownership, and the suburbanization of both jobs and housing have significant effects on transit ridership. In a similar analysis for the period from 1949-1990, Liu finds that the size of the central city population also has a significant effect on ridership.

Using data for the period from 1971 to 1990, Liu estimates the following regression model:

$$\Delta(\text{Linked Trips}) = -0.008 + 0.606\,\Delta(\text{Revenue Hours of Service}) - 0.285\,\Delta(\text{Average Fares}) + 0.861\,\Delta(\text{Regional Employment}) + 0.274\,\Delta(\text{Real gasoline prices})$$

(Δs are all annual percentage changes)

Kain and Liu (1995) produce similar results in their study of the San Diego and Houston transit systems in the early 1990s. They chose San Diego and Houston because the transit systems in these cities were adding riders during an economic downturn when most transit systems were losing riders. Using data for the period from 1968 to 1992, Kain and Liu find much of the increased ridership could be attributed to the number of revenue vehicle miles of service, average fares, regional employment levels, car ownership levels, and gasoline prices—in other words, to a combination of internal and (primarily) external factors.

Chung (1997) estimates the effects of employment, development levels, and parking availability on Chicago Transit Authority (CTA) rapid transit ridership for the period from 1976 to 1995 in Chicago, controlling for fare policy and service levels. Chung finds that parking availability, development, and employment had greater impacts on ridership than fares, although the array of variables considered in this study was considerably less comprehensive than those used in the studies by Kain and Liu.

McLeod, Flannelly, Flannelly, and Behnke (1991) estimate multivariate time-series regression models of transit ridership based on the aggregate data for the period from 1956 to 1984 in Honolulu, Hawaii. Their models, using revenue trips and linked trips as dependent variables, include five independent variables: civilian jobs, inflation-adjusted per capita incomes, inflation-adjusted fares, the size of the transit fleet, and a variable accounting for service disruptions due to strikes. Although both internal and external factors influenced ridership, other factors thought to be important—the number of tourists, the number of registered passenger vehicles, and gasoline prices—were not.

Gomez-Ibanez (1996) analyzes the changes in ridership and increases in deficits for the Massachusetts Bay Transportation Authority (MBTA) in Boston in the late 20th century. He estimates the effects on ridership of both internal (fare and service policies) and external (income, demographics, and others) factors in regression models. He produces one model that predicted ridership change based on two external factors (income and employment) and three internal factors (fare, revenue vehicle miles, and a dummy variable for a 1980-81 severe budget crisis). The model predicts an 11.9 percent increase in ridership between 1970 and 1990; the actual increase was 11.8 percent. A second model, using a simple time trend for income, predicts a 9.9 percent ridership increase.

Gomez-Ibanez's models show that, at least in Boston, transit ridership is strongly affected by external factors beyond the transit agency's control. He calculates, for example, that each percentage decrease in central city jobs reduced MBTA ridership by 1.24 to 1.75 percent, and each percentage increase in real per capita income reduced MBTA ridership by 0.7 percent. The effects of fare and service policies are, by contrast, relatively small. A 1 percent increase in service increased ridership by only 0.30 to 0.36 percent, and a 1 percent reduction in fares increased ridership by 0.22 to 0.23 percent.

A subset of studies in this category examines the effects of land use and urban form on ridership using statistical methods. In general, these studies find that decentralized residential and occupational locations are difficult to serve by public transit because transit works best when a large number of people are all headed to activity nodes that contain various destinations. Dense, compact development is more conducive to efficient transit operations than dispersed and sprawling patterns of urban development.

In an analysis of transit demand in Portland, Oregon, Nelson and Nygaard (1995, cited in TCRP 1996) note that the overall housing and employment density per acre are two of the most significant determinants of transit demand among the 40 land use and demographic variables studied. These two variables alone explain 93 percent of the variance in transit demand. Similarly, Pushkarev and Zupan (1977) find that residential densities in transit corridors, together with the size of the downtown and the distance of stations from downtown, explain the level of demand for a variety of transit modes.

The Transit Cooperative Research Program (1996), using a variety of sources, analyzes the relationships between urban form and transit ridership. The authors find that residential densities have a significant influence on rail transit ridership, as does the size and density of the central business district (CBD), although the influence was found to be greater for light rail ridership than for commuter rail ridership. The study also finds that, for a 25-mile light rail line surrounded by low-density residences, increasing downtown employment from 50,000 to 300,000 for a 3-square mile CBD could increase ridership along that corridor from 18,000 to 85,000 daily boardings. Beyond a certain size, however, CBD size is not found to be important.

The TCRP study also finds that the effects of density are interrelated with employment center size, “corridor-level” urban structure, transit service characteristics, and a variety of public policies. Lastly, the types and mix of land uses influence the demand for transit as well as the use of nonmotorized modes. However, it was difficult to sort out the effects of land use mix and urban design because they are so strongly correlated with density. An analysis of travel behavior in 11 metropolitan areas surveyed in the 1985 Housing Survey suggests that both land use mix and residential densities contribute to the probability of choosing transit in mode choice decisions. The authors find that the overall level of density is more significant than the mix of land uses. Land use mix has only one-tenth as much influence on transit choice as density.

Spillar and Rutherford (1998) examine the effects of urban residential densities and income on transit ridership in five western U.S. cities—Seattle, Portland, Salt Lake City, Denver, and San Diego—using 1980 Census data. The data include total population counts within a given geographic area, average annual income levels in that area, and the average area in acres of each zone. Since the data were drawn from the Census, Spillar and Rutherford examine only work-related trips. They find that transit use per person grows with increasing density up to a ceiling of between 20 and 30 people per acre, which is equivalent to 0.1 to 0.2 transit trips per day per person. In terms of income, density exhibits less effect on transit use in higher-income neighborhoods (those with less than 18 percent low-income families) than in low-income areas, although the sample size analyzed was rather small.

Since car ownership, car use, and transit use are all related, a change in one variable affects other variables; however, the magnitude of effect may not be symmetrical in terms of direction. Kitamura (1989) examines the causal relationships between car ownership, car use, and transit use using surveys and trip diaries given to nearly 4,000 people in the Netherlands. He finds that a change in car ownership leads to a change in car use, which influences transit use. Conversely, he finds that significant changes in transit use are usually related to changes in car use or car ownership.

Strategies to price parking can be an effective means of increasing transit patronage for the work trip (Dueker, Strathman, and Bianco 1998). Since increasing parking costs affects relative attractiveness of traveling by transit compared to driving an automobile, it has significant effects on mode share. In 1998, in TCRP Report Number 40, a quantitative analysis of mode choice and finds (1) the probability that people pay to park is likely to influence transit share more than either transit frequency or transit accessibility, (2) transit frequency has more significant effects on transit mode share than transit accessibility, and (3) pay-to-park probability and transit frequency combined have the greatest effect on transit share. The study finds that transit share increases nearly 300 percent, from 6.5 to 24.5 percent, when transit frequency doubles from 1.0 transit revenue hours per capita to 2.0, and when the pay-to-park probability doubles from 0.05 to 0.10. The study also estimates that increasing access to a transit stop from 30 percent of the population to 60 percent increases transit use only from 8.6 to only 9.3 percent. By comparison, an increase from 10 to 15 percent of the population that expects to pay to park at work is estimated to increase the transit share from 21 to 34 percent.

The San Francisco County Transportation Authority conducted a travel study in 1995 and finds that, when parking costs exceeded transit fares by 20 to 30 percent, commuters tend to take transit rather than drive alone. The study also finds that 47 percent of the employees who drove alone report that they either park free or are provided employer-paid parking (cited in TCRP 1980).

Cervero (1990) reports that riders are generally more sensitive to changes in service than they are to changes in fares. In other words, riders are more easily attracted by service improvements than fare decreases. A study by Syed (2000) supports Cervero’s findings. Syed conducts a factor analysis of the determinants of increasing transit ridership at the Ottawa-Carleton Transportation Commission (OC Transpo) using survey data on 47 variables for each of 2,000 transit riders. This analysis focuses on factors that users of the system judge the most important. Syed finds bus information is the most important factor among eight underlying factors in determining transit trips. Based on the factor analysis of the survey, Syed finds that the following factors were the most important factors in determining ridership: bus information, on-street service, station safety, customer service, safety en-route, reduced fares, cleanliness, and general transit operator attitudes. Because Syed combines the many original factors from the survey into a smaller number of categories, it may be difficult for transit agencies to implement any of the measures evaluated in the study with certainty of the probable outcome. For example, Syed lumps “on-street service” into one category that includes such aspects as on-time performance, system expansion, and frequency of service.

CROSS-SECTIONAL STATISTICAL ANALYSES

Cross-sectional statistical analyses are premised on the idea that there are underlying structural relationships between factors influencing transit use. The collection of detailed transit operator data by the Federal Transit Administration (FTA) in the National Transit Database (NTD) permits comparative analysis of transit systems. Hartgen and Kinnamon (1999) develop comparative statistics for the nation’s largest urban bus transit operators from nationally reported data for 1988 through 1997. Four measures of resources (vehicles, population base, fare revenue, and coverage area) are normalized and compared with seven outcome measures (operating expenses per mile, operating expenses per hour, operating costs per passenger, operating costs per passenger mile, vehicle miles of service, vehicle hours of service, and ridership). Systems are ranked according to overall performance against U.S. averages, weighting each statistic equally. Systems then are ranked within six peer groups based on population served and modes of service. Hartgen and Kinnamon find that the overall performance of bus transit systems steadily declined during their study period; only two of the 12 measures of performance improved from 1988 to 1997. They find evidence that service in general expanded: service coverage was 11 to 14 percent greater in 1997 versus 1988. However, costs per vehicle hour rose through 1997, 2 percent more than 1996 and 32 percent more than 1988. The 10 top-ranked systems for 1997 were Santa Monica, CA, Champaign-Urbana, IL, Tucson, AZ, Santa Barbara, CA, Milwaukee, WI, Long Beach, CA, Las Vegas, NV, Shreveport, LA, Durham, NC, and Newport News, VA. The study concludes that cost-effective performance depends on low unit costs, low fares, and low subsidies, with concentrated service that optimizes service utilization.

Kain and Liu (1996) conduct detailed analyses of factors that determined the level of transit ridership using the data for 184 systems over a 30-year period from 1960 to 1990. Kain and Liu essentially conduct two different econometric analyses. First, they estimate regression models for changes in ridership for the periods 1960-70, 1970-80, and 1980-90 using variables such as fare levels, revenue miles of service supplied, the rail share in revenue miles,[3] whether the system was publicly or privately operated, and a vector of control variables (population and employment, density, area, fraction of carless households in the area[4]). Because many of the control variables are highly correlated, only a few of them were included in each regression model. All models of ridership changes between 1980 and 1990 had $R^2 = 0.75$ or higher.

Second, Kain and Liu estimate cross-sectional regression models for the level of ridership for four different years—1960, 1970, 1980, and 1990—using transit fares, service levels, service types, public or private ownership, and a vector of exogenous or control variables (again, only a portion of which could be included in each regression model). All models for 1990 had a high explanatory power of at least $R^2 = 0.95$.

The results indicate that the mean fare elasticities for ridership changes during the 1980-1990 and 1970-1980 periods and the 1990 and 1980 cross section models range between –0.34 and –0.44, and that the mean revenue mile elasticities range between 0.70 and 0.89. These results imply that transit agencies will increase ridership less by reducing fares than by increasing service, although both changes are likely to reduce overall transit system performance. Since this study focuses more on the effects of four specific policy variables—transit fares, service levels, service types, and public or private ownership—it is not clear how explanatory variables in two groups—both policy and control variables—were selected from the large variety of possible variables.

Kohn (2000), in a study of 85 Canadian urban transit agencies, examines the data from 1992 and 1998 to identify significant explanatory variables to predict ridership. He concludes that the two main variables were average fares and revenue vehicle hours. Other variables he examines included demographics, hours of service, fare structure, vehicle statistics, energy consumption, employment, passenger statistics, revenues, and expenditures. However, Kohn's model includes only two main variables and does not control for other variables because two variables explain almost all variation in the ridership level (R^2 = 0.97). Table 3 shows the results of the study. Kohn's study does not specifically account for the fact that service levels are, at least in part, a function of the level of transit demand, which calls into question the implied causality of his analysis (that is, increasing service and lowering fares is the way to increase ridership).

Table 3: Statistical Results of Kohn's Model (2000)

Independent Variable	Coefficient	Standard Errors	t-statistic
Intercept	5,099,953	2,232,952	2.28
Average Fare	-7,976,442	2,024,021	-3.94
Revenue Vehicle Hours	49.58	0.41	119.85
R^2 = 0.97	F Ratio = 7190 (99% Significant)		

Hendrickson (1986) examines the significance of the share of employment in the central business district and the share of work trips by public transit using 1980 Census data for 25 large metropolitan U.S. areas, which made up 60 percent of all nationwide transit ridership. He finds that transit use was highly related to the percentage of jobs in the CBD for any given metropolitan area. He reports that the percentage of employees who worked in the CBD dropped from 8.5 percent in 1970 to 7.8 percent in 1980, while the percentage of work trips taken on public transit dropped from 12.2 percent in 1970 to 10.5 percent in 1980. His Ordinary Least Squares (OLS) regression model with only four variables—percentage of workforce in CBD, absolute number of workers in CBD, absolute number of work transit trips, percentage of work trips taken on transit—explains 96 percent of the variation of public transit use, signaling a strong relationship between transit use and CBD employment. This model does not consider the growth rate of an area, any other economic factors, or the land use patterns of the city (other than the CBD). For 1980, 90 percent of the variation is explained by the percentage of jobs based in the CBD rather than overall metropolitan employment. Hendrickson notes that CBD employment does not necessarily promote transit usage, but that the supply of transit to the CBD might actually bolster downtown employment. He also acknowledges that the definition of the CBD area in each city is somewhat arbitrary.[5]

Finally, Morral and Bolger (1996) examine the effects of downtown parking supply on transit use in eight Canadian cities and 14 U.S. cities. The study finds that the number of CBD parking spaces per downtown employee had a significant influence on the percentage of CBD workers that commute to work on transit; however, their models are single, nonlinear regression models only, and do not take into account other variables.

Canadian Cities	% transit modal split = 109.7e(-2.49x)	(R^2=0.92)
Canadian & U.S. Cities	% transit modal split = 3.6 - 32.97ln(x)	(R^2=0.59)
	where x = downtown parking stalls per CBD employee	

SUMMARY

This review of previous studies of transit ridership has identified several common factors that influence transit use. Among internal factors, increasing the quantity of service (in terms of service coverage and service frequency) and reducing fares are both found to have significant effects on ridership (Sale 1976; Cervero 1990; Kohn 2000). Systems with low unit costs, low fares, relatively low subsidies, and spatially concentrated service have proven the most cost-effective in increasing ridership (Hartgen and Kinnamon 1999). Kain and Liu (1996) estimate the fare elasticity of ridership with respect to fare changes to be between –0.34 and –0.44, while the elasticity of ridership with respect to changes in revenue miles of service is estimated to be between 0.70 and 0.89. A few studies found that pricing schemes, such as deep discounting, induce significant ridership increases because such schemes account for different sensitivity to price among various market segments. Some transit agencies provide discounted transit fares to students through partnerships with universities (university transit pass programs) and have been successful in increasing ridership without increasing service (Brown, Hess, and Shoup 2001). In addition to fare policies, some studies find that the quality of service—customer and on-street service, and station and on-board safety—is more important in attracting riders than changes in fares or the quantity of service (Cervero 1990). Syed's (2000) survey of transit users reveals that providing transit information, improving customer and on-street service, and improving station and on-board safety are generally more important to passengers than reducing fares.

Among the external factors studied, many researchers argue that residential and employment density are critical determinants of transit use, while the effects of land use mix and urban design are relatively small (Crane 2000; Cervero 1993; Pushkarev and Zupan 1977; TCRP 1996; Spillar and Rutherford

1998; Hendrickson 1986). Demographic factors, such as personal income, auto ownership, and suburbanization of residential and job locations, also have been found to significantly affect ridership (Liu 1993; Kain and Liu 1995; Gomez-Ibanez 1996). Gomez-Ibanez (1996) finds that transit ridership is strongly affected by forces beyond the transit system’s control. Finally, strategies to increase parking costs or the probability drivers will have to pay for parking are found to be more effective in increasing transit mode share than increasing the level of transit service in terms of frequency and accessibility (TCRP 1980).

The studies cited here adopted a wide array of methodological approaches: literature reviews and case studies, interviews and surveys, statistical analyses of a transit agency or region, and cross-sectional statistical analyses. The more objective statistical analyses typically focus on testing the relative causal influences of internal and external factors on transit ridership. Collectively, these studies find that external factors such as population and employment growth have had more influence on ridership than internal factors such as fare and service levels. Furthermore, there are clear limits to the effectiveness of using solely internal factors to stimulate transit use (European Commission Transportation Research 1996; TCRP 1980, 1995, 1998; Gomez-Ibanez 1996). Most of the authors of these studies recommend that, to increase transit use, external measures, such as increased gasoline prices or parking costs, should be combined with internal measures, such as increasing the transit service quantity and quality, to have large effects on transit ridership. Because these indirect measures are external to the transit operator and likely to be strongly opposed by nontransit interests, combining such internal and external factors in a concerted effort to increase transit use proves difficult for transit operators.

While past studies provide valuable information for transit agencies that seek measures to increase ridership, their results are quite mixed, partly due to the variation in methodologies and data used for analysis. In general, the aggregate statistical analyses have been hampered by limited and incomplete data, particularly concerning the external influences on patronage. In contrast, the more subjective studies based on literature reviews, surveys/interviews, and case studies typically have sought to identify the factors thought by experts to affect ridership. Many of these studies, however, are relatively old, and most of them do not specifically ask about perceptions of causality or the relative influence of internal or external factors. This study does two things to update and advance the research. First, we examine a recent period in history—the economic boom years of the late 1990s; second, we combine an array of methodological approaches used separately in previous research—aggregate, cross-sectional data analysis, a survey of more than one hundred transit managers nationwide, and in-depth case studies of a dozen transit systems. It is to the data analysis that we turn in the next chapter.

THE BIG PICTURE: RECENT TRENDS IN TRANSIT PATRONAGE

At the turn of the last century, public transit systems were the centerpiece of every urban transportation system in the United States, and indeed the world. Personal travel in the cities of 1900 usually took one of two forms: walking or public transportation. At that time, 99.7 percent of all passenger miles traveled in U.S. cities were on transit (Altshuler 1981). Although transit systems of a hundred years ago operated a variety of modes—cable cars, horse-drawn trolleys, and so forth—the vast majority of travel was by electric streetcar.

Cities and travel in them have changed greatly in a century. Travel is now dominated by private motor vehicles, and public transit systems in the United States—outside of New York City—play a decidedly supplementary role. Figure 1 shows the trend in transit use during the 20th century: Transit patronage in the U.S. climbed quite steadily until the economic downturn of the Great Depression, when ridership declined steadily for almost a decade.

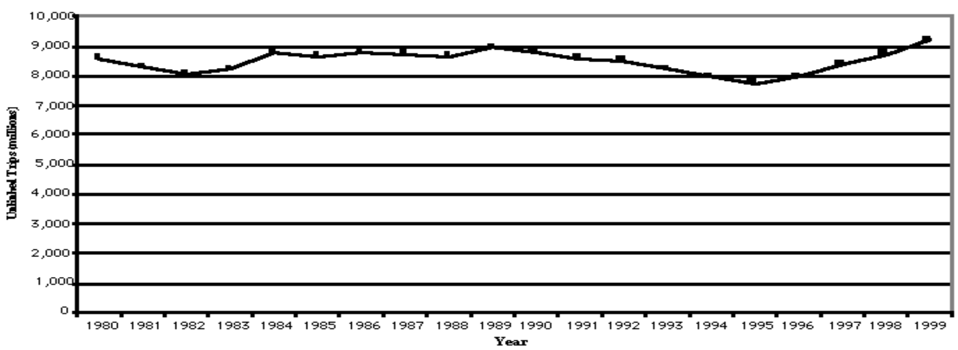


Figure 1. Total Unlinked Trips (1907-1999)

The rationing of oil, rubber, and steel during World War II, combined with a surge in war-related employment, pushed transit use to its highest-ever levels. Following the war, transit ridership plunged precipitously, and the quarter-century after the war was characterized by widespread bankruptcies among transit systems, which then were mostly private and for-profit. The advent of public subsidies for transit systems began in earnest in the mid-1960s and increased significantly into the 1980s. The effects of public subsidies were both to increase dramatically the cost of producing transit service and to stabilize transit ridership (Jones 1985; Pickrell 1988; Wachs 1989).

Figure 2 plots the trends in nationwide transit patronage over the last two decades to show recent trends in more detail: Overall transit use declined during the recession years of the late 1980s and early 1990s, but rebounded with the economy during the mid-1990s. The 9.1 billion unlinked passenger trips [6] made in 1999 represented an 18 percent increase in just four years (APTA 1999).

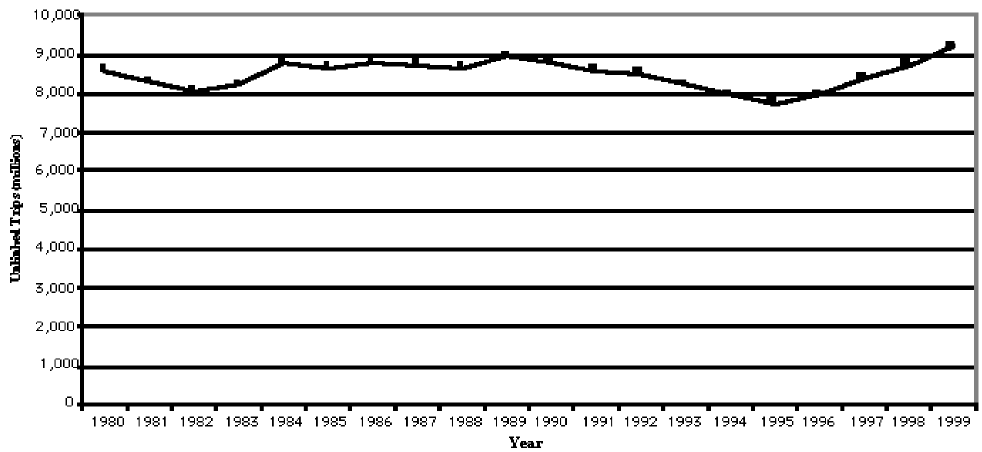


Figure 2. Total Unlinked Trips (1980-1999)

While these recent increases in transit patronage are encouraging, they probably do not herald a return to the heyday of urban public transit seen a century ago. Although overall transit use has gradually climbed since the 1970s, and quite significantly since the mid-1990s, transit's overall share of metropolitan travel continues to fall. This is because cities continue to grow and urban travel is growing even faster. Just 1.8 percent of all person trips in the United States were made by transit in 1995, down from a 2.2 percent share in 1983, and 2.4 percent in 1977. Nationwide, 4.5 percent of all commute trips were made by transit in 1983; by 1995, this share had fallen to 3.5 percent (FHWA 1995; Pisarski 1996). Similarly, data from the U.S. Census and Nationwide Personal Transportation Survey (NPTS) indicate that transit's market share of total travel is continuing to fall despite absolute ridership increases.

Why the continuing decline in transit's market share? Researchers have attributed the decline in transit ridership in U.S. metropolitan areas since the end of World War II to factors such as suburbanization of jobs and residences, rising incomes, increasing car ownership, declining gasoline prices (in real terms), ample free parking, and the effects of changing demographics (such as the maturing of baby-boomers), and the increase in trip-chaining, particularly among women who combine both workplace and household responsibilities in their trip-making (Fleishman, et al. 1996; Pisarski 1996; Taylor and McCullough 1998).

Given transit's declining overall market share of urban travel, perhaps the most auspicious aspect of the recent upswing in transit ridership is that transit trips per capita are on the rise as well, based on projections of 1990 Census data. As shown in Figure 3, Americans took an average of 31.3 trips per capita in 1999, compared to only 28.6 trips per capita in 1995 (a 9 percent increase).[7]

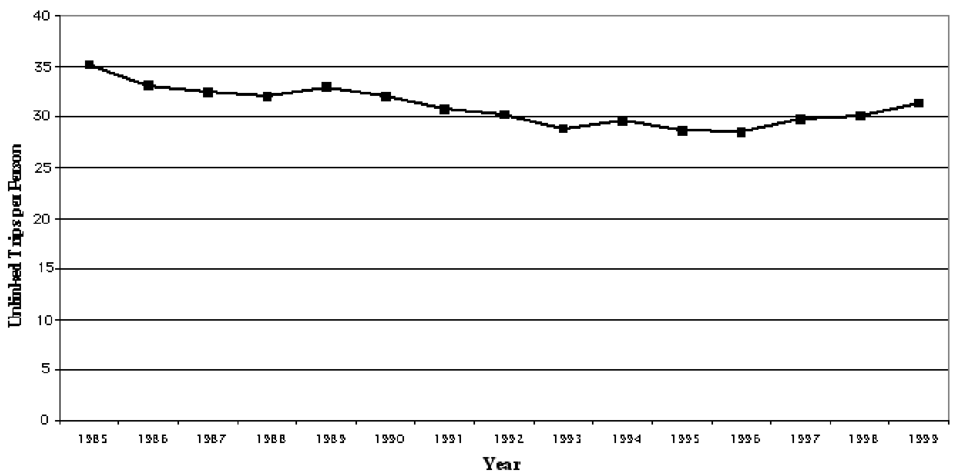


Figure 3. Unlinked Trips per Person

To help explain the forces and factors behind the recent increases in transit ridership, we deconstruct these summary patronage trends below along two dimensions. First, we explore how changes in the factors internal to transit systems (changes in service levels, fares, etc.) have influenced ridership; then we examine how factors external to transit systems (changes in population, employment, development density, etc.) have affected ridership. We conduct this initial analysis using data derived from the National Transit Database (NTD, formerly known as Section 15 database) maintained by the Federal Transit Administration (FTA). The NTD is a system of accounts and records reported annually by the more than 500 transit systems that receive federal operating assistance. These transit systems are required to report a wide range of data to the FTA concerning the finance and operation of their system. Although the NTD is clearly the best, most comprehensive, cross-sectional transit data source, it is not without limitations. For example, not all systems report data to the NTD because systems that do not receive federal subsidies are not required to report. However, the transit systems operating the vast majority of service and carrying the vast majority of passengers in the U.S. do report to the NTD.[8]

EFFECTS OF INTERNAL FACTORS ON TRANSIT RIDERSHIP

Ridership can be affected by internal factors in two principal ways: either by changing the price charged for transit service or changing the level of service provided. We examine each of these factors below.

Changes in the Price Charged for Transit Service

During our study period, changes in average fares per unlinked trip nationwide (calculated by dividing total fare revenues by total unlinked trips) was closely related to changes in ridership. Figure 4 shows that, controlling for the effects of inflation, average transit fares increased, although unevenly, from $0.94 per unlinked trip in 1991 to $1.04 in 1996, an 11 percent increase. Since 1996, however, average fares have declined to $0.93 per unlinked trip (all figures are in 2001 dollars).

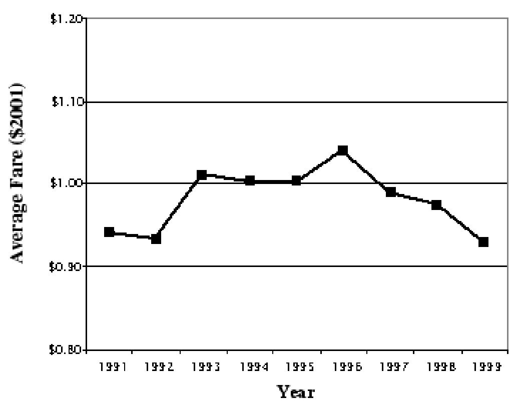


Figure 4. Average Fare per Unlinked Trip

The 11 percent decrease in inflation-adjusted transit fares since 1996 is closely correlated with a 12 percent increase in total ridership and a 10 percent increase in transit trips per capita over the same period. During the 1990s, changes in average fares were closely correlated (-0.61) with changes in overall transit patronage (Figure 5). Figure 6 shows that changes in transit fares were even more closely correlated with changes in transit use per capita

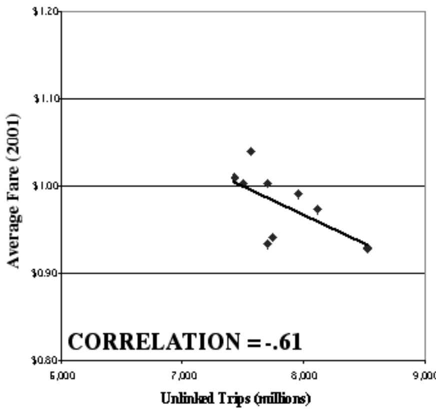


Figure 5. Unlinked Trips vs. Average Fare per Trip

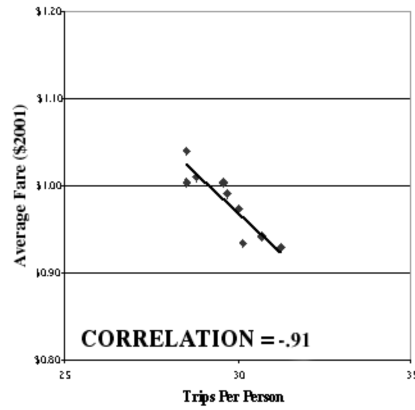
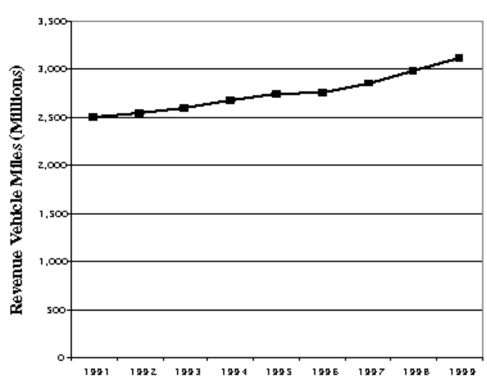


Figure 6. Unlinked Trips per Person vs. Average Fare per Trip

(-0.91). While such findings suggest that, during the 1990s, the demand for transit service was very sensitive to price, the causality of this relationship cannot be determined precisely without performing a more comprehensive multivariate analysis to control the wide array of factors (both internal and external to transit systems) that are thought to affect transit use (see Table B-1).

Changes in the Level of Service Provided

While transit ridership levels were quite volatile during the 1990s, transit service levels rose steadily throughout the decade, with revenue vehicle miles increasing 24 percent between 1991 and 1999, and vehicle miles per person increasing 15 percent over the same time period (Figures 7 and 8).



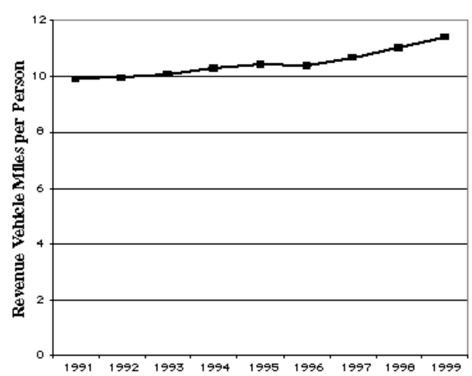


Figure 7. Revenue Vehicle Miles (1991-1999)

Figure 8. Revenue Vehicle Miles per Person (1991-1999)

One would expect that changes in transit service levels are strongly correlated with changes in transit patronage, and in the 1990s this was the case. Figure 9 shows that the correlation between service levels and ridership was 0.81 during the 1990s. The correlation between service levels per capita and ridership levels per capita in Figure 10 were much lower (0.37), which suggests that factors external to transit systems (such as population and employment changes) may have influenced both service and ridership levels during the 1990s, and thus influenced some of the relationships observed here (see Table B-2). We now turn to an analysis of the external factors.

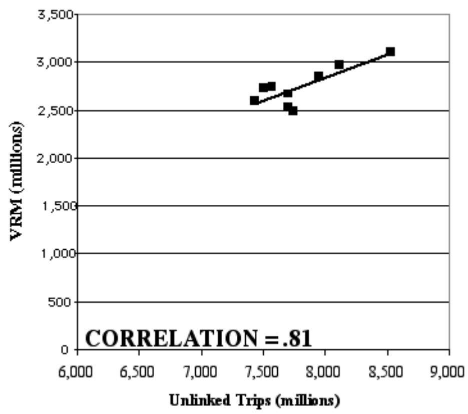


Figure 9. Unlinked Trips vs. Revenue Vehicle Miles

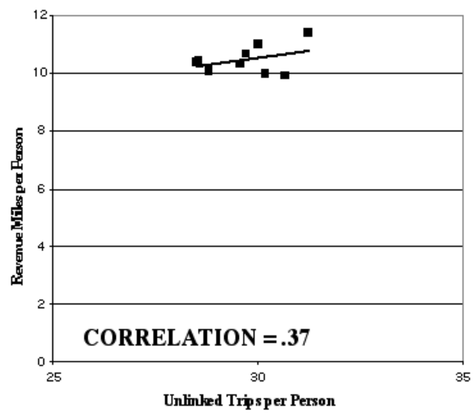


Figure 10. Unlinked Trips per Person vs. Revenue Vehicle Miles per Person

EFFECTS OF EXTERNAL FACTORS ON TRANSIT RIDERSHIP

The data presented in the previous section show that both fare levels and service levels were closely correlated with changes in ridership during the 1990s. What can be inferred from such findings? If transit systems simply cut fares and expand service, will they attract additional riders at a rate almost proportional to the fare and service changes? Perhaps not. While the case of transit fare levels is less clear, it stands to reason that changes in transit service levels are as likely to occur in *response* to increasing demand for transit service as they are to be a *cause* of increasing demand. This raises the question of what factors outside the control of transit managers may be exerting influence on both service and demand. We examine three such factors here: unemployment levels, average wage levels, and overall economic output.

Employment Levels and Transit Ridership

Given the apparent positive relationship between transit ridership and economic cycles, we hypothesized that transit use was inversely related to unemployment rates during the 1990s for three reasons. First, journeys to and from work comprise a larger share of transit trips than auto trips (Pisarski, 1996). Second, lower-wage, less-skilled workers are more likely to lose jobs when the economy contracts. Third, transit riders, especially bus riders, are far more likely to come from low-income households than those traveling in private motor vehicles (Pucher 1995; Garrett and Taylor 1999).

Indeed, we find the unemployment rate was highly correlated (-0.70) with overall transit use during the 1990s. Nationally, the unemployment rate declined for most of the 1990s, from a high of 7.7 percent in 1992 to a low of 4.3 percent in 1999 (Figure 11).

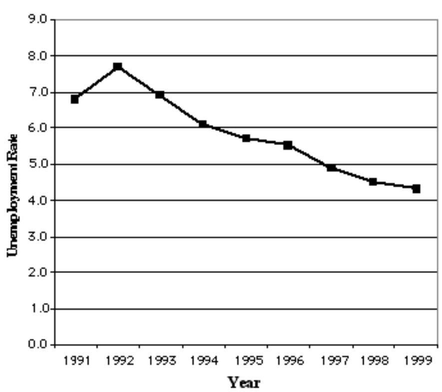


Figure 11. Unemployment Rate (1991-1999)

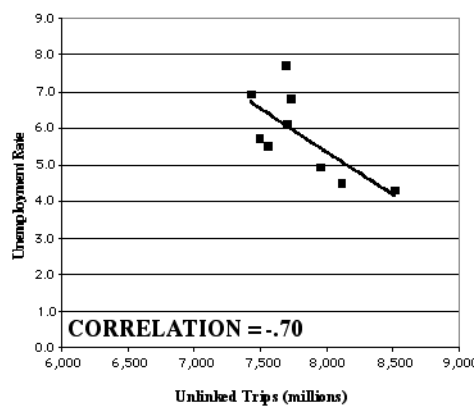


Figure 12. Unlinked Trips vs. Unemployment Rate

The correlation between unlinked trips and unemployment is shown in Figure 12. As noted earlier, transit ridership increased every year but one from 1993 to 1999 (see Table B-3).

Gross Domestic Product and Transit Ridership Levels

A second, common measure of economic activity is the Gross Domestic Product (GDP), calculated annually by the Bureau of Economic Analysis. The GDP grew throughout the 1990s. The average annual increase during the recession years of the early 1990s was just under 2 percent per annum, while the annual rate of increase was in excess of 3 percent per year in the late 1990s (see Figures 13 and 14).

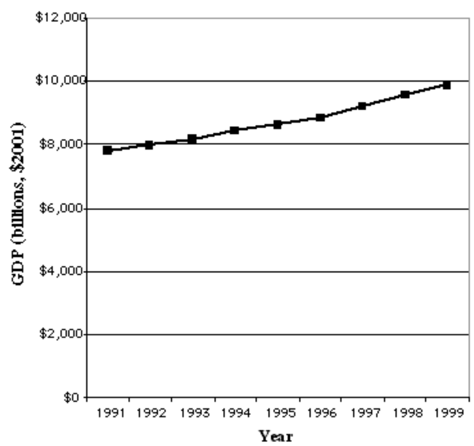


Figure 13. Gross Domestic Product (1991-1999)

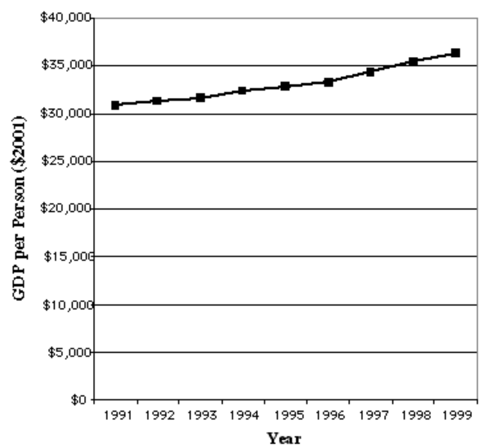


Figure 14. Gross Domestic Product per Person (1991-1999)

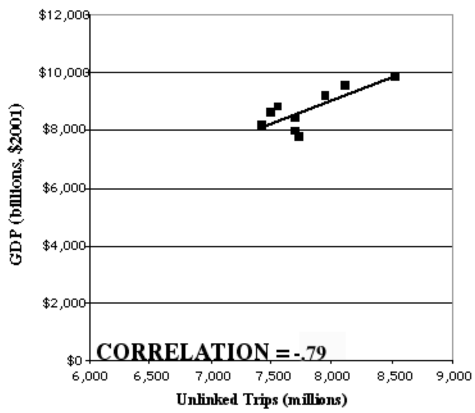


Figure 15. Gross Domestic Product vs. Unlinked Trips

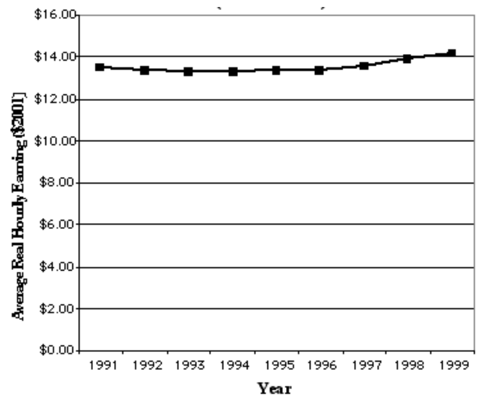


Figure 16. Average Hourly Wage (1991-1999)

We compared transit ridership trends to both the overall real (inflation-adjusted) GDP (Figure 15) and the real GDP per capita. Overall transit ridership tracked both of these measures closely—0.79 with the real GDP, and 0.82 with the real GDP per capita (see Table B-4).

Wage Levels and Ridership

Of all of the economic indicators tested, transit ridership tracked most closely with personal income, as measured by the average hourly wage from all industries (estimated by the Bureau of Labor Statistics). Average "real wages," measured by the BLS in $2001 using the Consumer Price Index, declined in the recession years of the early 1990s, from $13.47/hour in 1991 to $13.28/hour in 1994. For the remainder of the 1990s, average real wages increased every year, to a high of $14.13/hour in 1999 (Figure 16).

While transit trips per capita were not highly correlated with either the unemployment rate (-0.16) or the real Gross Domestic Product (0.24), transit trips per capita during the 1990s were strongly correlated with changes in average real wages (0.70) (see Figure 17). We also found that the unemployment rate was highly negatively correlated with overall transit ridership (-0.70). In addition, the correlation between average real wages and total transit ridership during the 1990s was almost perfect (0.96) (see Figure 18 and Table B-5).

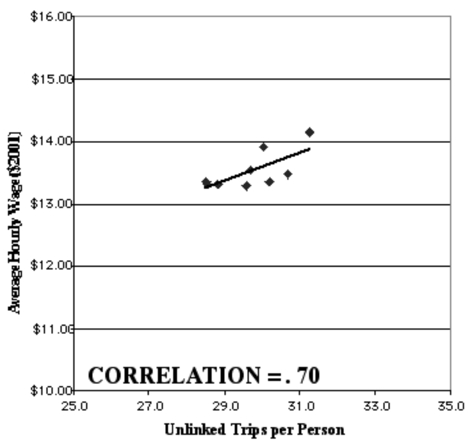


Figure 17. Trips per Person vs. Average Hourly Wage ($2001)

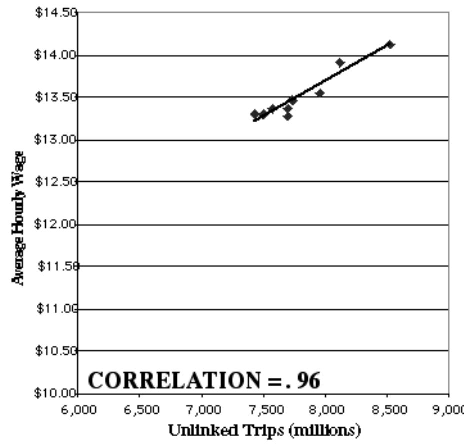


Figure 18. Unlinked Trips vs. Average Hourly Wage

SUMMARY OF EFFECTS OF INTERNAL AND EXTERNAL FACTORS ON RIDERSHIP

In this section, we compare national trends in transit ridership during the 1990s with a series of factors internal to transit systems (fares and service supply) and external to transit systems (unemployment, economic productivity, and wages). We expected to find a relatively high degree of correlation between transit ridership and the internal factors tested, and this was the case. However, such correlations do not necessarily imply causality; this is the "chicken or the egg" question. Increased service should increase ridership, but increased demand should also motivate transit managers to increase service. An important first step in breaking down this chicken-versus-egg question is to look for factors that may be influencing both service levels and ridership. We have analyzed three such factors here, all related to economic activity. As the summary data in Table 4 show, the extraordinarily strong relationships observed between an external economic measure—unconnected to the price or supply of transit service—suggest that many of the factors affecting changes in transit ridership may be outside of transit managers' control.

Table 4: Correlation Coefficients of Internal and External Factors and Transit Ridership

	Unlinked Trips	Unlinked Trips/ Person
Internal Factors		
Real Average Fare ($2001)	-0.61	-0.81
Revenue Vehicle Miles	0.81	n/a
Revenue Vehicle Miles/Person	n/a	0.37
External Factors		
Unemployment Rate	-0.70	-0.16
Real Hourly Wage ($2001)	0.96	0.70
Real GDP ($2001)	0.79	0.24
Real GDP per Person ($2001)	0.82	0.29

These issues will be further discussed in the next chapter, where we take an in-depth statistical look at the agencies across the country that have increased ridership since the mid-1990s.

THE BRIGHT PICTURE: ANALYZING TRANSIT SYSTEMS WITH SIGNIFICANT RIDERSHIP GAINS DURING THE 1990S

While overall transit ridership was up during the mid-and late-1990s, not all transit systems increased transit ridership. Some posted dramatic ridership gains, some tracked national trends, and some lost riders. Our focus here is on transit systems that added riders between the end of the economic recession in 1994 and the end of the economic boom in 1999 when, as noted in the previous chapter, transit use began to rise.

As with the data analyzed in “The Big Picture: Recent Trends in Transit Patronage,” the analysis in this chapter is drawn primarily from the Federal Transit Administration’s National Transit Database (NTD). While the NTD data presented in the previous chapter were drawn from the entire sample of 587 reporting transit agencies, this chapter narrows this sample, and our analysis, in several ways. First, we eliminated all systems that do not operate some form of fixed route transit—bus, trolleybus, light rail, heavy rail, commuter rail, ferryboat, cable car, inclined plane, monorail, jitney, or automated guideway. In other words, we excluded all agencies that operate only demand-response or taxi services. For the many agencies that provide both fixed-route and demand response or taxi services, we included data only on the fixed-route modes (so the data analyzed here may differ slightly from NTD published “totals” for each agency).

In all, 414 agencies offered some form of fixed-route service and reported data to the NTD during the late 1990s. Of these, 367 agencies submitted complete data for both 1995 and 1999. Of those 367 agencies, 227 (or 62 percent of the entire sample) increased ridership (measured as unlinked trips) during a four-year period between 1995 and 1999. Those 227 agencies carried more than 86 percent of the total unlinked trips reported to the FTA in 1999; each of those 227 systems and their patronage during the study period is listed in Appendix C.

The ridership data reported in this chapter, and throughout this document, are for unlinked trips. Most transit researchers would agree that linked trips (trips that include transfers) and passenger miles data (total trips’ average trip length) are more telling and less biased measures of transit use. However, reliable, comparable cross-sectional data for those measures of transit service consumption are not available. Lacking data on those measures, we (and nearly all previous research on transit ridership) use unlinked trip data.

SUMMARY OF AGENCIES THAT INCREASED RIDERSHIP

Perhaps the most distinguishing characteristic of transit systems that added riders during the late 1990s is that they have no distinguishing characteristics. They come in all shapes and sizes, from all areas of the country; some operate one way and others operate another; and they operate in a wide variety of settings.

Transit Modes Operated

Transit operators of all kinds increased ridership, including those with just one mode of operation and those that operated many forms of transit. Nine different modes—bus, light rail, ferryboat, heavy rail, commuter rail, trolleybus, cable car, automated guideway, and monorail—were represented among the agencies that increased ridership.

With trips on buses composing 62 percent of transit trips nationwide (APTA 1999), it makes sense that buses were the most represented mode. Two hundred eleven of the agencies (93 percent) had at least some bus service, while 82 percent of the agencies operated only buses. The second-most represented mode was light rail, which only 13 agencies operated. Table 5 details how many of the agencies operated each mode; Table 6 shows all the combinations of modes featured in the agencies that increased ridership (note in Table 6 that the “# of agencies” adds up to more than 100 percent, because some agencies operate more than one mode).

Table 5: Mode Combinations of Agencies with Increased Ridership (1995-1999)

Combination	Frequency
Bus	187
Bus, Heavy Rail	6
Bus, Light Rail	6
Commuter Rail	6
Ferryboat	6
Bus, Ferryboat	4

Table 5: Mode Combinations of Agencies with Increased Ridership (1995-1999) (Cont.)

Combination	Frequency
Bus, Heavy and Light Rail	2
Bus, Trolleybus	1
Bus, Trolleybus, Ferryboat, Heavy, Light and Commuter Rail	1
Bus, Trolleybus, Light Rail	1
Bus, Trolleybus, Light Rail, Cable Car	1
Bus, Light and Commuter Rail	1
Bus, Other	1
Heavy Rail	1
Heavy Rail, Ferryboat	1
Light Rail	1
Other	1
TOTAL	227

Table 6: Frequency of Modes in Agencies with Increased Ridership (1995-1999)

Mode	# of Agencies	% of Agencies
Motorbus	211	93.0
Light Rail	13	5.7
Ferryboat	12	5.3
Heavy Rail	11	4.8
Commuter Rail	8	3.5
Trolleybus	4	1.8
Other	2	0.9
Cable Car	1	0.4
TOTAL	262	115.0%

Twenty-five agencies operated some combination of modes, including Boston’s Massachusetts Bay Transportation Authority, which has six different modes of operation—bus, trolleybus, heavy rail, light rail, commuter rail, and ferryboat. Regardless, there is no dominant mode other than buses.

Agency Size

As agencies operated in a variety of different modes, the agencies that reported ridership increases also came in all different sizes. Of the 227 agencies, the smallest reported increase was by the Huntsville Department of Transportation (AL), with 217 annual trips; the largest reported increase was by the New York Metropolitan Transit Authority (New York MTA), with 536,000,000 annual trips. The New York MTA is, by far, the largest transit system in the United States. The New York MTA subway and bus system report more than 2.4 billion unlinked trips in 1999, an increase of 28 percent in just four years, and a significant recovery from several years of precipitous losses in the early 1990s (Taylor and McCullough 1998). Most of the other largest transit agencies also experienced patronage increases: the Chicago Transit Authority (CTA), the Los Angeles County Metropolitan Transportation Authority (LACMTA), the Washington Metropolitan Area Transportation Authority (WMATA), Boston's Massachusetts Bay Transportation Authority (MBTA), and the San Francisco Municipal Railway. Of the 10 largest transit agencies in the United States in 1995, only two lost ridership—SEPTA in Philadelphia and Baltimore's MTA.

In fact, 38 of the 49 U.S. transit systems (78 percent) that carry 20 million passengers per year or more increased ridership during the late 1990s, and accounted for 91 percent of the total growth in patronage nationwide (see Table 7). By comparison, about three-fifths of the "large" (61 percent), "medium" (62 percent), "small" (56 percent), and "very small" (59 percent) transit agencies added riders during the late 1990s.

Table 7 also shows that, although a majority of U.S. transit systems added riders in the late 1990s, the ridership gains by the New York MTA account for 62 percent of all increased transit ridership nationwide. In U.S. public transit, New York MTA is the eight-hundred-pound gorilla, and including its data in an analysis of ridership gains during the late 1990s can create a misleadingly rosy picture of nationwide trends in transit patronage. With nearly 2.5 billion riders, the New York MTA carries more than five times as many riders as the second-largest transit agency—the Chicago Transit Authority (see Table 8).

Consequently, here and throughout the remainder of the chapter we will look at the effect of factors on ridership, first considering the totals from New York MTA, and then excluding its totals. Table 7 shows that if we exclude New York data, the remaining "very large" transit agencies actually added riders at a much slower growth rate (5.9 percent) than did the group averages of the

Table 7: Agencies with Increased Ridership, by Size

Category	# of Agencies	# Increased	% Increased	1999 Unlinked Trips (thousands)	Absolute Change (thousands), 1995-99	% Change, 1995-99
Very Large	49	38	77.6	7,092,094	794,518	12.6
(minus NY MTA)	*48*	*37*	*77.1*	*4,663,138*	*258,679*	*5.9*
Large	61	37	60.7	676,670	38,910	6.1
Medium	71	44	62.0	256,679	23,462	10.1
Small	68	38	55.9	106,869	7,834	7.9
Very Small	118	70	59.3	63,428	5,549	9.6
TOTAL	367	227	61.9	8,195,740	870,273	11.9
Total minus NY MTA	*366*	*226*	*61.7*	*5,766,784*	*334,433*	*6.2*

Definition of Agency Size

Size	# of Unlinked Trips
Very Large	> 20 million
Large	5-20 million
Medium	2-5 million
Small	1-2 million
Very Small	< 1 million

Table 8: Largest U.S. Transit Agencies (Fixed-Route Transit Only)

Agency	Unlinked Trips, 1999 (fixed-route transit only)
New York MTA	2,429 million
Chicago Transit Authority	466 million
Los Angeles County MTA	399 million
Washington D.C. Metro (WMATA)	356 million
Massachusetts Bay Transportation Authority	318 million

smaller transit agencies. Excluding New York MTA data also cut the overall national growth in transit riders during the late 1990s nearly in half—from 11.9 percent to 6.2 percent.

Geographical Dispersion

Because of their tremendous population growth, it should come as no surprise that the Western states have the highest percentage of transit agencies that saw increased ridership in the late 1990s. Of the 90 agencies in the Western states, 71 (79 percent) witnessed increased ridership, far better than the national average of 62 percent. With a large percentage of the West within its borders, California had the most stunning growth of all, with 92 percent of systems adding riders. In fact, 47 of the 227 agencies that increased ridership are from California, discounting New York MTA, which accounted for 40 percent of the entire country's ridership growth. The West's transit agencies had a net gain of 194 million trips and a 12.5 percent increase in unlinked trips between 1995 and 1999—twice the national average, discounting New York MTA.

Conversely, it appears that transit ridership in the east is stagnating compared to the rest of the country. The East—which had the lowest percentage of agencies increase ridership (53 percent)—actually had the largest overall increase in trips (both in terms of absolute and percentage gains). However, take New York MTA out of the equation and the East falls toward the bottom, with only a little over 40 million transit trips added (12 percent of the nation's total) and a growth rate of only 2 percent. Only five of the 11 Eastern states saw increases in ridership, and, discounting New York MTA, Maine had the highest growth rate of any Eastern state, at 9.3 percent. This was lower than that of five Western states, four Southern states, and five Midwestern states. The South had lower absolute ridership gains than the East, yet its 3.8 percent growth rate was nearly twice as high as the East's (without New York MTA).

In all, 62 percent of the Midwestern agencies, 54 percent of the Southern agencies, and 53 percent of the Eastern agencies increased ridership. Consequently, the absolute and percentage increases varied across agencies nationwide, and some regions increased more than others. However, we can see that transit agencies were growing in all corners of the country. See Table 9 for state and regional breakdowns of ridership gains and losses.

On a more local view, transit agencies with increased ridership from 1995 to 1999 were found in a wide variety of metropolitan areas. In fact, the 227 agencies covered 162 different metropolitan areas. Twenty-four areas had more than one transit agency make the list, including New York City-Northeastern New Jersey with 15 and Los Angeles with 13. The San Francisco-Oakland area had six, Seattle had four, and Milwaukee, San Juan (PR), San Diego, and Washington (DC-MD-VA) had three each. Boston, Cleveland, Dallas-Fort

Table 9: Ridership Gains and Losses Across States and Regions, 1995-1999

Region	Systems Adding Riders	Total Trips Gained (thousands)	Systems Losing Riders	Total Trips Lost (thousands)	% of Systems Adding Riders	Net Change in Ridership (thousands)	% Change in Ridership
WEST	71	210,467	19	-16,141	79%	194,326	12.5%
Alaska	1	296	0	0	100.0%	296	9.8%
Arizona	3	2,525	2	-1,432	60.0%	1,093	2.1%
California	47	136,111	4	-3,199	92.2%	132,913	12.4%
Colorado	2	1,037	3	-176	40.0%	861	1.2%
Hawaii	0	0	1	-6,724	0.0%	-6,724	-9.2%
Idaho	1	120	1	-225	50.0%	-105	-6.5%
Nevada	1	24,723	1	-815	50.0%	23,908	65.3%
New Mexico	1	1	2	-124	33.3%	-123	-1.6%
Oregon	3	19,646	1	-342	75.0%	19,304	25.7%
Utah	1	149	1	-2,150	50.0%	-2,001	-7.9%
Washington	11	25,859	3	-955	78.6%	24,903	17.3%
SOUTH	52	69,148	44	-36,890	54.2%	32,170	3.8%
Alabama	2	144	0	0	100.0%	144	11.2%
Arkansas	1	1,025	1	-197	50.0%	828	21.4%
Florida	12	17,696	5	-1,842	70.6%	15,853	9.5%
Georgia	2	20,348	6	-1,979	25.0%	18,370	11.8%
Kentucky	1	1,772	2	-2,987	33.3%	-1,215	-4.8%
Louisiana	3	647	4	-12,237	42.9%	-11,590	-13.5%
Mississippi	1	77	0	0	100.0%	77	10.9%
North Carolina	5	2,813	5	-1,107	50.0%	1,706	5.6%
Puerto Rico	3	7,568	1	-3,483	75.0%	4,085	5.1%
South Carolina	3	268	1	-345	75.0%	-77	-1.9%
Tennessee	2	457	5	-3,658	28.6%	-3,201	-11.7%
Texas	10	12,113	8	-6,820	55.6%	5,293	2.4%
Virginia	5	4,034	5	-2,138	50.0%	1,897	5.2%
West Virginia	2	186	1	-97	66.7%	88	2.8%
MIDWEST	59	88,483	36	-21,423	62.1%	67,059	6.4%
Illinois	7	35,545	5	-1,244	58.3%	34,301	6.1%
Indiana	9	2,914	3	-1,013	75.0%	1,901	7.8%
Iowa	3	1,391	5	-797	37.5%	594	4.7%
Kansas	3	218	0	0	100.0%	218	5.9%
Michigan	7	4,506	6	-16,430	53.8%	-11,924	-13.6%
Minnesota	2	10,948	3	-214	40.0%	10,735	16.0%
Missouri	3	3,091	2	-160	60.0%	2,931	4.4%
Montana	2	143	0	0	100.0%	143	11.8%
Nebraska	1	281	1	-97	50.0%	184	2.9%
North Dakota	0	0	1	-54	0.0%	-54	-7.8%
Ohio	11	15,194	4	-556	73.3%	14,639	11.4%
Oklahoma	2	778	0	0	100.0%	778	11.8%
South Dakota	2	61	0	0	100.0%	61	8.8%
Wisconsin	7	13,412	6	-859	53.8%	12,553	16.7%
EAST	45	656,000	41	-79,371	52.9%	576,629	14.8%
EAST (w/o NY MTA)	44	120,161	41	-79,371	52.4%	40,790	2.0%
Connecticut	4	1,641	4	-1,756	50.0%	-116	-0.3%
District of Columbia	1	10,891	0	0	100.0%	10,891	3.2%
Maine	3	218	0	0	100.0%	218	9.3%
Maryland	2	2,299	2	-2,624	50.0%	-325	-0.3%
Massachusetts	7	23,238	4	-9,852	63.6%	13,386	4.2%
New Hampshire	1	1	1	-11	50.0%	-10	-1.4%
New Jersey	4	24,449	3	-36,491	57.1%	-12,042	-4.7%
New York	16	589,154	14	-12,133	53.3%	577,021	24.5%
Pennsylvania	6	3,928	12	-16,455	33.3%	-12,528	-3.0%
Rhode Island	1	181	0	0	100.0%	181	1.2%
Vermont	0	0	1	-48	0.0%	-48	-3.0%
GRAND TOTAL	**227**	**1,024,098**	**140**	**-153,825**	**61.9%**	**870,184**	**11.9%**
TOTAL (w/o NY MTA)	**226**	**488,259**	**140**	**-153,825**	**61.7%**	**334,345**	**6.2%**

*Delaware and Wyoming reported no agencies to the FTA that operate fixed-route transit.

Worth, Davenport-Rock Island-Moline (IA-IL), Durham (NC), Kansas City (MO-KS), Norfolk-Virginia Beach-Newport News (VA), Philadelphia, Phoenix, Portland-Vancouver (OR-WA), Riverside-San Bernardino (CA), Sacramento, Santa Rosa (CA), St. Louis (MO-IL), and Tacoma (WA) had two agencies each.

Almost all major cities had at least one transit agency that witnessed increased ridership at the end of the decade. The largest urbanized area in which no agency increased ridership was Baltimore (the 17th largest urbanized area, as of the 1990 Census). The only other urbanized areas with greater than 500,000 people as of the 1990 U.S. Census that did not see increased ridership were San Antonio, New Orleans, Buffalo-Niagara Falls, Indianapolis, Memphis, Salt Lake City, Louisville, Jacksonville, Honolulu, Birmingham, Rochester (NY), Richmond, El Paso, Austin, Hartford, and Omaha. The other 43 areas all had at least one agency that increased ridership during the late 1990s.

So although a quick glance at the geography of the agencies with increased ridership revealed that agencies—and ridership as a whole—are growing fastest in the West and Midwest, and slowest in the South and East (excluding New York MTA), agencies with increases are coming from all corners of the nation and from cities of all shapes and sizes—from the industrial cities of the Northeast to the sun-drenched, sprawled-out areas of the Southwest.

We next take a look at internal and external factors and their roles in the agencies that have increased ridership.

CHANGES IN FARES AND SERVICE LEVELS AMONG TRANSIT AGENCIES THAT INCREASED RIDERSHIP

As in the previous section, we will look at the effect that fares and revenue service have on the ridership figures. However, we again are looking at the effect and influence that fares and revenue service have within agencies that are increasing ridership, which is a different measure than in the previous chapter.

Fares

Among the 227 U.S. transit agencies that had increased ridership during the late 1990s, we found that changes in average fares are related to changes in ridership, in both expected and unexpected ways. As in the previous section, we calculated the average per-trip fare for each agency by dividing the total fare revenue by the number of unlinked trips. While this single measure does not account for variations in fares paid by different types of passengers, the calculated average fare takes into account passes, discounts, and special fare promotions, in addition to the single-trip base fare. Since we are using 1995 and 1999 endpoints, we converted both the 1995 and 1999 average fares to 2001 dollars based on the CPI figures for "all urbanized areas" given by the Bureau of Labor Statistics (Table B-1). We divided the 180 agencies in our sample that reported fare revenues to the NTD into three categories (see Table 10): agencies at which the inflation-adjusted average fare *increased* by more than 5 percent during the late 1990s; agencies with *little or no change* in the inflation-adjusted average fare (that is, the inflation-adjusted average fare increased or decreased by less than 5 percent during the study period); and agencies at where the inflation-adjusted average fare *decreased* by more than 5 percent during the late 1990s.

Table 10: Relationship of Fare and Ridership Changes

Fare Change ($2001)	# of Agencies	Unlinked Trips, 1999 (thousands)	% Increase, 1995-99
Fare Increase > 5%	68	812,252	10.3
No Significant Change (less than 5% increase or decrease)	45	2,367,469	8.5
Fare Decrease > 5%	67	3,651,367	23.2
Fare Decrease > 5% (excluding NYC)	66	1,222,419	14.2
Total Reported (with NYC)	181		
Total Reported (excluding NYC)	180		

Table 10 shows that, as a group, agencies at which the inflation-adjusted average fare decreased by more than 5 percent saw ridership climb by a whopping 23.2 percent. In contrast, increasing average fares appeared to have little effect on ridership; agencies with little change in the average fare, as a group, saw ridership climb 8.5 percent, while agencies that increased average inflation-adjusted fares by more than 5 percent, as a group, increased ridership by 10.3 percent. However, the New York MTA significantly influences the national sample. Table 10 also reports the data without New York MTA, and shows that the ridership increases 14.2 percent among the non-New York MTA systems that saw inflation-adjusted fares decline by more than 5 percent. This group of systems increased ridership more than the other two groups of transit systems, but just marginally.

This relationship is shown clearly in Figure 19, which plots each of the 180 transit agencies by the percent change in average inflation-adjusted fare and the percent change in ridership during the study period. The linear regression function shows that decreasing average fares are associated with increasing ridership, while increasing fares appear to have little (or even a slightly positive) relationship with ridership. The correlation coefficient stands at -0.079 between percentage fare increases and percentage ridership increases.

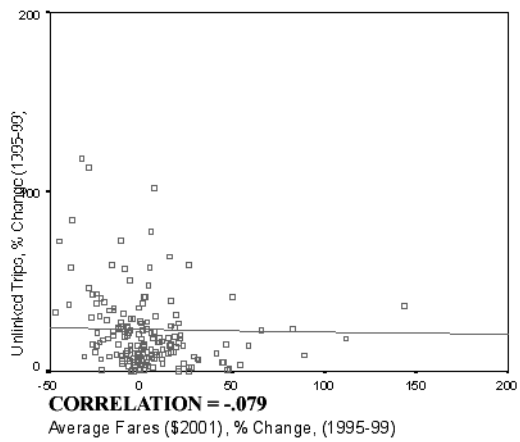


Figure 19. Scatterplot of Fare and Ridership Changes

One disclaimer has to be made here, in that we are calculating average fare as the total fare revenue divided by the number of unlinked trips. Thus, the statistic is slightly skewed, because unlinked trips would serve as factor on one side of the correlation and the denominator on the other.

The negative correlation agrees with the calculation that was made in the previous section looking at national trends, although it is not nearly as strong as the –0.61 correlation coefficient that appeared there.

Service Level Changes

As noted in the previous chapter, there is an obvious, although not exact, relationship between service supply and ridership. In general, as service frequency and coverage increase, patronage grows as well. However, because the level of transit service provided is, to a large degree, a function of the demand for transit service, there is no guarantee that simply increasing service will result in corresponding ridership growth.

When we compared service level and ridership trends among our 227 transit systems, we found a strong correlation between these factors. Among the 227 systems that added riders during the late 1990s, only 38 (17 percent) decreased service levels (measured in terms of revenue vehicle hours of service) during the study period.

Among the 188 transit systems (again, excluding the New York MTA) that increased both service levels and patronage during the 1990s, the average increase in revenue vehicle hours of service was 11.5 percent, and the average increase in ridership was almost the same, 11.9 percent (see Table 11).

Table 11: Relationship Between Service and Ridership

Revenue Vehicle Hours Change	# of Agencies	Unlinked Trips, 1999 (thousands)	% Change, 1995-99	Revenue Hours, 1999 (thousands)	% Change, 1995-99	Trips per Revenue Hour, 1999	% Change, Trips per Hour, 1995-99
RVH increase > 50 %	23	138,997	64.1%	5,078	79.0%	27.4	-8.4%
RVH increase 25 - 50 %	36	159,577	19.1%	6,396	29.8%	25.0	-8.2%
RVH increase 10 - 25 %	62	1,202,504	15.8%	32,321	15.9%	37.2	-0.1%
RVH increase < 10 %	67	2,932,876	8.5%	58,346	4.3%	50.3	4.0%
TOTAL RVH INCREASE	188	4,433,954	11.9%	102,141	11.5%	43.4	0.4%
RVH decrease < 10 %	29	240,741	4.3%	7,087	-4.8%	34.0	9.5%
RVH decrease > 10%	9	24,725	7.2%	728	-19.9%	34.0	33.9%
TOTAL RVH DECREASE	38	265,466	4.5%	7,815	-6.4%	34.0	11.7%
TOTAL	226	4,699,420	11.5%	109,956	10.0%	42.7	1.4%
NYC MTA		*2,428,957*	*28.3%*	*28,874*	*3.7%*	84.1	23.7%

Within the agencies that increased service, the more they increased it, the higher the ridership climbs were. For instance, the 67 agencies that increased service saw only an 8.5 percent increase in ridership, while those agencies that increased service by 50 percent saw a collective 64 percent increase in ridership.

However, as service was increased more, ridership gains were proportionately less. For example, the agencies that increased service slightly saw ridership increase at a rate double that of the service increase, while the agencies that increased service between 10 and 25 percent witnessed a rise in ridership that essentially equaled the increase in service. The agencies that increased service by more than 25 percent had a percentage increase in ridership that was 20 percent lower than the percentage increase in service.

For those agencies that decreased service, a collective total of a 6.4 percent decrease in revenue hours still allowed a 4.5 percent increase in unlinked trips. In an even more striking occurrence, in the nine agencies that decreased service by more than 10 percent, (a collective total decrease of nearly 20 percent) ridership increased by more than 7 percent.

Consequently, the agencies that decreased the most service actually witnessed the greatest trip-to-service-hour ratio, and those that decreased service by more than 10 percent saw a 34 percent increase in trips taken per revenue hour. Those that increased service by more than 50 percent had a decreasing trip-per-revenue-hour rate greater than 8 percent.

Thus, while ridership may have gone up in all of these agencies, this did not necessarily translate into improved service effectiveness, illustrating that ridership gains are not simply the direct result of added service.

Figure 20 shows the relationship of the percentage increase in revenue vehicle hours to the percentage increase of unlinked trips. As expected, the correlation between the increase in revenue hours and increase in ridership is quite high.[9]

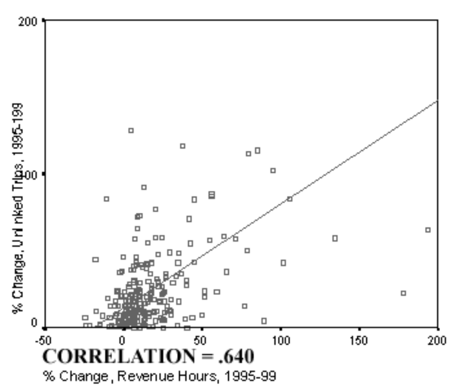


Figure 20. Scatterplot of Revenue-Hour Increase and Ridership Increase

Consequently, we arrived at a correlation coefficient of 0.640. This was by far the highest correlation between any internal factor and ridership increase that we saw in our study.

EFFECT OF EXTERNAL FACTORS ON TRANSIT RIDERSHIP

Given the surprisingly weak relationships observed between fare and service levels and patronage, we again consider the relationships between external economic conditions and ridership to look for the influence of factors beyond transit managers' control on transit use. In this section we examine the relationships between transit ridership and the unemployment rate, overall employment levels, and changes in personal income.

Unemployment Rate

In the previous chapter, we hypothesized and observed an inverse relationship between transit use and the unemployment rate. That is, for all transit systems during the 1990s, ridership increased when unemployment rates decreased.

However, the effect of the unemployment rate on ridership levels of the agencies with increased ridership was the opposite of what would be expected and the opposite of what we discovered in the national data discussed earlier in the chapter. In this case, the nine agencies that experienced an increase in the unemployment rate of their respective metropolitan areas (based on the unemployment rate of agencies' [MSA]) witnessed a collective ridership increase of 27.5 percent, while the remaining 210 agencies that were in metropolitan areas with declining unemployment rates (excluding NYC Transit) had a 7.6 percent increase in ridership.

The conundrum is even more exacerbated when looking at specific levels of reduction of the unemployment rate. There is no rhyme or reason behind the numbers. The agencies that were in areas where the unemployment rate dropped 10 to 20 percent saw an 11.2 percent increase in ridership, while those that had unemployment rates drop even more (20 to 30 percent) actually had a decrease in ridership (see Table B-6).

As can be seen in Figure 21, in these cases ridership is actually decreasing as the unemployment rate decreases. Without considering the outliers—New York MTA and Yuba-Sutter—the correlation coefficient is 0.022.

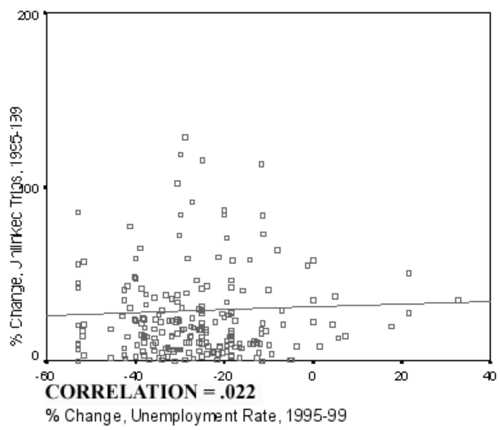


Figure 21. Scatterplot of Ridership Increase and Unemployment Rate Change (by MSA)

For the agencies that we looked at, the unemployment rate is clearly a much worse indicator of how much ridership will change, especially in comparison to absolute numbers of employment in any given metropolitan area, which we will discuss next.

Total Employment

Perhaps more than any other variable, the change in levels of employment has a tremendous effect on changes in transit ridership. To do this analysis, we took Bureau of Labor Statistics (BLS) data that included total employment in a given area. When possible, we used the MSA figure, but sometimes only the Consolidated MSA (CMSA), Primary MSA (PMSA), or even the city data. The MSA number was the most preferable, because it was the most prevalent within the BLS database and thus provided the most consistency. While we could have found the city data for every area, this would have been inappropriate because of the tendency of transit systems to cross jurisdictional lines. Since some agencies operate in areas smaller or larger than the boundaries of their MSAs, the employment figures might not represent exactly the number of jobs in any agency’s service area, but it is a close enough proxy.

Of the 220 systems for which we were able to get employment data, 209 (95 percent) had total employment increases in their respective metropolitan regions. These agencies, as a group, had a collective 11.6 percent increase in unlinked trips during the study period. On the other hand, the nine agencies that were in areas where employment was falling had only a 4.4 percent increase in ridership.

The degree to which employment increased played an important role in determining how much ridership would increase. We divided the agencies into four categories—those with less than a 5 percent increase in employment (59 agencies), those with between 5 and 10 percent increase in employment (100, without New York MTA), those with between 10 and 15 percent increase in employment (38), and those with more than a 15 percent increase in employment (12). Ridership increased 7.3 percent, 10.5 percent, 19.9 percent, and 25.9 percent, respectively. This is illustrated in Table 12 and Figure 22.

Table 12: Relationship of Ridership Increase and Absolute Employment Changes

Level of Increase/Decrease in Total Metropolitan Area Employment	# of Agencies	Unlinked Trips, 1999 (thousands)	% Increase 1995-1999
More than 15%	12	384,657	25.9
Between 10 and 15%	38	309,590	19.9
Between 5 and 10%, minus NYC	100	2,989,436	10.5
Less than 5%	59	890,753	7.3
TOTAL Increased Employment	209	4,574,437	11.6
TOTAL Decreased Employment	10	38,434	4.4

Las Vegas had the highest rate of increase of any metropolitan area that we studied, at 23 percent, and its transit system, ATC Van/Com, showed a ridership increase of 87 percent, which was the largest of any transit system that carried more than 3 million riders in 1995. ATC Van/Com carried just over 28.5 million riders in 1995, compared to 53.2 million in 1999.

However, when we look at a scatterplot of the growth of all agencies (minus New York MTA and Yuba-Sutter) in unlinked trips compared to the change in metropolitan area employment, we see a positive correlation of 0.046—a

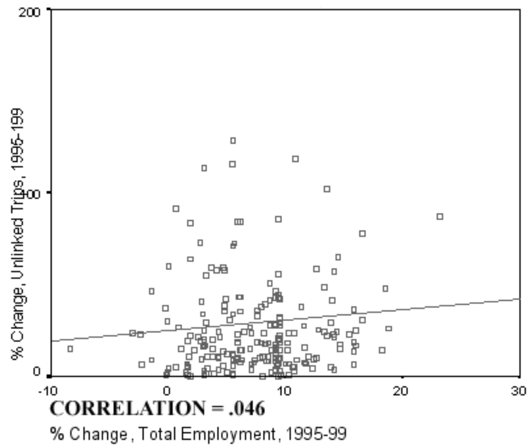


Figure 22. Scatterplot of Ridership Increase and Absolute Employment Changes

result we expected, and which conforms to the prediction that resulted from our study of national trends in the previous chapter.

Using the Bureau of Economic Analyses' Regional Economic Information System (REIS), we obtained per capita income data for the MSAs of 196 of the 227 agencies that increased ridership. Of these areas, the only MSA that had a decrease in its real per capita income (in 2001 dollars) was Flint, Michigan, which had a 12 percent decrease in the four-year span. Still, Flint's Mass Transportation Agency witnessed a 23 percent increase in boardings, most likely the result of a 59 percent increase in revenue hours.

Note that the percentage increase in income did not translate directly to how much ridership would grow. Table 13 shows that the group of agencies that were located in MSAs that grew the most economically had the least ridership growth, while the group of agencies whose per capita incomes grew at a rate below 10 percent saw ridership increase much more rapidly than those with income increases higher than 10 percent.

Similarly, Figure 23 shows an inverse relationship between per capita income and unlinked trips. The correlation between these variables is -0.022.

Table 13: Relationship Between Ridership Increase and Change in Per Capita Income by MSA

Change in Per Capita Income for Agency's MSA	# of Agencies	% Change in Unlinked Trips, 1995-99	% Change in Revenue Vehicle Hours, 1995-1999
Greater than 15%	24	8.0	9.2
Between 10 and 15%, minus NYC	84	12.3	9.8
Between 5 and 10%	77	18.6	8.0
Less than 5%	9	16.7	14.3

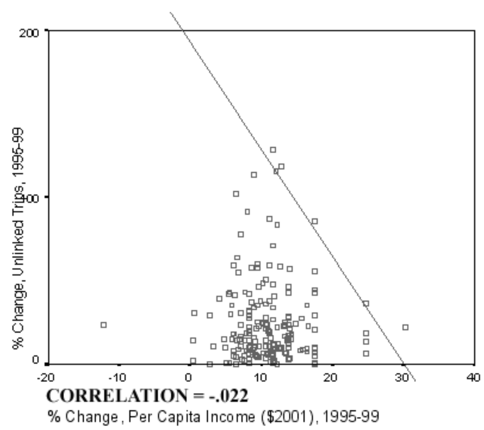


Figure 23. Scatterplot of Increase in Ridership and Growth in Per Capita Income by MSA

SUMMARY

In the previous chapter, we looked at both the nationwide trends of transit ridership and at agencies that have increased ridership in the late 1990s. We found that ridership began increasing in the mid-1990s and continued to increase throughout the last half of the 1990s, and looked at several external and internal factors that contributed to the changes in ridership levels.

This chapter presented an overview of the agencies that have increased ridership and explored the factors that could explain these ridership increases.

From this initial look, we have found that agencies have been improving ridership in all areas of the country, not only in specific geographic areas (other than a preponderance of agencies on the West Coast). Rather, they come from metropolitan areas of all shapes, sizes, and patterns. Some agencies are small, some big, some medium-sized, and virtually all modes are represented, although bus operations are the most in common.

From this chapter, we have found that the factors with the highest correlation to ridership increases (for those agencies that have increased ridership) are increases in revenue service and total employment. Surprisingly, increases and decreases in average fares appear to have relatively little effect on ridership, and the unemployment rate is positively correlated with increasing ridership (meaning as the unemployment rate goes up, so does ridership).

These questions will be further explored in detailed case study and survey analysis in the forthcoming chapters.

SURVEY OF SUCCESSFUL TRANSIT SYSTEMS: WHAT DO THE EXPERTS THINK EXPLAINS RIDERSHIP GROWTH?

Although the aggregate data analyses in “The Big Picture: Recent Trends in Transit Patronage” and “The Bright Picture: Analyzing Transit Systems With Significant Ridership Gains During the 1990s” paint a picture of increasing transit use during a period of sustained economic expansion, these analyses do not allow for a nuanced understanding of the internal strategies pursued by, and the external factors facing, individual transit operators. For example, while the data presented in those two chapters show that declining inflation-adjusted per-trip fares are associated with increased transit use, they tell us nothing about *how* fares have been reduced. Were they the result of changes in transfer policies (as in New York City)? Were fares cut for off-peak or other inexpensive-to-provide trips? Were unlimited access universal transit pass programs established with large entities (such as universities)? Answering such questions requires that more detailed, specific, and qualitative information be gathered directly from transit agencies, and that is the subject of this chapter.

We used the 227 federally subsidized transit operators that increased patronage between 1995 and 1999 and were analyzed in the previous chapter as the sample universe for a survey. We developed and mailed questionnaires to the chief executives of each agency (see Appendix D for a copy of the survey instrument). The questions were structured to allow respondents to address circumstances or issues they considered important, while focusing on key factors contributing to increases in ridership. The survey asked open-ended questions about the costs and benefits of programs and policies that contributed to ridership gains, the transit system’s goals in increasing ridership, and how the ridership increase has benefited the community and the transit system. In addition, the survey asked respondents to discuss their respective agencies’ future plans for maintaining and increasing ridership.

Five surveys were returned as undeliverable, and a second attempt was made to contact these agencies to obtain valid contact information. Calls were placed to a random sample of 60 agencies that did not respond to the initial survey. Five agencies that responded to the mailed survey indicated their ridership levels actually *decreased* during the time period of this study (in other words, the NTD data were inaccurate). These agencies were subsequently removed from the sample. In total, 103 surveys were returned, for a valid response rate of 45 percent.

It is important to note that there are some limitations to the data and findings. The survey asked transit officials for information about increases in ridership, and questionnaire responses are formed by transit officials' *perceptions* of ridership increases. Therefore, the results may portray a biased view of system performance. The questionnaire asked transit officials to determine if any particular programs or policies implemented by the transit agency could be responsible for the large growth in ridership. Transit officials are understandably more likely to attribute their ridership growths to internally controllable and internally controlled programs—fare changes or service increases, for example—than to external factors outside their immediate control, such as changes in the economy or population growth. In this sense, it is important to view the questionnaire results more as perceptions and less as causal explanations of noteworthy ridership increases.

Because the survey was sent to only one person in each agency, responses may be biased to the individual's perception of the effectiveness of particular programs and factors, rather than representative of the agencywide perspective about ridership increases. Finally, since surveys were conducted only of transit agencies that added riders in the late 1990s, the results do not reflect the views of transit managers whose systems lost riders during this period.

SURVEY FINDINGS AND ANALYSIS

Transit systems with large growth in ridership have some common elements. Consistent with the findings of the aggregate data analysis in the two previous chapters, the factors that transit system officials report as contributing to their increase in ridership can be divided into internal and external factors. Internal factors include real fares and service levels that are subject to the discretion of the system managers. External factors are largely exogenous to the system and its managers, and include levels and changes in employment and population within each system's service area; they are often proxies for the large number of factors that affect transit demand.

However, internal and external factors can be highly interdependent; for example, increased population growth may change demand for transit services, which in turn may change the levels of service provision. While many agencies attribute increased ridership to service expansion and the introduction of new and specialized programs, it is important to note that these services are often dependent upon demand. Many agencies report that an obstacle to increasing ridership counts even further is the lack of funds for more rolling stock and operating costs to meet demand.

Nevertheless, throughout this study we consider external and internal factors separately for purposes of analysis and presentation. Table 14 summarizes the factors

Table 14: Internal and External Factors Contributing to Ridership Growth

Table 5-1: Factors Attributed to Ridership Growth in Survey		
Internal	Fare Changes and Innovations	Fare decrease or freeze Universal fare coverage programs Introduction of new payment options
	Marketing and Information Programs	Advertising Niche marketing/marketing segmentation Survey research Customer satisfaction feedback mechanisms
	Service Improvements	Expansion of routes (geographic/temporal) Introduction of new/specialized service Route restructuring
	Amenities/Service Quality	Development of transit centers Development of park-and-ride facilities Increasing frequency/reliability of service Cleanliness of vehicles New equipment/rolling stock Bus stop improvements (signage, shelters, benches)
	Partnerships	Community outreach/education Planning and strategies Intra-agency collaboration
External	Population Growth	More immigration Rising transit dependency (aging populations, etc)
	Strong Economy and Employment Growth	Increased tourism More demand for travel
	Changing Metropolitan Form	Suburbanization Residential and employment relocation
	Changes to Transportation System	Increased congestion Parking shortage and increasing costs Rising gas prices Construction projects and time delays

INTERNAL FACTORS

The survey respondents indicated that a focus among policymakers on increasing public transit ridership has increased in recent years, due in part to legislation such as the Clean Air Act Amendments of 1990 (CAA) and the Transportation Equity Act for the 21st Century (TEA-21). When queried on strategies to attract new riders, the survey responses can be grouped into five general types: (1) transit service improvements through route expansion, restructuring, and new or specialized services, (2) fare innovations and changes, (3) marketing and informational efforts, (4) partnerships with local communities and other agencies, and (5) improvements to service quality and passenger amenities. Many transit systems report carrying out initiatives in several categories simultaneously. Each of these types of efforts is discussed in turn below.

Table 15 shows the questionnaire results concerning the operating changes that transit officials believe have helped increase ridership.[10] The items are categorized by the five general categories described above, and each subtype is ranked by the percent of all agencies that attributed growth to this program.

Table 15: Frequency of Internal Programs Contributing to Ridership Growth

Internal Programs	Very Small (n=29) [1]	Small (n=13) [2]	Medium (n=22) [3]	Large (n=17) [4]	Very Large (n=22) [5]	Total (n=103) [6]=[1]+[2]+[3]+[4]+[5]	Average [6]/103	Rank
Service Improvements								
Service Expansion	23	13	17	14	16	83	81%	1
Route Restructuring	19	12	11	12	8	62	60%	2
Introduction of New/Specialized Services	14	10	10	6	11	51	50%	4
Fare Innovations and Changes								
New Payment Options	7	5	2	8	7	29	28%	6
Universal Fare Coverage Programs (UFC)	2	6	6	5	9	28	27%	7
Fare Freezes/Decreases	12	1	1	2	4	20	19%	9
Marketing								
Advertising/Information Programs	20	9	12	7	11	59	57%	3
Market Segmentation/Niche Marketing	2	0	0	6	2	10	10%	10
Partnerships								
Employer-Based Partnerships (incl. UFC)	3	7	6	9	8	33	32%	5
University-Based Partnerships (incl. UFC)	3	4	7	5	6	25	24%	8
Community Outreach/Local Government	2	0	3	2	0	7	7%	11
Social Services Collaborations	1	1	0	1	2	5	5%	14
Service Quality and Amenities								
Reliability/Shortened Headways	1	0	2	3	1	7	7%	11
Park and Ride Lots	1	2	1	0	2	6	6%	13
Rail Development	0	1	0	0	4	5	5%	14
Bus Stop Improvements	1	0	1	1	0	3	3%	16
Safety, Cleanliness	0	0	0	3	0	3	3%	16
New Buses	1	0	0	0	1	2	2%	18

Note: Multiple-responses, do not sum to 100%

Service Improvements

Transit systems have undertaken a wide array of service improvements that have resulted in ridership gains. Service changes are any changes that alter the nature or character of transit services as perceived by the riding public. As noted in "Previous Research: What Do We Know About the Factors Affecting Transit Use?" Cervero (1990) reports that riders are twice as sensitive to changes in service as they are to changes in fares—in other words, riders are more easily attracted by service improvements than fare decreases.[11]

Service Expansion

Service expansions mentioned by questionnaire respondents include a wide array of programs that increase service hours, provide additional or extended evening and/or weekend service, and expand the geographic coverage area through new routes. Seventy-nine percent of the very small, 100 percent of small, 77 percent of medium, 82 percent of large, and 73 percent of very large transit systems—or 81 percent of *all* responding transit systems—report that service expansions and changes contributed to ridership increases (see Table 15).

Route Restructuring

Most of the route restructuring reported by transit systems involved service modifications, such as redesigning routes for efficiency, simplifying routes for user-friendliness, eliminating unproductive service, redirecting obsolete service, eliminating deviations, coordinating radial/grid routes, creating tiered systems of transit, and focusing service on major corridors and activity centers. Above all, transit officials report that they attempt to structure their services so that they better match an increasing variety of travel needs within diverse markets. For example, the Redding Area Bus Authority (CA) reports that improved service and broader coverage has diversified mode choice options for many trips. Transit systems also have improved timing to provide more frequent service to shorten passenger waiting time. Some respondents reported, for example, that timed transfers have served both as an operating system and a customer service approach.

The most commonly reported form of route restructuring included new services to meet special needs, such as programs for suburb-to-suburb commuter travel, seasonal tourism, welfare-to-work transportation, and medical transportation. These specialized transportation needs often were the result of other exogenous societal changes, and are discussed in more depth later in this report.

Introduction of New/Specialized Services

Agencies also reported that the introduction of new services targeted to specialized needs helped increase ridership. In all, 48 percent of very small, 77 percent of small, 45 percent of medium, 35 percent of large, and 50 percent of very large transit systems—or 51 percent of *all* responding transit systems—report that new and specialized services contributed to their ridership increase (see Table 15). Many of the specialized services are geared toward populations with specific transportation needs, such as welfare-to-work recipients, tourists, the disabled, and senior citizens. Other services are in response to changing urban form and travel patterns; for example, the Sunline Transit Agency (CA) introduced intercity commute services to meet growing suburbanization and increasing travel distances.

Table 16 identifies agencies that specifically cited particular types of service improvements—through expanded geographic coverage area, temporal expansion of service (that is, new evening and/or weekend service), route restructuring, or the introduction of specialized services. The table also shows the reported degree to which respondents attribute ridership increases to service improvements.

Fare Innovations and Changes

Fare and pricing adaptations include a variety of actions that have the effect of altering the absolute or relative price of transit service, or that change the fare media or payment options. The types of fare adjustments mentioned by questionnaire respondents include changes in base fares, passes and discounting strategies, changes to transfer policies that effectively lowered fares, and partnerships with businesses or other organizations or institutions to provide discounts or universal fare coverage.

Fare Decreases and Freezes

Forty-one percent of very small, less than 1 percent of small, less than 1 percent of medium, 12 percent of large, and 18 percent of very large transit systems—or 20 percent of *all* responding transit systems—report that a fare decrease helped increase their ridership (see Table 15). Some transit agencies use deep discount pricing strategies by offering a discount for multiple rides, which increases ridership without losing much fare revenue (Oram 1990). Some transit systems have kept cash fares the same for many consecutive years; when transit fares are *not* indexed with inflation, the result is similar to a

Table 16: Transit Service Improvements Contributing to Ridership Growth

	Agency Name	Effectiveness	Type of Expansion
Very Small	Alameda Ferry Services	Very effective	Frequency
	Alameda Ferry Services	Very effective	New Service - linking activity center
	Cape Ann Transportation Authority	Did not specify	New Service - new park-and-ride shuttle
	Cape Cod Regional Transit Authority	Did not specify	New Service - summer trolley
	Dutchess County Division of Mass Transportation (LOOP)	Did not specify	New Service - medical transportation
	Eau Claire Transit System	Somewhat effective	Temporal - extended evening and/or weekend
	Montachusett Regional Transporation Authortiy	Somewhat effective	Temporal - extended evening and/or weekend
	Redding Area Bus Authority	Did not specify	Geographic - area expansion
	Tri-State Transit Authority	Very effective	New Service - paratransit
	Tri-State Transit Authority	Very effective	Temporal - extended evening and/or weekend
	Tuscaloosa County Parking and Transit Authority	Did not specify	Geographic - area expansion
Small	Lakeland Area Transit District	Somewhat effective	Geographic - area expansion
	Lakeland Area Transit District	Somewhat effective	Restructure Routes - better transfers
	Sonoma County Transit	Somewhat effective	New Service - senior routes and expanded paratransit
Medium	Ann Arbor Transportation Authority	Very effective	Geographic - area expansion
	Ann Arbor Transportation Authority	Somewhat effective	Restructure Routes - better transfers
	Central Arkansas Transit Authority	Very effective	Temporal - extended evening and/or weekend
	Central Arkansas Transit Authority	Very effective	Temporal - extended evening and/or weekend
	Grand Rapids Transit Authority	Very effective	Geographic - area expansion
	Kalamazoo Metro Transit System	Did not specify	Geographic - area expansion
	Kalamazoo Metro Transit System	Did not specify	Temporal - extended evening and/or weekend
	Lexington-Fayette County Transportation Authority	Very effective	Frequency
	Lexington-Fayette County Transportation Authority	Very effective	Restructure Routes - to serve university connections
	Monorail Transit of Seattle	Somewhat effective	Frequency
	Rock Island County Metrolink	Did not specify	New Service - seasonal ferry
	Salem Area Mass Transit District	Very effective	Frequency
	Salem Area Mass Transit District	Very effective	Geographic - area expansion
	Sunline Transit Agency	Very effective	Frequency
	Sunline Transit Agency	Very effective	Geographic - area expansion
	Sunline Transit Agency	Very effective	New Service - dial-a-ride intercity commuter service
	VOTRAN - County of Volulsia	Very effective	Geographic - area expansion
	Whatcom Transportation Authority	Somewhat effective	Restructure Routes - connect university and shopping
	Wichita Transit	Somewhat effective	New Service - neighborhood routes
Large	Capital District Transportation Authority	Did not specify	New Service - welfare-to-work
	Capital District Transportation Authority	Somewhat effective	Restructure Routes - use of circulators
	Central Ohio Transit Authority	Somewhat effective	Geographic - area expansion
	Charlotte DOT	Very effective	Frequency
	Corpus Christi Regional Transportation Authority	Somewhat effective	Geographic - area expansion
	Flint Mass Transportation Authority	Did not specify	New Service - job access
	Pinellas Suncoast Transit	Very effective	New Service - beach trolley
	Pinellas Suncoast Transit	Very effective	Restructure Routes - improve direct connections
	Rhode Island Public Transit Authority	Very effective	Geographic - area expansion
	Rhode Island Public Transit Authority	Very effective	New Service - medical transportation
	Suburban Mobility Authority	Very effective	New Service - paratransit
	Suburban Mobility Authority	Very effective	Restructure Routes - suburban job growth areas
	Suburban Mobility Authority	Very effective	Temporal - extended evening and/or weekend
Very Large	Alameda/Contra Costa Transit District	Very effective	Temporal - extended evening and/or weekend
	Chicago Transit Authority	Did not specify	New Service - limited stop service
	Los Angeles County Metropolitan Transportation Authority	Very effective	New Service - rapid bus
	Miami-Dade Transit	Somewhat effective	New Service - mini bus routes
	Port Authority of Allegheny	Somewhat effective	Restructure Routes - express and shuttle
	Santa Clara Valley Transportation Authority	Somewhat effective	Frequency
	Santa Monica Municipal Bus	Very effective	Geographic - area expansion
	Santa Monica Municipal Bus	Very effective	Temporal - extended evening and/or weekend

Note: Only agencies that specified the type of expansion are included above.

fare decrease. For example, the Cape Ann Transportation Authority (MA) has kept its shuttle fares at 25 cents and 50 cents and reports that this has helped increase ridership over time. Similarly, the Orange County Transportation Authority (CA) reports that its ridership growth may be due in part to steady fares—it has not instituted a fare hike in nine years.

Special fare promotions and "free fare" events, however, have been used to a lesser extent to increase ridership. Ben Franklin Transit (WA) experimented with fare-free local routes on Wednesdays and Saturdays. The agency found that the free days introduced new riders to the system, thus increasing ridership on regular fare days. The primary cost of the fare-free program was lost revenue on free routes, but the transit system reports that revenue reduction was minimal because fares were only $0.40 to $0.50.

New Payment Options

Technological advances in recent years have brought stored-value card technology to transit, and in some cases transit cards can be used on more than one transit system. Twenty-four percent of very small, 38 percent of small, 9 percent of medium, 47 percent of large, and 32 percent of very large transit systems—or 28 percent of *all* responding transit systems—report that new payment options helped increase their ridership (see Table 15). Omnitrans (CA) has equipped buses with new add-on farebox units for handling the new technology, offering passengers a choice among a variety of fare media at minimal operations costs. Rhode Island Public Transit (RIPTA) also has created one-day and family passes that are targeted toward area tourists. Other agencies, such as Bay Area Rapid Transit (BART) in the San Francisco Bay Area (CA), have provided pass sales over the Internet, and credit and debit card payment options at stations. Similarly, Sonoma County Transit (CA) reported credit card payment options for pass purchases.

Many of the respondents believe that the new flexibility in fare payment has helped increase ridership—both Rhode Island and BART reported that their one-day pass and Internet sales option were "very effective" and "somewhat effective," respectively, in increasing ridership. Sonoma County Transit also reported that their new credit card payment option was "very effective." However, most other agencies that reported fare media changes (generally discounted passes or ride cards rather than purchase options) reported that these programs were "very effective" in affecting ridership increases (Pinellas Suncoast Transit (FL), Queens Surface Corporation (NY), Los Angeles County Metropolitan Transportation Authority (CA), Waukesha Transit Commission

(WI), Tri-State Transit Authority (WV), and Long Island Bus (NY) programs, to name a few).

Universal Fare Coverage

Combining the innovation of new fare media and payment options while at the same time incorporating fare discounts, some agencies have implemented universal fare coverage programs in partnerships with universities, businesses, and other agencies. In a universal fare coverage program, local public transit systems provide fare-free transit service for all members of a particular group, such as employees of a business or students of a local university or school. The partnering agency or institution typically pays the transit agency an annual lump sum based on expected ridership, and riders either receive free or heavily discounted transit passes, or show their business or school identification as fare payment. A detailed review of universal fare payment programs in universities—also called Unlimited Access—is given in Brown, Hess, and Shoup (2001); the authors found that at the universities studied, student transit ridership increases ranged between 71 percent and 200 percent during the first year of Unlimited Access, and growth in subsequent years ranged between 2 and 10 percent per year.

Fifteen agencies surveyed in our study reported ridership increases were attributed to university-based fare programs. Thirteen of those agencies reported that the programs were "very effective" or "somewhat effective" in helping to increase ridership. Only two agencies—Sonoma County Transit and Wichita Transit (KS)—reported that the programs had very little or no effect on ridership.

Partnering with businesses also has been reported to increase ridership. For example, 13 agencies surveyed reported that such fare programs—either employer-subsidized passes or universal fare coverage—helped increase ridership levels. The City of Rochester (MN), Ann Arbor Transportation Authority (MI), Salem Area Mass Transit District (OR), Capital District Transportation Authority (NY), and Suburban Mobility Authority (MI) all reported that such programs were "very effective" in helping to increase ridership. Sonoma County Transit reported that a universal fare coverage program for all county employees was only "somewhat effective" in increasing ridership. Several agencies, including Abilene Citylink Transit (TX), plan to establish employer-based or university-based transit pass programs in the future.

Table 17 summarizes the types of fare programs or changes that agencies reported, and the effectiveness of each in increasing ridership.

Table 17: Fare Restructuring Contributing to Ridership Growth

	Agency Name	Effectiveness	Type of Program or Change
Very Small	Eau Claire Transit System	Very effective	Fare freeze
	Eau Claire Transit System	Very effective	University-based program - universal fare coverage
	Laguna Beach Municipal Transit	Somewhat effective	Employer-based program - fare subsidy
	Pasco County Public Transportation	Did not specify	Fare decrease
	Tri-State Transit Authority	Very effective	Fare decrease (33%)
Small	City of Rochester	Very effective	Employer-based program - universal fare coverage
	Greater Portland Transit	Very effective	University-based program - universal fare coverage
	Logan Transit District	Did not specify	University-based program - universal fare coverage
	Madison County Transit District	Did not specify	University-based program - universal fare coverage
	Sarasota County Transportation Authority	Did not specify	Fare decrease
	Sonoma County Transit	Somewhat effective	Employer-based program - universal fare coverage for county employees
	Sonoma County Transit	Not effective	University-based program - universal fare coverage
Medium	Ann-Arbor Transportation Authority	Very effective	Employer-based program - Go Passes in downtown
	Ben Franklin Transit	Did not specify	Free local fares on Wednesdays and Sundays
	Kalamazoo Metro Transit System	Did not specify	University-based program - universal fare coverage
	Salem Area Mass Transit	Very effective	Employer-based program - universal fare coverage
	Salem Area Mass Transit	Somewhat effective	University-based program - universal fare coverage
	Wichita Transit	Somewhat effective	Employer-based program - passes sold in bulk at discount
	Wichita Transit	Not effective	University-based program - limited rides for students
Large	Capital District Transportation Authority	Very effective	Employer-based program - passes sold in bulk at discount
	Rhode Island Public Transit Authority	Very effective	Conversion from zone-based to flat fare structure
	Rhode Island Public Transit Authority	Somewhat	University-based program - universal fare coverage
	Snohomish Community Transit	Did not specify	Fare decrease (40%)
	Snohomish Community Transit	Did not specify	Employer-based program - passes sold in bulk at discount
	Snohomish Community Transit	Did not specify	University-based program - universal fare coverage
	Suburban Mobility Authority	Very effective	Employer-based program - universal fare coverage for new employees
Very Large	Alameda/Contra Costa Transit District	Very effective	University-based program - universal fare coverage
	Chicago Transit Authority	Somewhat effective	Pass prices reduced
	Chicago Transit Authority	Somewhat effective	University-based program - universal fare coverage
	Denver Regional Transportation Authority	Somewhat effective	Employer-based program - universal fare coverage
	Denver Regional Transportation Authority	Somewhat effective	University-based program - universal fare coverage
	Long Island Bus	Very effective	Free transfers, purchase discounts
	New Jersey Transit	Somewhat effective	Fare freeze
	Port Authority of Allegheny	Somewhat effective	Employer-based program - discount passes and tax incentive
	Port Authority of Allegheny	Very effective	University-based program - discounted school zone
	Portland Tri-Met Sacramento RTD	Did not specify	Employer-based program - universal fare coverage
	Queens Surface Corporation	Very effective	Fare decrease, free transfers
	Sacramento Regional Transit District	Did not specify	University-based program - universal fare coverage
	Santa Clara Valley Transportation Authority	Somewhat effective	Employer-based program - universal fare coverage

Note: Only agencies that specified the type of fare program are included above.

Marketing

New marketing strategies include general information programs and programs targeted at specific riders or specific services. Marketing strategies increase the level of information about transit services without actual changes to the services themselves. Table 18 summarizes the types of marketing programs that respondents believe have helped increase ridership, and the degree of effectiveness.

Table 18: Marketing Programs

	Agency Name	Degree of Effect	Type of Program
Very Small	Alameda Ferry Services	Very effective	Advertising/General
	Annapolis Department of Parking and Transportation	Did not specify	Improve printed information, new marketing staff position
	City of Kingsport KATS	Did not specify	Marget segmentation - welfare-to-work, disabled riders
	Columbia Area Transit System	Somewhat effective	Advertising/General
	Laguna Beach Municipal Transit	Somewhat effective	Advertising/General
	Missoula Urban Transport	Very effective	Advertising/General
	Putnam County Transit	Somewhat effective	Advertising/General
	Sioux Falls Transit	Very effective	Advertising/General, market segmentation - new residents
Small	Escambia County Area Transit	Somewhat effective	Advertising/General
	Five Seasons Transportation	Did not specify	New marketing staff position
	Greater Portland Transit	Somewhat effective	In-house marketing
	Lakeland Area Transit District	Very effective	Advertising/General
	Livermore/Amador Valley	Very effective	Advertising/General
	Logan Transit District	Somewhat effective	Advertising/General
	Sonoma County Transit	Somewhat effective	Advertising/General
	Space Coast Area Transit	Somewhat effective	Advertising/General
	Tri-State Transit Authority	Very effective	Advertising/General
	Waukesha Transit Commission	Very effective	Advertising/General
	Yuba-Sutter Transit Authority	Somewhat effective	Advertising/General
Medium	Ann Arbor Transportation Authority	Somewhat effective	Advertising/General
	Connecticut Transit - Stamford Division	Somewhat effective	Advertising/General
	Grand Rapids Transit Authority	Somewhat effective	Advertising/General
	Lexington-Fayette County Transportation Authority	Very effective	Advertising/General
Large	Alameda/Contra Costa Transit District	Somewhat effective	Market segmentation - San Francisco
	Charlotte DOT	Very effective	Market segmentation - retail
	Clark County Public Transportation Benefit Area Auth.	Did not specify	Market segmentation - periodic, targeted
	Corpus Christi Regional Transportation Authority	Somewhat effective	Advertising/General
	Golden Gate Bridge Highway and Transp. District	Somewhat effective	Advertising/General
	Miami Valley Regional Transportation Authority	Somewhat effective	Market segmentation - businesses, universities, bicyclists
	Pinellas Suncoast Transit	Very effective	Advertising/General
	Rhode Island Public Transit Authority	Very effective	Improve local image
	Snohomish Community Transit	Did not specify	Improve local image, market segmentation - new residents
	Suburban Mobility Authority	Very effective	Market segmentation - employers
Very Large	BART-San Francisco	Somewhat effective	New website
	Denver Regional Transportation District	Somewhat effective	Advertising/General
	Long Island Bus	Somewhat effective	Advertising/General
	Los Angeles County Metropolitan Transportation Auth.	Somewhat effective	Advertising/General
	Port Authority of Allegheny	Somewhat effective	Improve local image, advertising, logo changne
	Santa Clara Valley Transportation Authority	Somewhat effective	Advertising/General
	Santa Monica Municipal Bus	Somewhat effective	Advertising/General
	Southwest Ohio Regional Transit Authority	Very effective	Advertising/General
	Tacoma-Pierce Transit	Very effective	Market segmentation - directed mailings
	Washington Metropolitan Area Transit Authority	Somewhat effective	Advertising/General

Note: Only agencies that specified the type of marketing program are included above.

Advertising/ Information Programs

In all size categories, more than half the respondents referred to marketing initiatives as major factors: 69 percent of very small, 69 percent of small, 55 percent of medium, 41 percent of large, and 50 percent of very large transit systems—or 57 percent of *all* responding transit systems—report that general marketing and advertising campaigns helped increase their ridership (see Table 15).

Market Segmentation/ Niche Marketing

In addition to general advertising and marketing campaigns, transit agencies have pursued innovative marketing techniques aimed at certain submarkets. Market segmentation, widely used throughout the transit industry, is the practice of identifying groups of people—market segments—that have similarities in characteristics or needs and who are likely to exhibit similar purchase behavior and/or responses to changes in the marketing mix (Elmore-Yalch 1998). Ten percent of *all* responding transit systems report that market segmentation helped increase ridership (see Table 15). Transit systems report that ridership gains are being made for various market segments defined by geographic area, trip purpose, or socioeconomic characteristics. For example, the respondent from Cleveland-LAKETRAN (OH) reports that the agency looks for niche markets to serve. Kingsport Area Transit Service (TN) reports that the operator targets markets that it has determined are in need of transit service: welfare recipients, low-income workers, and disabled citizens. Snohomish Community Transit (WA) reports that it heavily markets express bus and commuter services to appeal to "choice" or "discretionary" commuters to work sites in Seattle who choose to ride transit even though they have access to cars. To better inform and identify markets and submarkets, three transit systems—Fresno Transit Express (CA), Los Angeles County MTA (CA), and Five Seasons Transportation (IA)—conducted periodic ridership studies to evaluate customer satisfaction with their use of the transit service. The surveys determined a profile of the transit riders, identified travel origins and destinations, determined trip purposes, and identified potential service improvements. Results of the rider surveys were used to aid in the planning of service and policy changes and to gauge the transit system's progress in meeting its goals.

Partnerships and Community Collaborations

When transit systems coordinate services with businesses or other organizations or institutions, they attempt to address the needs of a specific market on a unique basis. In recent years, transit systems have begun to enter into partnership with colleges and universities, employers, housing developers, and social service agencies and clients. As discussed previously, some partnerships with businesses and universities result in programs in which partners purchase transit service at a bulk rate for their members. In addition, transit systems often add new service or tailor existing service to the riding patterns of the new group of riders. As a result of participating in these partnerships, transit systems report that they have increased ridership because they reach a wider range of citizens. Table 19 presents collaborative programs reported by respondents[12].

Table 19: Partnerships (Excluding Fare Programs) Contributing to Ridership Growth

	Agency Name	Nature of Collaboration
Very Small	Columbia Area Transit System	Three area universities - coordinate service
	Dutchess County Division of Mass Transp.	Citizens, businesses, and county officials - meet needs
	Missoula Urban Transport	Employers and community - neighborhood passes
	Sioux Falls Transit	Government - build support for funding transit
	Springfield City Aea Transit	Social service agencies - meet targeted needs
Small	City of Visalia - Visalia City Coach	Social service agencies - meet targeted needs (welfare-to-work)
	Five Seasons Transportation	Local government - build support
	Greater Portland Transit	Businesses and university - coordinate service
	Lakeland Area Transit District	Businesses - provide fare promotion programs
Medium	Ann Arbor Transportation Authority	Collaboration with university to coordinate airport service
	Central Arkansas Transit Authority	Citizens - develop priorities for transit investment.
	Kalamazoo Metro Transit System	Students, transit operators, university - route development
	Rock Island County Metrolink	Local government, communities - joint development of transit center
	Salem Area Mass Transit District	Businesses, community leaders, government, media - public support for transit
	Whatcom Transportation Authority	Shopping mall and university - improve connections
Large	Flint Mass Transportation Authority	Employers, communities - improve service
	Rhode Island Public Transit Authority	Social service agencies - meet targeted needs, education of stakeholders
	Suburban Mobility Authority	Local governments, employers, social service agencies - creation of "ombudsman"
	Tacoma-Pierce Transit	Businesses - rideshare and commuter services
Very Large	Denver Regional Transportation District	Businesses - meet employer needs

Note: Only agencies that specified the type of collaboration are included above.

Employer-Based Partnerships

Several agencies reported that they work in cooperation with local businesses to provide service to employees, reduce parking pressures on businesses, and encourage a higher transit mode split. For example, Lexington-Fayette County Transportation Authority (KY) advertises through employers by mail-out flyers, and the Charlotte Department of Transportation (NC) provides transit schedule and fare information to employees of local businesses. Other agencies, including Rhode Island Transit, Chicago Transit Authority (IL), and Tacoma-Pierce Transit (WA), have partnered with local businesses to provide commuter benefit and rideshare programs.

In total, 32 percent of all agencies responding to the survey reported some interaction or collaboration with the local business community. Ten percent of very small, 54 percent of small, 27 percent of medium, 53 percent of large, and

36 percent of very large agencies reported either universal fare coverage programs or service planning alongside a business partner.

University-Based Partnerships

Sandra Rosenbloom (1998) finds that university-based transit programs are some of transit's key success stories in the United States. Twenty-five transit systems (24 percent of transit systems responding to the questionnaire) report that coordination with colleges and universities in their service area helped increase their ridership. These transit systems report that aside from universal fare programs, gearing transit service toward the university community has helped increase ridership. Many of these programs, such as Logan Transit District (UT), work to reduce parking demand. Others, including the Ann Arbor Transportation Authority (MI), provide park-and-ride lots and shuttles, or advertise services through university papers and media.

Ten percent of the very small, 31 percent of small, 32 percent of medium, 29 percent of large, and 27 percent of very large agencies reported working with universities to better serve travel needs and thus increase ridership.

Community Outreach and Local Government

Seven percent of the agencies reported that support from citizens and local governments has been critical in implementing service and attracting riders. Through community meetings and local government support, agencies are better able to address the general public needs, build support and consensus, and develop community objectives and priorities. Most important, these outcomes led to an increased likelihood for funding; for example, Sioux Falls Transit (SD) reported strong support from the local city government, which has ensured funding and facilitated marketing efforts.

Social Services Collaborations

Five percent of *all* responding transit systems report that partnerships with human and social service agencies helped increase ridership (Table 15). One result of suburbanization and industrial restructuring is that low-income people are left in central cities, while jobs matched to their skill levels are increasingly in the suburbs (Cervero 1989; Giuliano 1992; Levine 1998). Transit systems are assessing how public transit can address the needs of this potential market. As the cost of transportation to a suburban work site falls (cost measured in both transit fare and travel time) more inner-city residents might see the trip as worthwhile. Three transit systems report that their coordination with welfare-to-work programs has helped increase their ridership: Kingsport Area Transit Service (KATS) (TN), Visalia City Coach (CA), and Cedar Rapids (IA). Usually, the county department of welfare purchases transit passes from the transit system for eligible clients to facilitate travel to social service agencies, job training centers, and potential employment locations that are dispersed across a wide geographic area.

In Poughkeepsie, New York, the Duchess County Mass Transit (LOOP) (NY) acquired responsibilities for the County Medicaid Transportation program. The transit service has succeeded in converting a large number of taxi and medical transportation passengers to public transit. (The Duchess County Division of Social Services pays the transit system $2 million annually, which represents a dramatic saving on transportation for participants over the system it replaced.) In addition, some systems report modifying and expanding bus routes to meet the needs of the traveling public. The number of eligible paratransit passengers in the Abiline Transit System (TX) has increased by an average of 13 percent each year. Kingsport Area Transit Service (TN) also reports that it serves a large number of disabled passengers, because when the city eliminated its taxi subsidy program, many passengers shifted to its KATS service. The Santa Maria Area Transit System (CA) has become important in recent years for citizens making trips to clinics, medical offices, and hospitals.

Service Quality and Amenities

Improving the attractiveness of transit requires broadening the traditional transit service planning and operators' agendas while attempting to enhance the quality and attractiveness of the transit product in more traditional ways. Many of the questionnaire respondents mentioned the importance of improvements or enhancements to the quality and reliability of current or new transit services. Apart from service modifications, some transit systems have made service quality improvements that they believe have helped increase ridership. In general, such improvements extend beyond simple route and time schedule adjustments and incorporate such operational strategies as reducing headways or service frequencies, as well as improving safety, security, and cleanliness.

Twenty-five percent of all responding transit systems report that passenger amenities and other quality improvements that enhance the experience of riding transit helped increase ridership. Common amenities reported include bus shelters, benches and signage at bus stops, the provision of park-and-ride lots at rail stations or points near bus or commute services, improvements in safety and cleanliness, and more reliable service. Table 20 summarizes the service quality and amenities most commonly reported.

Table 20: Service Quality and Amenities Contributing to Ridership Growth

	Agency Name	Type of Amenity
Very Small	Cape Ann Transportation Authority	Park-and-ride lots/shuttles
	Sioux Falls Transit	New buses
	Space Coast Area Transit	Bus stop amenities
Small	City of Rochester	Park-and-ride lots/shuttles
	Livermore/Armador Valley	Rail development
	Greater Roanoke Transit	Park-and-ride lots/shuttles
Medium	Ann Arbor Transportation Authority	Park-and-ride lots/shuttles
	Lexington-Fayette County Transp. Auth.	Bus stop amenities
	Rock Island MetroLink	Transit center
	Salem Area Mass Transit	Park-and-ride lots/shuttles
Large	Fresno Area Express	Saftey, Cleanliness
	Fresno Area Express	Reliability
	Montebello Bus Lines	Saftey, Cleanliness
	Montebello Bus Lines	Reliability
	Pinellas Suncoast Transit	Bus stop amenities
	Pinellas Suncoast Transit	New buses
	Rhode Island Public Transit Authority	Saftey, Cleanliness
	Rhode Island Public Transit Authority	Reliability
Very Large	Chicago-RTA-Metra	Park-and-ride lots/shuttles
	Denver Regional Transportation Authority	Rail development
	Los Angeles County MTA	Rail development
	Massachusetts Bay Transportation Auth.	Rail development
	Queens Surface Corporation	New buses
	San Juan MTA	Reliability
	Southwest Ohio Regional Transit Authority	Park-and-ride lots/shuttles
	Washington Metro Area Transit Authority	Rail development

Note: Only agencies that specified the type of quality/amenity program are included above.

Transit Center Improvements

A few respondents reported that their agencies had developed new intermodal transit centers to help coordinate and improve transfers among transportation modes. These centers provide rider-friendly environments for waiting passengers, and some provide passenger amenities.[13] Madison Metro Transit (WI) restructured its bus system around three new transit centers, and improved bus-rail connections with St. Louis's light rail system. Rock Island Metrolink (IL) completed a new transfer center in 1998 at a cost of $8 million. The facility, a joint development project between a municipality and a private development company, allows more convenient and secure transfer between routes. Federal, state, and local sources funded the transit portion of the development. Rock Island Metrolink reports that the transit center is an integral part of a large downtown redevelopment program and has allowed the transit system to be recognized as a significant partner in economic development while providing greater mobility for citizens.

Park and Ride Lots

Several transit systems report that they have coordinated transit services with parking. Five Seasons Transportation (IA) has assumed management of downtown parking in Cedar Rapids and subsidizes citywide transit with downtown parking revenue. Other systems operate suburban park-and-ride facilities. Chicago's Metra (IL), a suburban rail system that depends on commuters being able to park their cars at stations, has recently expanded the parking supply at commuter rail stations; Metra reports that park-and-ride lots also have helped boost nearby commercial activity.

The Sacramento Regional Transit District (CA) provides eight free park-and-ride lots at light rail stations. The Cape Ann Transportation Authority (MA) maintains suburban park-and-ride lots and attributes its ridership growth in part to commuters. Many of the questionnaire respondents reported that their transit systems had made commitments to improve passenger amenities both on-board and at terminals, stations, and transfer facilities.

Rail Development

Five agencies report that rail projects helped to increase ridership during the late 1990s. Livermore/Amador Valley (CA) attributes 20 percent of its ridership growth to BART's extension into its service area. The Los Angeles County MTA and Washington Metropolitan Area Transit Authority (D.C.), both report that expanded rail routes and services were a major factor contributing to ridership increases. Denver Regional Transportation District in (CO) also attributes ridership growth to a new light rail development and the linking of buses into the rail configuration. Massachusetts Bay Transportation Authority (MA) reports that commuter rail expansion has contributed heavily to ridership growth by increasing capacity and improving the reliability of the transit system.

While rail development may increase system capacity and attract new riders, it can also increase the number of transfers needed to complete a journey, and thus increase the number of unlinked passenger trips but not the total number of linked trips.

New Buses

Agencies often mentioned bus procurement as a factor in providing increased service, but a few agencies specifically named acquiring new buses as a way to improve passenger comfort and convenience. Some respondents claim that the acquisition of new handicap-accessible, low-floor buses has been instrumental in attracting specific populations as well as increasing the reliability of the fleet.

Safety, Cleanliness, Reliability, and Shortened Headways

Several agencies, such as Fresno Area Express (CA), and Montebello Bus Lines (CA), and Rhode Island Public Transportation Authority, reported that safety and cleanliness were important factors in attracting riders by changing perceptions about transit and increasing the comfort of the rides.

Efforts to increase service reliability were also important in attracting riders, and included shortening headways, increasing schedule adherence, and reducing wait times. San Juan Metropolitan Bus Authority (PR) aggressively works to comply with schedules and attributes ridership growth to their increasingly dependable service.

EXTERNAL FACTORS

External factors, those outside the direct control of transit agencies, are less policy-relevant than internal factors, but still are important determinants of transit patronage. These external factors can sometimes have a greater effect on ridership than system and service design initiatives. External factors can be subdivided into five categories: population growth, employment growth, economic growth, changing metropolitan form, and changes to the transportation system.

Population Growth

As discussed in the previous chapter, location in a rapidly growing metropolitan area clearly contributes to the success of some transit systems. Regional population growth can help boost transit ridership, because a percentage of the new residents will use transit for some or all of their trips.[14] Added population usually results in more travel and more activity. High population growth was mentioned by survey respondents in all five agency-size categories and in all regions of the country.

In some areas, particular segments of the population are growing faster than others, and many of the respondents from such areas identified particular growing population subgroups as important transit markets. Santa Maria Area Transit (CA) and Annapolis Department of Parking and Transportation (MD) report that growth in the Latino population has contributed to the increase in ridership on their systems. The Pasco County Public Transportation Authority in Sarasota (FL) reports that its growing population of senior citizens, many of whom are no longer able to drive automobiles, is an important captive transit market that has contributed to the growth in ridership.

Some agencies target new residents moving into the service area to encourage transit use. Snohomish Community Transit (WA) and Sioux Falls Transit (SD), for example, market to new residents in the area through targeted mailings or Welcome Wagon promotions.

Employment Growth

Growth in employment generally accompanies growth in population. For systems that reported that high population growth contributed to the ridership increase, one can reasonably assume that accompanying employment growth also played a role. As noted in “Previous Research: What Do We Know About the Factors Affecting Transit Use?” previous research has found a relationship between system size and employment level; according to Kain and Liu (1996) “service miles supplied is a policy variable highly correlated with both employment and population in the service area.” (p. 2)

Respondents in our survey identified certain employment/worker subgroups as contributing to their overall ridership increase. For example, the Jackson Transit Authority (TN) reports that large employment growth among part-time fast-food workers, who typically depend on transit for their commute to work, helped to increase ridership.[15] In addition, local governments in some rapidly growing areas have partnered with transit agencies, such as Greater Roanoke Transit (VA), to increase and integrate transit service in order to attract businesses and light industrial companies to locate in the area.

Economic Growth

During the early 1990s, aggregate transit ridership nationwide was declining slightly, coinciding with lagging economic performance nationally. As noted in previous chapters, after the economic recession of 1989 to 1993 abated, the late 1990s were marked by a sustained period of economic growth nationwide. Some transit officials surveyed report that, with a healthy economy, more people are working, have more money to spend, and tend to travel more. These factors, our respondents conclude, have combined to boost transit ridership. For example, the Orange County Transportation Authority (CA) reports that an improved local economy in recent years has helped increase its ridership. Other transit officials report that transit ridership fell during the period of economic growth, concluding that the robust economy improved incomes and increased levels of automobile ownership, which led to increased auto travel and decreased transit use.

Some respondents report that their transit systems have begun to pay more attention to visitor and tourism demands. Transit systems can make transit travel attractive to tourists through route design and payment options. As mentioned earlier, some agencies have created pass programs and specialized services to serve tourist and visitor needs. These include Escambia County Area Transit's (FL) beach trolleys and Rock Island County Metrolink's (IL) seasonal ferries. The Cape Cod Regional Transit Authority (MA) reports that an expanding tourist industry has helped increase its ridership. Seasonal peaking, however, may be difficult to manage in the long term because it does not efficiently use capital and labor throughout the year.

Changing Metropolitan Form

Many academics and researchers have attributed transit's decline in the United States to the suburbanization of jobs and households. Low-density suburban neighborhoods separate homes both from each another and from commercial establishments. Decentralized job sites and residences are difficult to serve by traditional public transit, because transit works best when a large number of people are all headed to activity nodes that contain various destinations. Dense and compact is more conducive to efficient transit operations than dispersed and sprawling patterns of urban development.

For suburban transit systems, however, growing suburbs mean more riders. This is particularly true of commuter rail systems; according to the respondent from Chicago's Metra (IL): "Suburban residential growth has been a significant factor in our system's growth."

As State College, Pennsylvania, continues to grow, new apartment complexes being built are beyond reasonable walking distance to the Penn State University campus. In one type of unlimited access transit program, apartment owners have developed a partnership whereby they purchase transit passes from Centre Area Transportation Authority (PA) for all tenants who sign leases in these apartments. This attracts students to the apartment complexes and guarantees students transportation to campus, where high parking demand makes it difficult for students to park.

While sprawling homes and work sites are blamed by many for decreasing transit use, the respondent from the Sacramento Regional Transit District (CA) reports that a state policy of locating office buildings along transit lines (both bus and rail) has helped boost ridership.

Changes to the Transportation System

Significant travel time and dollar savings can induce riders to switch from other modes to transit. Snohomish Community Transit (WA) reports that the addition of high-occupancy vehicle/bus lanes on the Interstate 5 corridor has helped boost its ridership by reducing the time costs of transit travel relative to single-occupancy driving. The transit agency there reports that its "commuter express" serves a well-defined commuter need and is an important market where transit can be competitive with the single-occupancy vehicle. Changes to the price of traveling by automobile, which is transit's chief competitor, can affect people's mode choices. The Orange County Transportation Authority (CA) reports that the rising cost of owning an automobile (especially the cost of insurance and fuel), as well as stiff penalties for DWI and driving without a license, have helped increase ridership. In addition, 15 percent of all agencies pointed to increasing congestion and time costs of driving, and believe that this disincentive to car use has given people an incentive to use transit. Other agencies, such as Whatcom Transportation Authority (WA) and Southwest Ohio Regional Transit Authority (OH), reported that increasing parking costs, high demand for parking, and parking shortages have been influential factors in their ability to attract riders.

Several agencies reported that regional construction projects, although localized and temporary, helped to increase the viability and attractiveness of transit use. Washington Metropolitan Area Transit Authority's (D.C.) rail construction, Massachusetts Bay Transportation Authority's (MA) Big Dig freeway project, and highway and riverfront construction in the Southwest Ohio Regional Transit Authority's area are all examples cited in our survey of local and temporary disruptions to transportation systems that have shifted some drivers to transit.

SUMMARY

The successful transit systems surveyed for this research actively pursue a wide array of policies and program to improve their flexibility and responsiveness in meeting mobility needs. Several important insights emerge from the foregoing analysis of our survey results:

- Overall, service improvements were the most frequently cited factors. This is perhaps not surprising because more frequent service and broader network coverage can serve more riders, and service improvements often—though not always—occur in response to increasing demand.
- While the survey respondents were collectively skeptical of the effects of across-the-board fare reduction on ridership, they were generally enthusiastic about the influence of universal fare coverage programs. Those programs, which are combinations of fare discounts and the innovation of new fare media and payment options, represent the efforts of transit systems to improve their flexibility and responsiveness in meeting mobility needs of particular market segments and changing demographics and development patterns.
- Although several previous studies of transit ridership have found that service quality improvements trump fare reductions in attracting riders, relatively few respondents attributed patronage growth to improvements in the quality of service. Transit fares are a significant factor, especially for particular market segments that are sensitive to price.

- As expected, transit managers surveyed were more likely to cite factors internal to their systems as responsible for increasing ridership than external factors. However, among cited external factors, population growth, economic/employment growth, and worsening traffic congestion were the most frequently mentioned.
- Ridership productivity is easiest to maximize in traditional transit territory (dense corridors, central cities, areas with low levels of automobile ownership, suburb-to-central city commutes, etc.).
- Agencies' abilities to form partnerships with communities, businesses, universities and schools, social service agencies, and local government clearly garner support and interest in meeting the needs of changing demographics and development patterns.
- Above all, transit systems with the greatest increases in ridership report tailoring services and product mixes to meet customer needs. Transit officials report that ridership increases lead to a more efficient and productive transit system.

While the findings of this survey are limited to the *perceptions* of transit managers responding to the survey, this method offers an illuminating snapshot of the strategies pursued by transit systems that added riders during the 1990s. Although the causality between system changes and ridership growth is only hypothesized by the respondents to this survey, the respondents are, as a group, professionals for whom the relationship between transit service provision and transit service consumption is a daily (pre)occupation. As such, the findings here at least reflect the views of informed observers.

The final step in our research on transit systems that increased patronage during the 1990s was to select one dozen transit systems from among the more than 200 that added riders during the late 1990s for in-depth case study and analysis. The results of these case studies are the subject of the next chapter.

EXPLAINING TRANSIT RIDERSHIP INCREASES: CASE STUDIES OF NATIONAL LEADERS

INTRODUCTION

In order to more fully understand and explain the factors behind ridership increases, interviews were conducted with key personnel from 12 of the most successful transit agencies in the nation. The agencies that were the subject of case studies were selected from the list of the top echelon of agencies with respect to ridership increases over the past five years. From that group, agencies were selected that represented a cross section of type of service (bus, rail, multi-modal, etc.) and size and population of service area. Some agencies that were selected had increases in ridership due to service level increases, others because of other factors. Thus, the agencies included in this part of the study are not necessarily the ones with the largest overall increases nationally; rather, they reflect a cross section of agencies with notably high ridership increases.

Table 21 lists the agencies that were the subject of the case studies, along with key ridership statistics. The individual respondents for the interviews varied from agency to agency, and ranged from Chief Executive Officers to planning and marketing directors (see Table 21). In a few instances, more than one subject participated in the interviews. The interviews, which were conducted over the phone, focused on identifying factors that, in the respondents' perspectives, were influential in helping to affect the observed increases in ridership at each agency.

The following sections profile each system and identify the major factors for ridership increases discussed in the case study interviews. The section beginning on page 98 contains a synthesis of the findings from all of the case studies and a discussion of the implications of the findings from this part of the study.

Table 21: List of Case Study Systems and Respondents

Name of Agency or Firm	City	Primary Respondent	Unlinked Trips, 1999 (thousands)	% Change, 1999-95
ATC	Las Vegas, NV	Planning Director	53,262	86.6
Autoridad Metroplitana de Autobuses	San Juan, Puerto Rico	Assistant to the President	25,139	41.2
Caltrain	San Francisco, Bay Area		8,622	55.7
Gainesville Regional Transit System	Gainesville, FL	Transit Director	4,405	115.1
Green Bus Line	Brooklyn, NY	Board Chairman	72,422	76.5
Long Beach Transit	Long Beach, CA	Marketing Manager	27,119	28.9
Metro Atlanta	Atlanta, GA	Transportation Analyst	163,652	14.0
Milwaukee County Transit System	Milwaukee, WI	Marketing Director	68,826	21.8
NYC Transit	New York City, NY	Manager, Fare Structure Analyst	2,428,957	28.3
OMNITRANS	Riverside, CA	Marketing Director	14,630	77.7
Pace Suburban Bus Division	Chicago, IL	Director of Planning Services	37,449	11.7
Portland Tri-Met	Portland, OR	General Manager/ Communications Director	81,650	27.6

PROFILES OF RESPONDING AGENCIES

ATC (Las Vegas, NV)

Service Background

Las Vegas is one of the fastest-growing metropolitan areas in the nation. The ATC (not an acronym) is a private company that since 1992 has contracted with the Regional Transportation Commission of Southern Nevada (RTC-SN) to provide bus service to Clark County, including Las Vegas. ATC was originally a school bus company in the 1930s; it evolved into a transit provider. In 1999, the National Express Company purchased the company, but it retains the ATC identity. The system won the 1997 American Public Transit Association (APTA) best transit system award. The service area includes 542 square miles with 46 routes in Las Vegas and three to the nearby communities of Laughlin and Mesquite.

Key Factors Affecting Ridership Increases

Ridership gains there are apparently the result of increased, and very reliable, service meeting rapidly increasing demand for service. The primary driving force appears to be population growth: each month approximately 5,000 people move into the metropolitan area. Many new residents are relatively poor with few job skills, meaning that they are more likely to be transit-dependent. The dramatic population increases are not without negative consequences for the ATC: The valley attracts a transient workforce and the company must compete with the casinos for low-skilled employees. The system's biggest labor problem, therefore, is turnover, with approximately 35 percent of employees leaving each year.

The influx of new residents might not impact ridership so dramatically if it were not for the high level of reliability and responsiveness to increased demand that the ATC has apparently achieved. The system has won several APTA awards for management and safety during the past five years. However, for the most part ATC management has *not* instituted specific strategic initiatives that would explain the ridership increases.

A second source of potential growth has been the ever-increasing popularity of the Las Vegas Strip as a tourist destination. The Strip is densely congested with automobiles from dawn until late in the evening nearly every day, making transit a sensible and convenient alternative for many tourists and other visitors.

Third, the system is an efficient one that runs consistently on a grid pattern. Service is half-hourly or less on 70 percent of the routes; on the Strip, service is every 8 minutes. This makes it relatively easy for newcomers and other residents to use the bus as a practical alternative to driving (or, in many cases, the only alternative available).

As stated earlier, increased demand has been met with increased levels of service. Approximately 100,000 service hours per year were added in 1996; future increases will depend in part upon renewal or increase of a 0.25 cent sales tax that was passed in 1990.

Other Possible Influences

Monthly and day passes are available at a discount, as are discounted passes for the elderly and youth. Approximately 37 percent of ATC's riders use passes or tokens, and this number is growing.

Autoridad Metropolitana de Autobuses (Metropolitan Bus Company, San Juan, Puerto Rico)

Service Background

The Autoridad Metropolitana de Autobuses (AMA) provides regular fixed route bus and paratransit service to San Juan's dense urban populations. Riders are primarily from low-income populations, and most trips made by bus are work trips. The agency operates a 273-bus fleet. Currently, AMA's weekday ridership with schools in session averages 112,000. Weekend ridership reaches 55,000 to 60,000 on Saturdays and 30,000 to 35,000 on Sundays.

Key Factors Affecting Ridership Increases

Much of the growth experienced by the AMA is attributed to route restructuring. Ridership declined during the 1980s and did not begin to increase again until 1995-96. In the mid-1990s, a study entitled "Short-Range Transit Center Plan" was conducted to evaluate the existing route structure and improve the reliability of bus services provided by AMA. Some bus routes had not changed in many years and bus service had become slow, infrequent, and unreliable. The long, indirect routes of the old system allowed for many common trips to be performed by using only one bus, although the waiting time was long because of low-frequency headways and unreliability. The new route structure was implemented in December 1997, with high-frequency trunk services connecting transit centers and shorter local routes feeding activity centers. On weekends, headways were shortened to 15 minutes or less for trunk lines and 20 and 30 minutes for local lines. Before these changes, route headways varied considerably, reaching up to one hour in some cases. The changes enabled more frequent service to be provided with the same number of scheduled vehicles. Transfers were introduced for some trips, but transfers were between frequent routes.

The combination of shorter routes to serve local needs and the shortened headways to improve frequency of service made the buses more reliable and convenient and increased the agency's patronage.

The study also set out parameters to ensure that no more than 25 to 30 percent of the users of the old network would be forced to make transfers in the new route structure. While the agency recognizes that the new shorter routes may have increased unlinked counts because of forced transfers, this is not a large factor in the ridership increases, since the parameters were set before the route changes.

In order to meet high levels of compliance with scheduled trips, AMA also acquired 100 new buses in 1997-98 to replace older buses. The younger fleet now has improved service performance, especially in terms of schedule adherence.

Other Possible Influences

AMA charges a flat fare of $0.25 per ride, and this low fare remained stable throughout the 1990s. The agency offers no free transfers or transfer discounts. Discounted fares are available for participants in the Half Fare Program (elderly and handicapped persons) who pay $0.10 per ride.

Caltrain (San Francisco Bay Area, CA)

Service Background

Caltrain is a passenger rail system that serves the peninsula of the San Francisco Bay, which extends from San Francisco south to San Jose and Gilroy. The service is operated by the Peninsula Corridor Joint Powers Board, which was formed by the three counties served by Caltrain in order to continue the rail service that had been owned and maintained by the California state transportation department (and previously by the Southern Pacific Railroad Company). The system consists of 77 miles of track, 35 stations, and 73 train cars (including 21 cab cars). The system primarily serves commuters traveling to and from San Francisco and the Silicon Valley, although a significant number of riders use the system for other purposes.

Key Factors Affecting Ridership Increases

Caltrain is in an unusual circumstance with respect to external growth factors. The system is at ground zero in the region of intense economic growth between the San Francisco Peninsula and Silicon Valley. The extent to which passengers commute in both directions is unique: approximately 60 percent of northbound riders commute to jobs in San Francisco, while 40 percent of southbound riders end their trips in Santa Clara Valley. There is a high percentage of ridership growth in the reverse commute direction (toward Santa Clara County). The extremely rapid economic growth that occurred in both San Francisco and Santa Clara County has been the prime force behind ridership growth in the system.

Growth has occurred in response to these external factors through two main actions:

- Additional service was added during peak commute periods. Service levels are constrained by the availability of rolling stock and the number of tracks.
- Additional midday and peak services have been added, with results that have been better than expected.

A related source of ridership expansion has been employer shuttle services, which have been particularly important in the reverse commute direction. The number of routes has increased from 25 to 34.

Several years ago the agency undertook a major reorganization with respect to its connection to Samtrans, the bus service of San Mateo County (which lies between the termini in San Francisco and Santa Clara Counties). As a result of the reorganization, less service is now provided to schools and more bus feeder routes now service the Caltrain system. Thus, Samtrans thus lost ridership because of the loss of student passengers. As a whole, therefore, this reorganization has not been a major contributor to transit ridership growth except in so far as it contributes to train ridership.

Other Possible Influences

An increasing number of bike riders are using the system. Caltrain carries more on-train bike riders than any other system in the nation—more than 2,000 bicycles per day.

Gainesville Regional Transit System (Gainesville, FL)

Service Background

The Gainesville Regional Transit System (GRTS) provides bus service to the city of Gainesville, Florida. Gainesville is home to the University of Florida, which has approximately 47,000 students. The system consists of 58 buses running Monday through Friday, with limited Saturday service. Approximately 22,000 riders use the system during the fall and spring semesters. During the 2001 fiscal year, that number increased to approximately 30,000 passengers per day. The service area is small (72 square miles) and contiguous. Thus, the setting for transit service is that of a small town with a major university.

Key Factors Affecting Ridership Increases

According to GRTS officials, the transit system's partnership with the University of Florida is the major driving force behind the dramatic ridership increases. Per an agreement with the University, all students receive unlimited access to the system in the form of a transit pass that is paid for by student fees. The fee for the transit pass was initially $0.50 per credit hour per student, increasing to $2 per credit unit per semester per student in Fall 2001. This agreement, coupled with limited parking on the UF campus, has resulted in a ridership increase of 154 percent over the past four years, and ridership in 2001 was 21 percent higher than the previous year. Six million riders are projected for the 2001 fiscal year. These achievements have occurred in the absence of major marketing and market analysis efforts.

Another source of increased ridership is the disabled community. When the partnership with UF began four years ago, the system began increasingly to use older buses that were not accessible. Moreover, the agency failed to include the disabled community in the planning process, resulting in an alienated source of opposition. Under new management instituted over the past year and a half, the agency convened a task force that included the disabled and sought to rectify the situation. Existing buses were retrofitted and new buses purchased. Now the disabled advocate *for* the system and their use of it has increased. The regional Metropolitan Planning Organization, along with the city and county, is now including transit in its planning documents.

The ridership increases have not come without a cost. Because the system was unprepared for the ridership increases, there was insufficient capital stock (buses). The existing buses are quite old, with an average age of more than 13 years. State and federal funds have been obtained to purchase new buses, and the system also receives approximately $2 million from the local gas tax. Additionally, the increased fee for students should enable the fleet to increase to 70 buses, along with providing later nightly service, in the near future. Some older routes with relatively low ridership had to be cut or combined in order to accommodate the heavy use by students.

Other Possible Influences

The success of the partnership with UF has bred more success. Ridership is increasing across the town and should increase even more when adequate capital is available. Plans are underway to enhance service to areas whose service levels were reduced, along with some new service in the eastern part of town. A side benefit is that support for the system is growing because citizens recognize that it is taking cars off the road. Another source of increased ridership in the future may be marketing unlimited access passes to other groups, such as businesses and homeowner associations.

Green Bus Line (Brooklyn, NY)

Service Background

The Green Bus Line operates service throughout the southern and central areas of Queens County in the New York City metropolitan area. It operates 15 local routes, 1 limited-stop route, and 5 express routes to Manhattan. Most important, the service is a commuter link from southeast Queens to subway lines in Manhattan. The NY Department of Transportation contracts with the Green Line, although the company has been in operation since 1897.

Key Factors Affecting Ridership Increases

According to Green Bus Line officials, the explanation for the 30 percent increase in ridership since 1997 is simple and straightforward: in 1994 New York City instituted a “one city, one fare” system. Riders buy swipe cards (known as MetroCards) that work across NYC. This essentially cut the system’s fares in half. For example, riders can board the Green Bus in Queens and transfer to a subway route for $1.50—half of what it would have cost before the change to a unified one-fare system. (For more details about the MetroCard, see the discussion of the New York City Transit system beginning on page 92.)

Prior to the fare change, ridership levels on the Green Bus Lines had deteriorated due to competition from unlicensed vans. The institution of the swipe cards and the “one city, one fare” system, however, caused immediate and significant increases in ridership.

The ridership surge has not been without negative consequences for the company, which has experienced significant cash-flow problems due to the fact that return fares (primarily from Manhattan) accrue to the subway system and not to the bus company. Moreover, the company’s capital stock is aging—the average bus in the system is 12 to 13 years old.

Other Possible Influences

Green Bus management strongly emphasized the impact of the MetroCard system. In fact, the company currently does little in the way of marketing studies, marketing activities, or other management techniques that might affect ridership. Adjusting routes and service levels in response to changes in service demands is difficult, because the service operates under a labor contract that stipulates that drivers select which routes to drive on the basis of seniority. Therefore, it is difficult for the agency to manipulate routes and service, because it has no control over which drivers operate which routes. This, in turn, affects the costs and availability of drivers in sometimes unpredictable ways.

Long Beach Transit (Long Beach, CA)

Service Background

Long Beach Transit (LBT) provides bus services to Long Beach and the adjacent communities of Lakewood and Signal Hill. It maintains 38 bus routes with pick-up points nearly every two blocks. Most Long Beach Transit routes run seven days a week. The service enables connections with the Metropolitan Transportation Authority (MTA) light rail service to Los Angeles, El Segundo, and Norwalk.

Key Factors Affecting Ridership Increases

The trend toward higher ridership, in the view of Long Beach Transit officials, has been the result of a 10-year process, and LBT has devoted considerable effort toward becoming a customer service-oriented organization that meets the needs of its customer base. LBT also has improved its public image, such that it defies the stereotype of the older, central city municipal bus system.

Recently, LBT has adjusted schedules, routes, and types of services—such as tourism and visitor shuttle services—to areas that are highly desirable among prospective riders. Some services are designed to look different. For example, a fleet of 30 shuttle vehicles is painted differently, has new names, and is marketed differently than the rest of the fleet. Shuttles do not charge a fare, but are subsidized by the City of Long Beach. Shuttle routes have been adjusted to be convenient for popular transit routes such as those from hotels to the convention center, to the Queen Mary, then to downtown restaurants, and so on. Linking popular destinations this way has increased ridership, improved the agency's image, and attracted new riders.

As the fare boxes disappeared, ridership grew quickly and by a considerable margin. This was partly a result of the disappearance of transfers, which many riders did not like or did not know how to use. LBT also added a ferry system (a water taxi). It was successful the first year, but not as popular in subsequent years because waterfront development has been delayed.

Other Possible Influences

LBT makes extensive use of marketing data and analysis, including annual surveys for the past 20 years. Standard questions for each year help to define emerging trends, easing the process of modifying services and allocating resources. For example, five or six years ago there was a downward trend in on-time performance. The agency focused on finding solutions, and by the next year the trend had reversed.

Atlanta Metro

Service background:

The Metropolitan Atlanta Rapid Transit Authority (MARTA) operates the subway and bus system in the City of Atlanta, Fulton and DeKalb counties, serving the 800-square mile district at the heart of the metro area. The rail system currently has 36 stations with 46 route miles. MARTA carries about 250,000 rail passengers on weekdays. MARTA also operates buses over 150 routes through the greater Atlanta area. The first MARTA rail stations opened in June 1979. MARTA operates 240 electric rail cars on 46 miles of track with regular service to 36 rapid rail stations. In addition, 705 buses traverse more than 150 routes covering 1,500 miles. On an average weekday, the system records 560,000 passenger boardings. MARTA's service area consists of DeKalb and Fulton Counties, which includes the City of Atlanta. Based on the 1990 census data and the Atlanta Regional Commission's 1999 adjusted count, this two county area's population was 1,396,100, of which 427,500 were residents of the City of Atlanta. The broad 20-county metropolitan area encompasses 6,150 square miles with a population of over 3 million, making it the ninth largest metro region in the United States.

Key factors affecting ridership increases:

The majority of the ridership increases appear to be the result of events and trends beyond the immediate control of MARTA management. In 1996, three new stations were opened on a branch. However, the big boost in ridership appears to have been the result of the Olympics occurring in July of that year. The organizers made MARTA a big point of emphasis, and visitors and residents responded to that by generating huge numbers of trips. Between July & August, approximately 20,600,000 additional unlinked passenger trips were made on MARTA - about double the expected volume of 24-26 million trips. Thus there was a 90 percent increase for that two-month period. The effort impressed the community so much that there was carry over after the Olympics ended, despite a fare increase.

After the Olympics, MARTA anticipated a slight recession in the economy as most of the jobs created by the Olympics were projected to disappear. In fact, there was only a small drop, but within four to five months a rebound occurred translating into about a million extra boardings per month. This increase resulted from a combination of the boost from the Olympics and good local economic conditions. During the 1998 fiscal year, for example, unemployment was under 3 percent in Atlanta.

In 1999 MARTA experienced an increase of 5.5 million trips or 3.5 percent - which was attributed largely to the fact that the economy was still booming. Residential and commercial construction was visible everywhere and the area was growing at about 1 percent per year. MARTA worked with big employers to provide tokens through a partnership program. These tokens and monthly passes were provided at a discount. Then the receiving organization would discount the tokens even further to their employees to qualify for an available tax write off benefit, which had recently increased. The number of rides a passenger could take was unlimited and government and university employees both made heavy use of the system. As a result, the monthly ridership was increasing at an extremely fast pace, which continued through the 2000 fiscal year.

In 2000 the Super Bowl was hosted in Atlanta, the Phillips Arena (Basketball / Hockey) opened, and the National Youth Gathering (sponsored by Lutheran Church) brought tens of thousands of youth to Atlanta. These events alone brought approximately 500,000 riders. MARTA works with the organizers of such events to facilitate access and use of the system.

Milwaukee County Transit System (Milwaukee, WI)

Service Background

The Milwaukee County Transit System provides bus-only transit in a dense, urban environment with a major university (University of Milwaukee-Wisconsin). Of the county's 240 square miles, approximately 80 percent is served by the bus system. The population within the county is concentrated, and the grid street system helps makes it possible for more than 90 percent of residents to live within walking distance of a bus stop. The Milwaukee economy is diverse, having expanded from its old manufacturing base to include elements of the financial and service industries. This has resulted in a pattern of steady economic growth, more jobs, and, at least in theory, more bus-riding commuters. (These factors do not in themselves explain increases in ridership, but they may serve to make other factors more effective in doing so.)

Key Factors Affecting Ridership Increases

From the standpoint of agency actions, one of the most important initiatives over the past few years has been a focus on a variety of prepayment fare options. Students at the University of Wisconsin-Milwaukee, for example, can purchase low-cost university passes that enable use of the transit system for a fixed price. The cost of the passes is partially paid by student fees. Through the efforts of their employers, workers may be eligible to participate in two Commuter Value Programs: passes and certificates. Passes allow unlimited rides at a cost of only $16 a month to the employee; approximately 3,400 employees use them monthly. Certificates are essentially vouchers that employers can purchase and distribute to their employees. Approximately 37,000 certificates are issued on a monthly basis.

Users of prepayment fare options in the Milwaukee system tend to be high-frequency riders. The initiative to promote prepayment has resulted in an increase from 42 percent to approximately 60 percent in the percentage of total riders who prepay. More high-frequency riders translate into higher overall ridership rates.

Another agency policy has been to emphasize deep discount fare structures. In the agency's experience, passengers who purchase discounted, high-volume tickets are motivated to consume them more quickly, thus increasing ridership. The effort to market these fares has been in place since the late 1980s, although it may be increasing in effectiveness over recent years.

The system makes an ongoing effort to match service levels to demand. This is not achieved by mathematical formula; instead, changes in demand are consistently monitored and incremental adjustments made on the basis of experienced judgment and past experience.

Finally, the agency has been an aggressive user of federal funds to promote transit use, including the Joint Access Reverse Commute (JARC) and the Congestion Mitigation Air Quality (CMAQ) programs. For example, funds from these programs were used to extend service to an industrial park area.

Other Possible Influences

The agency places a high value on providing good quality service. To achieve this, concomitant efforts are focused on measuring service quality. The agency conducts a semiannual service quality measure study. The results are applied directly to management of the agency. For example, a measure of operator interaction recently indicated some problems with operator courtesy to passengers; as a result, an operator interaction workshop was created and there has been a measurable increase in satisfaction with the system.

The system also conducts a monthly telephone survey of 500 persons. Presently, approximately 80 percent of respondents report that the system meets or exceeds their needs. The system is widely regarded as safe and clean, which has helped to create a high level of passenger loyalty; one-third of current passengers have used the system for at least five years.

NYC Transit (New York, NY)

Service Background

New York City Transit (NYCT) operates local and express buses, as well as subways for the five boroughs of New York City. Under an agreement with the City of New York, NYCT also manages the provision of paratransit services (demand-response vans) for disabled individuals through contracts with several private operators. The five boroughs—Brooklyn, Queens, Manhattan, Bronx, and Staten Island—receive bus service. The subway serves Brooklyn, Queens, Manhattan, and the Bronx. NYCT also operates the Staten Island Railway, an aboveground heavy rail line on Staten Island that provides connecting service with the Staten Island Ferry for service between Staten Island and Manhattan. Travel between Manhattan and its surrounding boroughs is predominantly commuter travel, but there is also a great deal of travel within Manhattan. The subways tend to serve borough-to-borough travel, while buses generally serve intraborough travel.

Key Factors Affecting Ridership Increases

NYCT experienced a 20.4 percent growth in unlinked passenger trips between 1995-1999. Ridership grew from 1,905,193,756 to 2,293,679,963. Much of this growth is due to changes in fare structure and fare media. In 1994, the agency first introduced an electronic fare card, called the MetroCard, and began phasing from token fares to prepaid electronic fares.

Automated Fare Collection (AFC) technology was installed on a station-by-station basis, and all stations were equipped to accept MetroCard by May 1997. All buses were AFC-equipped by late 1995. Prior to July 1997, the

MetroCard was used simply as an electronic form of a token that did not provide other fare structure changes.

In July 1997, however, the agency introduced free intermodal transfers. Before this change, many transit riders depended on the buses to reach the subways; they were required to pay fares twice, so the free transfer policy essentially cut fares in half for many riders. The agency experienced ridership growth in the second half of 1997, following the free transfer changes. In addition to the free intermodal transfers, the new electronic transfers resulted in a less restrictive bus-to-bus transfer policy than had existed with paper transfers. The transfers encoded on MetroCards were no longer controlled by location and direction, making several new travel patterns possible, such as round-tripping and trip-chaining on a single fare, as long as the passenger did not board the same bus route and transferred within 2 hours of boarding the first bus. This likely induced new trips, although it is difficult to accurately estimate the impact.

At the same time (July 1997), the seven privately operated bus companies franchised by the New York City Department of Transportation (NYCDOT) adopted AFC technology and began accepting MetroCard. Before MetroCard, free transfers between NYCT and NYCDOT-franchised buses were limited by route, direction, location, and time. In July 1997, these restrictions were relaxed. In addition, for the first time, NYCDOT customers with MetroCard could transfer free to and from the subway.

In January 1998, the agency also introduced the MetroCard Bonus. Cards purchased at a $15 value or higher received 10 percent more value on the card. This essentially meant that when a rider paid for 10 rides at $1.50 per ride, the eleventh ride is free. The agency continued to see ridership growth in the first half of 1998 as a result of the free transfer and card bonus programs.

Also in January 1998, another MTA agency, Long Island Bus (LI Bus) began using MetroCard. LI Bus serves suburban riders in Nassau County on Long Island as well as reverse commuters from the City. For the first time, LI Bus customers with MetroCard were able to transfer to the NYCT subway at major terminal stations in Queens.

In March 1998, the agency lowered express bus fares from $4 to $3, which increased express bus ridership. In July 1998, two types of unlimited-ride MetroCards were implemented: For $63, a rider could make unlimited rides for 30 days; for $17, a rider could make unlimited rides for seven days. These cards are valid for both bus and subway use. An express bus plus pass was introduced as well, which provided unlimited local bus, express bus, and subway use for $120 per month.

To meet the growing demand, NYCT has been expanding service since 1997, adding new capacity on 90 percent of its subway lines and 96 percent of its bus routes. The agency had to add a great deal of express service to meet demand when the express bus fare was reduced from $4 to $3. The agency purchased new coaches called “called over-the-road coaches,” similar to Greyhound buses. The agency previously had used local bus stock for express bus service, but the new over-the-road coaches provide a higher level of comfort for long-distance travels.

Finally, a one-day fun pass for unlimited rides for one day at $4 was implemented in January 1999. In late 1998 and early 1999, the agency experienced large ridership increases.

Ridership growth also can be attributed to a strong regional economy and a series of 5-year capital programs starting in the 1980s, which provided funding for new vehicles as well as the rehabilitation and rebuilding of the system. After an economic slowdown in the early 1990s, the economy rebounded in the mid- to late-1990s when the economy was growing at 2 to 2.5 percent a year. Employment increased by 2.2 percent in 1997, 2.5 percent in 1998, 2.6 percent in 1999, and 2.8 percent in 2000. Subway use traditionally has been highly correlated with employment, but in the mid- to late-1990s, both subway and bus use increased much more than employment growth. Also in the 1990s, a major influx of immigrants near subway stations and a reduction in crime and fare evasion contributed to increased ridership.

Other Possible Influences

The NYTC collects a variety of data that are used to help adjust service levels and routes in a more efficient and convenient way. Subway ridership generally accounts for between 65 and 70 percent of system (combined subway and bus) ridership. In 2000, for example, 66 percent of system ridership was on the subway. Prior to the MetroCard, it was difficult to obtain good bus-to-bus transfer information through paper transfer counts, because the volume of paper transfers collected on buses was impossible to count on a regular basis. With the MetroCard, the agency gets accurate electronic counts of origin and transfer trips on buses, so NYCT measures bus ridership by the total number of bus boardings (that is, unlinked trips). Bus-to-subway transfer information can be collected electronically, but counts of transfers between subway lines are still impossible, because there is no fare payment or MetroCard dipping. Therefore, NYCT measures subway ridership by the number of entries into the subway system (that is, linked trips).

In order to estimate unlinked subway trips for NTB reporting, subway transfer counts are derived primarily from surveys. The main survey deployed is a once-a-year survey that asks a small sample of passengers their boarding and alighting stops; these points are used to reconstruct the travel between the two points. For other studies, the agency uses a network assignment model to estimate linked and unlinked trips. Ridership counts are extrapolated from a sample of journey-to-work trips, combined with Census and survey data.

The agency also administers a tracking survey of 1,500 residents—transit riders and nonriders—of NYC through travel journals and diaries. Once a month for a few days, participants record all transit and other trips. The agency tracks the market share of transit use compared with auto and taxi use each quarter.

OMNITRANS (Riverside, CA)

Service Background

OMNITRANS serves 480 square miles in the San Bernardino Valley of Southern California with bus and paratransit service. The area is fast growing but relatively low in population density. In 1995 and 1999, the system won APTA awards for outstanding transit system in its size and class. It is considered a high-quality, reliable system with courteous drivers.

Key Factors Affecting Ridership Increases

With respect to ridership growth, the system underwent a massive operational analysis in 1997, which resulted in a major route restructuring. This made the system more efficient and created a higher level of service with fewer necessary transfers for many riders. The changes tended to increase service in the core area and reduce emphasis on serving radial areas. This effort did not result in a higher total level of service, but ridership increased dramatically after the changes were instituted.

A second change was the creation in 1996 of a day and monthly pass system. Approximately one-third of riders now use day passes and another one-third use monthly passes. Fares have not been increased.

Other Possible Influences

OMNITRANS makes extensive use of market research data in designing and implementing transit services. For example, a marketing push toward the full-fare market of the working young and college students was instituted in the form of a consistent marketing presence, including direct mail.

Pace Suburban Bus Division (Chicago, IL)

Service Background

Pace Suburban Bus Division primarily serves suburbs outside of Chicago, Illinois. Service runs from the suburbs into the city and connects with the urban rapid transit service. A dense core of city-oriented suburbs characterizes the service area. The system also serves a larger expanse of newer suburbs that are less dense and more locally oriented, as well as older satellite cities. These satellite cities have a pulse system, by which all buses meet at the same time downtown and then pulse out to the local neighborhoods, serving 80-90,000 residents each. Pace also serves some areas that are almost rural. The agency runs para-transit programs in various parts of the service area for the general public, the elderly, and the disabled, in compliance with ADA. Pace operates a 360-vehicle vanpool program, a 550- to 600-vehicle bus fleet (including 25 to 30 contractor buses), and approximately 350 paratransit buses.

Key Factors Affecting Ridership Increases

Much of the growth in ridership is attributable to several factors. First, Pace retained a fairly stable fare structure during the period of interest. Around 1995, the agency, in cooperation with Metra Commuter Rail, offered combined monthly rail and bus ticket discounts. Holograms were put on the monthly ticket to combine both bus and rail tickets into one fare medium. The bus portion of the ticket was discounted with the purchase of the rail portion of the ticket.

Student reduced rates, which offered half-price fares during the regular school year, have been longstanding programs. In the last few years, Pace introduced a new summer pass for students at $40 per month, because the agency had the capacity to continue serving students during the summer.

Pace uses a graduated flat-fare structure: For local trips in satellite cities, all trips cost $1.25; lines that interchange with Chicago Transit Authority (CTA) cost $1.50; and the handful of express routes running on expressways to the Chicago loop cost $3. (In 2000-2001, Pace increased some fares, which had negative effects on the ridership.)

Another major factor that increased ridership was the opening of a UPS sorting facility in Hodgkins, Illinois, in 1996. Pace worked with the facility before it opened, to coordinate transit to and from the facility. The UPS facility operates four work shifts of four hours each, and Pace schedules service to meet demands of the various shift schedules. With UPS' financial assistance, Pace operates 20 to 30 buses for each shift from several points of origin.

Pace also has been fairly active in working with employers who are moving in the areas (within or from without) to set up transit services for the workers. Employees working in the CBD loop are more likely to use transit due to the congestion and high costs of parking. In contrast, when a firm moves to a suburban area, parking is usually free and transit is much less plentiful than in the Loop. Because the demand in these areas is marginal, Pace has tried to work with employers to fill these gaps in transit service.

Other Possible Influences

Pace uses promotional activities to keep ridership going. Over the last five years, the advertising focus has been shifting from general system promotions to route level changes and services. The agency also has moved away from radio advertisements to direct delivery and mail.

Portland Tri-Met (Portland, OR)

Service Background

Tri-Met provides public transit service, including light rail, bus, and paratransit, to the Portland metropolitan area. The agency is also actively involved in a host of related programs, such as station area planning, land use planning, growth management, and transit-related housing.

Key Factors Affecting Ridership Increases

In the view of Tri-Met officials, land use restrictions around Portland have created an environment that supports transit ridership growth at the same time that growth is occurring. It has taken time for these land use policies to translate into increased use of public transportation, which may help to explain recent increases in ridership.

Increases in ridership are also likely the result of an absence of investments in downtown road capacity for the past 20 years. In fact, 83 percent of Tri-Met riders are “choice” riders (those who could drive instead). Approximately 276,000 trips are taken per day on light rail and the bus system. One-third of all work trips to downtown are on transit.

Finally, the completion of the Westside light rail line has had a tremendous impact on ridership. Westside is an 18-mile extension to the west of downtown Portland. The transit-oriented development around the rail line translated into an investment of more than $856 million worth of development along with 8,000 new houses within walking distance of the line. One-half of riders in this area were new to transit.

Other Possible Influences

Market research is a key management tool for Tri-Met. It is used for a variety of purposes, including planning new major routes; examining specific areas; and determining where senior centers are located and where there are greater percentages of low-income and immigrant populations. These findings are subsequently linked to decisions about service levels and routes.

Additionally, Tri-Met has created a “fareless square” in downtown Portland. All rides are free in the downtown Portland area bounded by the Willamette River, NW Irving, and the I-405 (Stadium) freeway. Among other benefits, this program is thought to promote transit riding by providing people who do not currently use transit an opportunity to try it.

SYNTHESIS OF CASE STUDY DATA

Analysis of the interviews with officials from these agencies reveals that ridership increases are attributed to a wide variety of factors. Reasons for ridership growth cited by respondents range from macroeconomic conditions largely beyond the control of transit agencies to specific strategies (such as rerouting and fare adjustments) specifically intended to increase ridership. Two general patterns of response are particularly noteworthy. First, respondents were not reluctant to attribute ridership increases to external forces (economic and/or population growth). Second, most respondents focused on only a few reasons, rather than a complicated explanation, for their ridership increases.

Table 22 contains a matrix that identifies which *major* causes of ridership

Table 22: Causes of Ridership Increases Reported by Responding Agencies

	Major population / employment increases	Major fare structure change	Flash pass system instituted	Coordination with major employers	Extensive public participa-tion	Extensive use of market research	Major capital invest-ment	land use policies	New fixed rail routes	Major routing reconfig-uration
ATC	✔									
Autoridad Metropoli-tana de Autobuses										
Caltrain	✔			+						✔
Gainesville Regional Transit System		+	✔		+		+			
Green Bus Line		✔								
Long Beach Transit		✔				+				
Metro Atlanta	✔			+						
Milwaukee County Transit System		✔	✔	✔						
NYC Transit	✔	✔				+	✔			
OMNI-TRANS						+				
Pace Suburban Bus Division		✔		✔						
Portland Tri-Met						+		✔	✔	
% cited as major factor	33 %	50 %	17 %	17 %	0 %	0 %	8 %	8%	8 %	8 %
% cited as minor factor	0 %	0 %	0 %	17 %	8 %	33 %	0 %	8 %	0 %	0 %
% cited asfactor	33 %	42 %	17 %	33 %	8 %	33 %	8 %	17 %	8 %	8 %

Table 22: Causes of Ridership Increases Reported by Responding Agencies (Cont.)

	Major population / employment increases	Major fare structure change	Flash pass system instituted	Coordination with major employers	Extensive public participa-tion	Extensive use of market research	Major capital invest-ment	land use policies	New fixed rail routes	Major routing reconfig-uration
4 Denotes cited as major factor			+ Denotes cited as secondary factor							

increases were identified by each responding agency. Casual observation of the analysis reveals that the responses are diverse—no factor was cited by a majority of respondents

Fare Structures Changes

The most commonly mentioned factor was “major fare structure change.” The table includes another category, “Flash pass system instituted,” that also may pertain to fare changes. Six systems reported that some form of fare structure change was a major cause of their ridership increase. Fare structure changes assumed a variety of forms among the agencies that cited this factor:

- The New York City Transit Agency and the Green Bus Line in Brooklyn participated in the New York area’s adoption of a single fare system, which had the effect of halving the fares of commuters into Manhattan and made it much easier for passengers to navigate the metropolitan area via transit.
- Long Beach Transit created a fare-free shuttle service that linked popular destinations.
- Both the Gainesville Regional Transit System and the Milwaukee County Transit system created a system of reduced fare passes for the large universities they serve. (These two systems also instituted flash-pass systems with related polices.)
- The Pace Suburban Bus Division offered combined monthly rail and bus ticket discounts, along with student passes in the Chicago area.

These cases demonstrate that reduced fares, and reduced fares coupled with a simplified fare structure, can help create significant ridership increases.

Coordination With Employers

The second most common factor cited was “coordination with major employers.” This generally entails some form of reduced fare or pass system or other arrangement to link transit to large employers in an agency’s service area. Some systems make discounts or passes available to many or all employers, while others work to cater to the needs of specific large employers. Among the examples provided by respondents were the following:

- Caltrain coordinates with shuttles provided by major employers along its rail route.
- In Atlanta, MARTA worked with employers to provide tokens through a partnership program. These tokens and monthly passes were provided at a discount, and were particularly popular with workers from government agencies.
- The Milwaukee Transit System’s Commuter Value Program provides low-cost passes that employers purchase and pass on to employees.
- In Chicago, Pace worked with a new UPS facility to schedule service that meets the demands of that company’s four-shift schedule, operating up to 30 buses for each shift.

Use of Market Research

Four respondents mentioned the potential role of market research, which can assume a variety of forms. These respondents tended not to emphasize these efforts as primary causes of ridership increases, perhaps because it is difficult to document the possible linkages between specific efforts and subsequent increases in ridership. Among the examples provided by responding agencies:

- Long Beach Transit reported extensive use of marketing data and analysis, including annual surveys for the past 20 years. The questions asked each year help enable the definition of emerging trends, and service adjustments can be made accordingly.
- New York Transit collects a wide variety of data, including extensive measures of ridership and passenger satisfaction, as well as travel journals, that provide the system with powerful analytic tools.
- In Riverside, California, OMNITRANS uses market segmentation data to target specific groups with direct mail advertising.

- Portland Tri-Met regards market research as a key management tool and uses its analysis of market data to support a variety of decisions.

Economic and Demographic Change

Four respondents heavily emphasized economic and/or population growth as the primary cause of their agency's rise in ridership. As a rule, these respondents tended to explicitly downplay any of their own efforts to increase system use, tending to portray their agencies as meeting rising demand with additional service:

- Set in one of America's fastest-growing metropolitan areas, ATC in Las Vegas struggled to cope with the transit needs of an additional 5,000 area residents every month.
- Caltrain is situated in California's Silicon Valley and San Francisco, the location of then-prosperous "dot-coms," where unprecedented employment growth and traffic combined to help propel commuters aboard its commuter rail service.
- In Atlanta, MARTA is similarly set to serve an incredibly fast-growing metropolitan area that was also the backdrop for the 1996 summer Olympics and several other events that brought many tourists to the area.

Route Restructuring

Two agencies reported significant ridership increases as a result of major route restructuring efforts, which did not entail major service increases.

- In San Juan, Autoridad Metropolitana de Autobuses attributes their increases in ridership to a major route restructuring; the changes were made to allow more frequent service to be provided with the same number of scheduled vehicles.
- In Riverside, California, the OMNITRANS agency instituted a route restructuring that did not result in a higher total level of service, yet apparently resulted in dramatic increases in ridership.

SUMMARY

Interviews with officials from transit agencies and firms with notably high ridership increases reflect the variability noted earlier in this report with survey responses; no single explanation emerges as the common factor that accounts for a ridership increase. Instead, the interview responses indicate that a broad variety of factors could account for these increases. First, several agencies were forthright in attributing the bulk of their ridership increases to external factors such as rapid population increases and economic growth. In that context, transit agencies can experience rapid ridership increases merely by adding service to match the increased demand. This is a relatively simple task, particularly for fixed-rail systems such as the San Francisco Bay Area's Caltrain or Atlanta's MARTA.

Perhaps the most striking increases that resulted from more internally developed policies were those associated with changes in fare structure and/or transit pass programs. These policies seem capable of effecting significant ridership increases, although it is possible that they do not raise transit fare box revenues concomitantly. New York City's MetroCard program has clearly resulted in a much more passenger-friendly system for that metropolitan area. However, the New York area is unique with respect to the complexity of its transit, meaning that most other communities could not replicate this strategy with ease. Flash pass systems, implemented with links to universities or major employers, were given credit for ridership increases at several sites and may prove more easily imitated nationally. Some agencies were apparently able to increase ridership merely by better coordinating their existing service to the needs of employees of major firms.

Given that we interviewed transit managers, many from agencies that have won awards for various aspects of their management prowess, it is interesting that no one interviewed mentioned good management as a factor explaining ridership growth. While two responding agencies reported great success from major rerouting efforts, all were generally reluctant to attribute their success to proficient management.

SUMMARY AND CONCLUSIONS

This study examines recent trends in public transit ridership in the United States to increase our understanding of why some public transit systems have been successful at attracting new riders, while others have not. This research is unique in that it uses three methodological approaches to analyze the factors influencing transit use: an analysis of nationwide transit data; a survey of the managers of most of the transit systems that increased patronage during the late 1990s; and in-depth case study analyses of 12 systems that were particularly successful at attracting new riders during our study period.

This research focused, although not exclusively, on the 227 public transit systems that added riders during the economic boom years of the late 1990s, a period in which transit ridership nationwide increased by 13 percent. Although a wide array of factors clearly influence transit patronage, it appears that the most significant factors influencing transit use are *external* to transit systems. This finding was consistent throughout our review of the research literature, our analysis of nationwide data, our survey of successful transit systems, and our detailed interviews with transit managers. In our data analysis, we found extraordinarily strong correlations between ridership and three external factors related to economic activity: unemployment rate, real hourly wage, and real GDP (Table). Such external factors are largely beyond the control of transit managers.

Table 23: Correlation Coefficients of External Factors and Transit Ridership, 1995-1999

	Unlinked Trips	**Unlinked Trips per Person**
EXTERNAL FACTORS		
Unemployment Rate	-0.70	-0.16
Real Hourly Wage ($2001)	0.96	0.70
Real GDP ($2001)	0.79	0.24
Real GDP per Person ($2001)	0.82	0.29
Source: Calculation of National Transit Database data by the authors		

We find that while transit agencies experiencing ridership growth are dispersed throughout the nation, many such agencies are clustered on the West Coast.

In our nationwide survey of 103 transit systems, we asked transit managers about recent operational changes and what factors, both internal and external to their systems, that they thought were most responsible for increasing ridership. Population growth, economic/employment growth, and worsening traffic congestion were the most frequently mentioned external factors. Among internal factors, service improvements were the most frequently cited. This is perhaps not surprising, because more frequent service and broader network coverage can serve more riders, and service improvements often (but not always) occur in response to increasing demand. Transit managers told us that they concentrate their efforts on producing good service for the most responsive areas and groups of riders. How do transit managers decide where to implement service improvements? The survey results indicate that ridership productivity is easiest to maximize in traditional transit territory (dense corridors, central city, suburb-to-city alignments, and areas with relatively low levels of automobile ownership). This leads us to conclude that transit systems with the greatest increases in ridership appear to tailor services and product mix to best meet customer needs.

While the concept of niche marketing is not new to the transit industry, our survey results indicated that more agencies are targeting market segments to increase ridership. Agencies' abilities to form partnerships with communities, businesses, universities and schools, social service agencies, and local government can significantly increase ridership.

While the survey respondents were collectively skeptical about the effects on ridership of across-the-board fare reductions, they were generally enthusiastic about the influence of universal fare coverage programs, which are combinations of fare discounts and new fare media and payment options. These universal fare coverage and partnership programs represent the efforts of transit systems to improve their flexibility and responsiveness in meeting the mobility needs of particular market segments and responding to changing demographics and development patterns.

These findings were generally supported by our in-depth interviews with officials from transit agencies. Managers at several agencies were forthright in attributing the bulk of their ridership increases to external factors such as rapid population increases and economic growth. In such a context, transit agencies may experience rapid ridership increases merely by adding service to match the increased demand. Perhaps the most striking increases that resulted from internally developed policies and programs were those associated with changes in fare structure and/or transit pass programs. Such policies appear capable of producing significant ridership increases, although it is possible that they do not raise transit fare box revenues concomitantly.

Although the findings in the survey and interviews are limited to the *perceptions* of transit managers, this study offers an illuminating snapshot of the strategies pursued by transit systems that added riders during the 1990s. In particular, we find that transit systems have employed a wide array of fare and service innovations coincident with increasing patronage. While the causality between system changes and ridership growth is only hypothesized by the respondents to this survey, they are, as a group, professionals for whom the relationship between transit service provision and transit service consumption is a daily (pre)occupation. As such, the findings here, at the very least, reflect the views of informed observers.

Although we were not able to uncover a “magic bullet” that promises ridership growth for transit systems, the results of this multipronged study should ring true to experienced transit managers and analysts: While transit use is largely a function of factors outside the control of transit systems, flexible and creative management can and does make a difference.

APPENDIX A: LITERATURE REVIEW

This literature review is a compilation of the readings that have provided the background to this report. In order to provide quick and easy access to these resources, each article is broken down into the following elements:

1. Brief summary
2. Methodology
3. Findings
4. Comments.

In some cases, the methodology and findings were combined because the organization of the reviewed article made more sense to organize the review in that manner.

Some reviews are longer than others. This can be the result of a number of factors, including the length and breadth of each article and the relevance that it had to our report.

At the beginning, you will find a reference table matrix of all the articles. The descriptive summaries are in the same order as they appear on the matrix

Table A-1: Layout of Literature Review Matrix

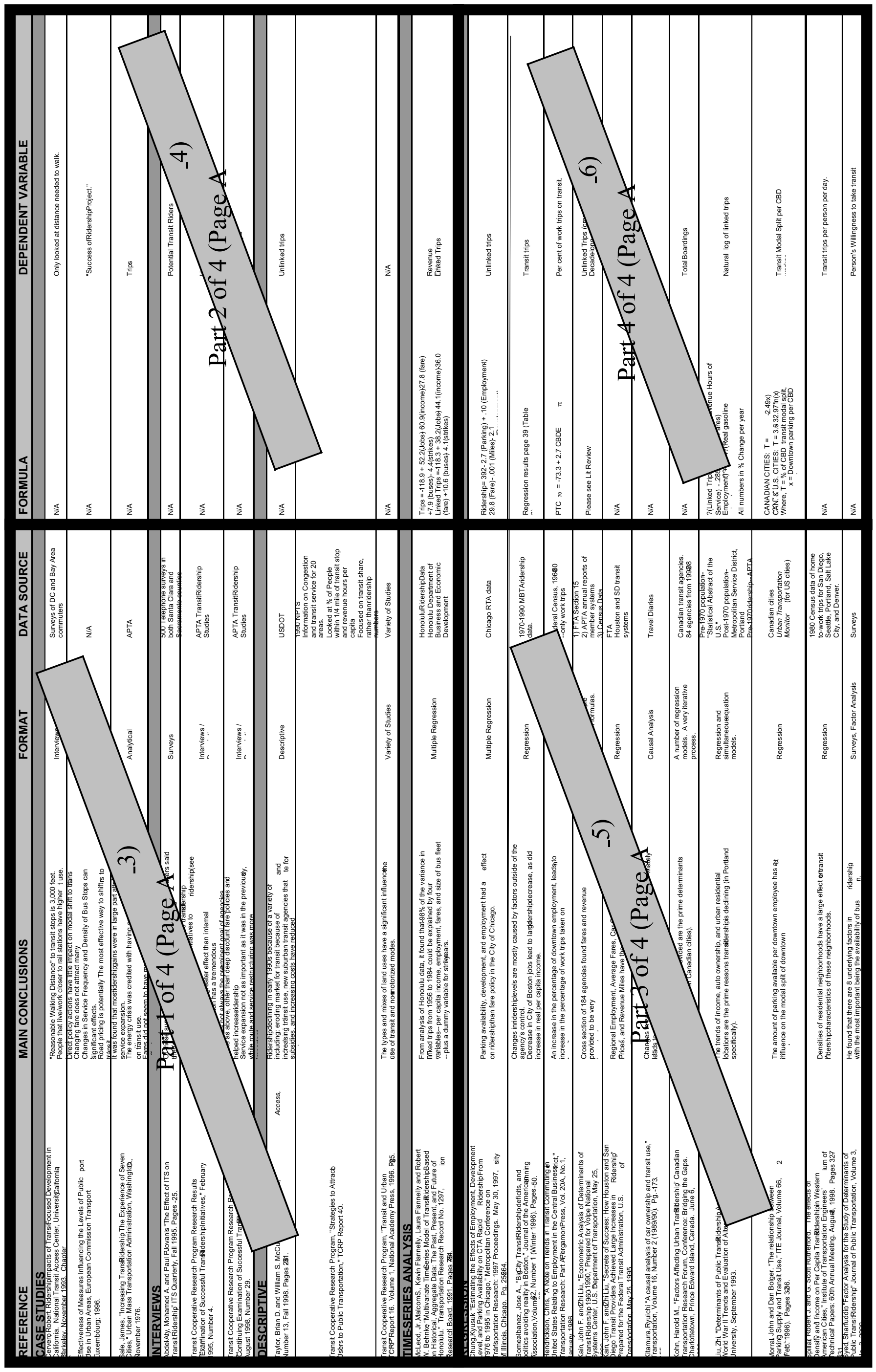


Table A-2: Literature Review Matrix, Part 1 of 4

REFERENCE	MAIN CONCLUSIONS	FORMAT	DATA SOURCE
LITERATURE REVIEWS AND CASE STUDIES			
Cervero, Robert. Ridership Impacts of Transit-Focused Development in California. National Transit Access Center, University of Calfornia; Berkeley, November 1993. Chapter 2.	"Reasonable Walking Distance" to transit stops is 3,000 feet. People that live/work closer to rail stations have higher transit use.	Interviews	Surveys of DC and Bay Area commuters
European Commission on Transportation Research; "Effectiveness of Measures Influencing the Levels of Public Transport Use in Urban Areas," Luxembourg; 1996.	Direct policy actions have little impact on modal shift to transit. Changing fare does not attract many riders. Changes in Service Frequency and Density of Bus Stops can have significant effects. Road pricing is potentially The most effective way to shif	Review of Literature and Case Studies	N/A
Sale, James, "Increasing Transit Ridership: The Experience of Seven Cities," Urban Mass Transportation Administration, Washington D.C., November 1976.	It was found that most ridership gains were in large part attributable to service expansion. The energy crisis was credited with having an immediate positive effect on transit use. Fares did not seem to have much of an effect.	Analytical	APTA
SURVEYS AND INTERVIEWS WITH TRANSIT MANAGERS			
Brown Jeffrey, Daniel Baldwin Hess, and Donald Shoup. 2001. Unlimited Access. *Transportation* . vol. 28. pp. 233-267.	University transit pass programs that provide discounted transit fares to university students through partnership between a transit agency and a university have been very successful to increase ridership without increasing service.	Suveys	Surveys of 35 transit agencies
Transit Cooperative Research Program Research Results Digest, "Examination of Successful Transit Ridership Initiatives," February 1995, Number 4.	There is no one single reason for increased transit ridership There are five main strategies and initiatives to increase ridership (see other factors) External forces have greater effect than internal forces Service Expansion has a tremendous effect Rider	Interviews / Descriptive	APTA Transit Ridership Studies
Transit Cooperative Research Program Research Results Digest, "Continuing Examination of Successful Transit Ridership Initiatives," August 1998, Number 29.	Same as above, other than deep discount fare policies and passes helped increase ridership. Service expansion not as important as it was in the previous study, while route and service restructuring was more important.	Interviews / Descriptive	APTA Transit Ridership Studies
STATISTICAL ANALYSES OF A TRANSIT AGENCY OR REGION			
Chung, Kyusuk. "Estimating the Effects of Employment, Development Level, and Parking Availability on CTA Rapid Transit Ridership: From 1976 to 1995 in Chicago," Metropolitan Conference on Public Transportation Research: 1997 Proceedings. May 30, 1997, Un	Parking availability, development, and employment had a greater effect on ridership than fare policy in the City of Chicago.	Multiple Regression	Chicago RTA data
Gomez-Ibanez, Jose A., "Big-City Transit Ridership, deficits, and politics avoiding reality in Boston," Journal of the American Planning Association,Volume 62, Number 1 (Winter 1996). Pages 30-50.	Changes in ridership levels are mostly caused by factors outside of the agency's control. Decrease in City of Boston jobs lead to large ridership decrease, as did increase in real per capita income.	Regression	1970-1990 MBTA ridership data.
Kain, John F. and Zhi Liu, "Secrets of Success: How Houston and San Diego Transit Providers Achieved Large Increases in Transit Ridership," Prepared for the Federal Transit Administration, U.S. Department of Transportation, May 25, 1995.	Regional Employment, Average Fares, Car Ownership, Gasoline Prices, and Revenue Miles have the most impact on ridership.	Regression	FTA Houston and SD transit systems
Kitamura, Ryuichi. "A causal analysis of car ownership and transit use," Transportation, Volume 16, Number 2 (1989). Pg. 155-173.	Changes in car ownership leads to changes in car use, which ultimately leads to changes in transit use.	Causal Analysis	Travel Diaries
Liu, Zhi. "Determinants of Public Transit Ridership: Analysis of Post World War II Trends and Evaluation of Alternative Networks," Harvard University, September 1993.	The trends of income, auto ownership, and urban residential job locations are the prime reasons transit ridership is declining (in Portland specifically).	Regression and simultaneous-equation models.	Pre-1970 population -- "Statistical Abstract of the U.S." Post-1970 population -- Metropolitan Service District, Portland Pre-1970 ridership -- APTA Postr-1970 ridership -- Tri-Met
McLeod, Jr., Malcom S., Kevin Flannelly, Laura Flannelly and Robert W. Behnke, "Multivariate Time-Series Model of Transit Ridership Based on Historical, Aggregate Data: The Past, Present, and Future of Honolulu." Transportation Research Record No. 1297,	From analysis of Honolulu data, it found that 97-98% of the variance in linked trips from 1956 to 1984 could be explained by four major variables -- per capita income, employment, fares, and size of bus fleet -- plus a dummy variable for strike-years.	Multiple Regression	Honolulu Ridership Data Honolulu Department of Business and Economic Development

Table A-3: Literature Review Matrix, Part 2of 4

FORMULA	DEPENDENT VARIABLE	COMMENTS
N/A	Only looked at distance needed to walk.	
N/A	"Success of Ridership Project."	
N/A	Trips	Only looked at few studies (in the West and MW).
N/A	Unlinked Trips	
N/A	Unlinked Trips	No analysis of outside factors -- rather only looked at what the transit systems told them.
N/A	Unlinked Trips	No analysis of outside factors -- rather only looked at what the transit systems told them.
Ridership = 392 - 2.7 (Parking) + .10 (Employment) - 29.8 (Fare) - .001 (Miles) - 2.1 (Development)	Unlinked trips	No ridership for non-rail modes was considered.
N/A	Transit trips	Commuter Rail figures only. There was no data on automobile use or infrastructure (road space, parking rates, etc.)
N/A	Linked trips and unlinked trips (Houston) Unlinked trips (San Diego)	
N/A	Trips	No consideration of any other factor than car ownership or car use that would lead to transit trips -- such as land use patterns or transit availability.
[illegible] + .274 gasoline prices) All numbers in % Change per year	Natural log of linked trips	Did not look at many land-use characteristics, other than the % of population in center city.
Trips = -118.9 + 52.2(Jobs) - 60.9(income) -27.8 (fare) +7.9 (buses) - 4.4(strikes) Linked Trips = -118.3 + 38.2(Jobs) - 44.1(income) -36.0 (fare) +10.6 (buses) - 4.1(strikes)	Revenue Trips Linked Trips	Did not have a good measurement for service supplied (# of buses) and did not have any land-use data (job density,etc.) Elasticities used were not Honolulu-specific.

Table A-4: Literature Review Matrix, Part 3 of 4

Spillar, Robert J. and G. Scott Rutherford. "The effects of Population Density and Income on Per Capita Transit Ridership in Western American Cities," Institute of Transportation Engineers Compendium of Technical Papers: 60th Annual Meeting. August 5-8,	Densities of residential neighborhoods have a large effect on the transit ridership characteristics of these neighborhoods.	Regression	1980 Census data of home-to-work trips for San Diego, Seattle, Portland, Salt Lake City, and Denver.
Syed, Sharfuddin, "Factor Analysis for the Study of Determinants of Public Transit Ridership," Journal of Public Transportation, Volume 3, No. 3, 2000.	He found that there are 8 underlying factors in determining ridership, with the most important being the availability of bus information.	Surveys, Factor Analysis	Surveys
Transit Cooperative Research Program, "Strategies to Attract Auto Users to Public Transportation," TCRP Report 40.	Parking availability and pricing are the prime determinants in increasing transit ridership.	Various studies	1990 NPTS Information on Congestion and transit service for 20 areas. Looked at % of People within 1/4 mile of transit stop and revenue hours per capita Focused on transit share, rather than ridership numbers
Transit Cooperative Research Program, "Transit and Urban Form," TCRP Report 16. Volume 1, National Academy Press, 1996. Pg. 1-25.	The types and mixes of land uses have a significant influence on the use of transit and non-motorized modes.	Variety of Studies	Variety of Studies
CROSS-SECTIONAL STATISTICAL ANALYSES			
Hartgen, David T. and Mrtin L. Kinnamon. 1999. Comparative Performance of Major U.S. Bus Transit Systems: 1988-1977. Charlotte, North Carolina: Center for Interdisciplinary Transportation Studies, University of North Carolina at Charlotte.	Cost-effective performance depends on low unit costs, low fares, and low subsidies with concentrated service that maximizes ridership.	Comparative analysis across transit systems	FTA National Transit Database
Hendrickson, Chris, "A Note on Trends in Transit Commuting in the United States Relating to Employment in the Central Business District," Transportation Research: Part A," Pergamon Press, Vol. 20A, No.1, January 1986.	An increase in the percentage of downtown employment, leads to an increase in the percentage of work trips taken on transit.	Regression	Federal Census, 1960-80 --only work trips
Kain, John F. and Zhi Liu, "Econometric Analysis of Determinants of Transit Ridership: 1960-1990," Prepared for Volpe National Transport Systems Center, U.S. Department of Transportation, May 25, 1996.	Cross section of 184 agencies found fares and revenue service provided to be very important.	Two sets of Multiple Regression formulas.	1) FTA Section 15 2) APTA annual reports of member systems 3) Census Data
Kohn, Harold M., "Factors Affecting Urban Transit Ridership," Canadian Transportation Research Forum, Conference: Bridging the Gaps. Charlottetown, Prince Edward Island, Canada. June 6, 2000.	Fares and Revenue Service Provided are the prime determinants of transit ridership (at least in Canadian cities).	A number of regression models. A very iterative process.	Canadian transit agencies. 84 agencies from 1992-98
Morral, John and Dan Bolger. "The relationship between Downtown Parking Supply and Transit Use," ITE Journal, Volume 66, Number 2 (Feb. 1996). Pages 32-36.	The amount of parking available per downtown employee has a direct influence on the modal split of downtown employees.	Regression	Canadian cities *Urban Transportation Monitor* (for US cities)
OTHER			
Abdel-Aty, Mohamed A. and Paul P. Jovanis. "The Effect of ITS on Transit Ridership," ITS Quarterly, Fall 1995. Pages 21-25.	Of those surveyed in Northern California, 38% of non-transit users said they would consider transit if more information was available.	Surveys	500 Telephone surveys in both Santa Clara and Sacramento counties
Taylor, Brian D. and William S. McCullough, "Lost Riders," *Access,* Number 13, Fall 1998. Pages 26-31.	Ridership declining in early 1990s because of a variety of reasons, including: eroding market for transit because of suburbanization and increasing transit use, new suburban transit agencies that compete for subsidies, and increasing costs have reduced se	Descriptive	USDOT

Table A-5: Literature Review Matrix, Part 4 of 4

FORMULA	DEPENDENT VARIABLE	COMMENTS
N/A	Transit trips per person per day.	Paper focused on sub-system neighborhood level. This makes it difficult to translate to study of large number of cities.
N/A	Person's Willingness to take transit	Based solely on surveys. He originally starts with 47 factors, but these are never fully explained.
N/A	Transit Share of Trips	Looked at only parking factors and thus many other determinants could have been lost.
N/A	N/A	The report looked only at land use and not at other issues -- such as income.
N/A	Operating expenses per mile per hour, operating costs per passenger and per passenger mile, vehicle miles and hours of service provided, and ridership rates	
PTC_{70} = -73.3 + 2.7 $CBDE_{70}$	Per cent of work trips on transit.	Looked at only work trips. Definitions of CBD were somewhat arbitrary.
Please see Lit Review	Unlinked Trips (cross-section samples) Decade-long changes in boardings (change analysis)	One of very few cross-section analyses that was encountered.
N/A	Total Boardings	Many variables were ignored (such as population and land use patterns), as only average fare and service supplied.
CANADIAN CITIES: T = 109.7e^(-2.49x) CAN. & U.S. CITIES: T = 3.6 - 32.97*ln(x) Where, T = % of CBD transit modal split, x = Downtown parking per CBD worker	Transit Modal Split per CBD worker	There was no explanation as to why some U.S. cities were chosen and others weren't. There were no other factors considered other than parking availability.
N/A	Potential Transit Riders	
N/A	Unlinked trips	

Cervero, Robert. 1993. *Ridership Impacts of Transit-Focused Development in California*. Berkeley, CA: National Transit Access Center, University of California, Berkeley. Chapter 2.

BRIEF SUMMARY

Cervero conducts a literature review of several studies that examine the transit ridership characteristics of housing and commercial projects located near rail-transit stations.

METHODOLOGY

Surveys of riders and workers in the San Francisco and Washington, D.C., metropolitan areas.

FINDINGS

Looking at four different Bay Area Rapid Transit (BART) stations in San Francisco, the study finds that there is no differences in modal splits for distances of less than one-third of a mile away from a transit rail stop.

A 1989 study finds that 35-40 percent of residents living in close proximity to BART suburban stations on the Concord line used public transportation (this did not consider frequency of service or purpose of trip).

A Washington, D.C., study finds that the share of trips by rail and bus transit declines by approximately 0.65 percent for every 100-foot increase in distance of a residential site from a Metrorail station.

In terms of workplaces, the study finds that ridership was much higher at downtown sites than at suburban sites, and ridership fell steadily as distances from the offices to the stations increased.

COMMENTS

The only factor that is examined is the proximity of the stop and if the office, residence, etc. is located in a downtown area or a suburban location.

There is no discussion of how much traffic there is, the regular commuting patterns, or other factors involved in a person’s decision to take transit. Rather, it seems to only indicate that the closer a station is to someone's origin or destination, the more likely that person is to ride transit, which makes sense. Nor did the study take into account the other transit that is available to get someone to a station (such as a bus line to a rail station).

European Commission Transport Research. 1996. *Effectiveness of Measures Influencing the Levels of Public Transport Use in Urban Areas*. Luxembourg: European Commission Transport Research.

BRIEF SUMMARY & METHODOLOGY

Generated from a literature review and a series of case studies, this report describes some of the factors that should be involved when evaluating the successes of transit ridership projects.

FINDINGS

They recommend that the following factors be studied:

REFERENCE	MAIN CONCLUSIONS	FORMAT	DATA SOURCE
LITERATURE REVIEWS AND CASE STUDIES			
Cervero, Robert. Ridership Impacts of Transit-Focused Development in California. National Transit Access Center, University of Calfornia; Berkeley, November 1993. Chapter 2.	"Reasonable Walking Distance" to transit stops is 3,000 feet. People that live/work closer to rail stations have higher transit use.	Interviews	Surveys of DC and Bay Area commuters
European Commission on Transportation Research; "Effectiveness of Measures Influencing the Levels of Public Transport Use in Urban Areas," Luxembourg; 1996.	Direct policy actions have little impact on modal shift to transit. Changing fare does not attract many riders. Changes in Service Frequency and Density of Bus Stops can have significant effects. Road pricing is potentially The most effective way to shif	Review of Literature and Case Studies	N/A
Sale, James, "Increasing Transit Ridership: The Experience of Seven Cities," Urban Mass Transportation Administration, Washington D.C., November 1976.	It was found that most ridership gains were in large part attributable to service expansion. The energy crisis was credited with having an immediate positive effect on transit use. Fares did not seem to have much of an effect.	Analytical	APTA
SURVEYS AND INTERVIEWS WITH TRANSIT MANAGERS			
Brown Jeffrey, Daniel Baldwin Hess, and Donald Shoup. 2001. Unlimited Access. *Transportation* . vol. 28. pp. 233-267.	University transit pass programs that provide discounted transit fares to university students through partnership between a transit agency and a university have been very successful to increase ridership without increasing service.	Suveys	Surveys of 35 transit agencies
Transit Cooperative Research Program Research Results Digest, "Examination of Successful Transit Ridership Initiatives," February 1995, Number 4.	There is no one single reason for increased transit ridership There are five main strategies and initiatives to increase ridership (see other factors) External forces have greater effect than internal forces Service Expansion has a tremendous effect Rider	Interviews / Descriptive	APTA Transit Ridership Studies
Transit Cooperative Research Program Research Results Digest, "Continuing Examination of Successful Transit Ridership Initiatives," August 1998, Number 29.	Same as above, other than deep discount fare policies and passes helped increase ridership. Service expansion not as important as it was in the previous study, while route and service restructuring was more important.	Interviews / Descriptive	APTA Transit Ridership Studies
STATISTICAL ANALYSES OF A TRANSIT AGENCY OR REGION			
Chung, Kyusuk. "Estimating the Effects of Employment, Development Level, and Parking Availability on CTA Rapid Transit Ridership: From 1976 to 1995 in Chicago," Metropolitan Conference on Public Transportation Research: 1997 Proceedings. May 30, 1997, Un	Parking availability, development, and employment had a greater effect on ridership than fare policy in the City of Chicago.	Multiple Regression	Chicago RTA data
Gomez-Ibanez, Jose A., "Big-City Transit Ridership, deficits, and politics avoiding reality in Boston," Journal of the American Planning Association,Volume 62, Number 1 (Winter 1996). Pages 30-50.	Changes in ridership levels are mostly caused by factors outside of the agency's control. Decrease in City of Boston jobs lead to large ridership decrease, as did increase in real per capita income.	Regression	1970-1990 MBTA ridership data.
Kain, John F. and Zhi Liu, "Secrets of Success: How Houston and San Diego Transit Providers Achieved Large Increases in Transit Ridership," Prepared for the Federal Transit Administration, U.S. Department of Transportation, May 25, 1995.	Regional Employment, Average Fares, Car Ownership, Gasoline Prices, and Revenue Miles have the most impact on ridership.	Regression	FTA Houston and SD transit systems
Kitamura, Ryuichi. "A causal analysis of car ownership and transit use," Transportation, Volume 16, Number 2 (1989). Pg. 155-173.	Changes in car ownership leads to changes in car use, which ultimately leads to changes in transit use.	Causal Analysis	Travel Diaries
Liu, Zhi. "Determinants of Public Transit Ridership: Analysis of Post World War II Trends and Evaluation of Alternative Networks," Harvard University, September 1993.	The trends of income, auto ownership, and urban residential job locations are the prime reasons transit ridership is declining (in Portland specifically).	Regression and simultaneous-equation models.	Pre-1970 population -- "Statistical Abstract of the U.S." Post-1970 population -- Metropolitan Service District, Portland Pre-1970 ridership -- APTA Postr-1970 ridership -- Tri-Met
McLeod, Jr., Malcom S., Kevin Flannelly, Laura Flannelly and Robert W. Behnke, "Multivariate Time-Series Model of Transit Ridership Based on Historical, Aggregate Data: The Past, Present, and Future of Honolulu." Transportation Research Record No. 1297,	From analysis of Honolulu data, it found that 97-98% of the variance in linked trips from 1956 to 1984 could be explained by four major variables -- per capita income, employment, fares, and size of bus fleet -- plus a dummy variable for strike-years.	Multiple Regression	Honolulu Ridership Data Honolulu Department of Business and Economic Development

Although it was just a review of some literature and some case studies in Europe, the study came to the following conclusions:

- Direct policy actions have little impact on modal shift to transit. The most successful implementations are likely to be those that combine direct and indirect measures through a combination of physical, flow control, and relative pricing measures.
- Changing fare does not attract many riders.
- Changes in service frequency and density of bus stops can have significant effects.
- Road pricing is potentially the most effective way to shift riders to transit.

COMMENTS

This paper provides little that helps us to determine formulas or an exact method for our analysis. However, it brings up several interesting points that we might want to consider in our study. For example, it mentions that road pricing can have a significant impact on ridership, so we might want to look at the number of toll roads in a given area. It also mentions parking, indicating we could look at the cost of parking.

Sale, James. 1976. *Increasing Transit Ridership: The Experience of Seven Cities*. Washington, D.C.: Urban Mass Transportation Administration, November.

BRIEF SUMMARY

Based on the experience of seven cities (Eugene, Madison, Minneapolis, Portland, Salt Lake City, San Diego, and Vancouver, B.C.) from 1971 to 1975, the Urban Mass Transportation Agency tries to identify the factors attributed to ridership increases and the techniques used to gain ridership that could be transferable to other systems.

METHODOLOGY

The case study analyses use the following data: passengers per vehicle mile operated, vehicle miles per employee, vehicle miles per vehicle, operating revenue versus cost ratio, operating deficit per passenger, and operating cost per vehicle mile.

The selection of cities is somewhat arbitrary, as they were chosen from a list of transit systems that had experienced an increase of 5 percent or more unlinked trips since 1970.

The study looks at seven agencies from the Midwest and West only, in cities that were rapidly growing at the time, and for the most part, where service was being greatly expanded. These agencies are fairly typical of Western and Midwestern cities in terms of land development patterns, density, auto ownership, freeway networks, and other characteristics that are commonly associated with the use of transit. All transit systems expand with the conversion from private to public operation.

FINDINGS

Sale notes a number of common themes among the agencies that enabled them to dramatically increase ridership:

- Strong public and political support, which made substantial and stable financial resources available.
- Service expansion (the least-expanded service is Minneapolis, with a 47.3 percent increase in vehicle miles operated).
- A reduction or consistency of fares.
- The energy crisis of the 1970s.

The study finds that most ridership gains are in large part attributable to service expansion—especially the addition of routes in areas that previously were served poorly.

All fares were either kept constant or reduced, except in San Diego, which reduced fares then raised them (and ridership continued to grow).

COMMENTS

The study just states the facts, and does not indicate the role that each variable played in determining the change in ridership levels.

The study does not look at agencies nationwide, but only those in the Midwest and West; thus, the study may not be applicable to agencies nationwide. At the time, most of these cities were growing rapidly and service was being expanded rapidly, so it is difficult to determine which factors had the most effect.

The impact of energy crisis is an interesting area on which to focus.

***Transit Cooperative Research Program Research Results Digest*. 1995. Transit Ridership Initiative. Number 4, February.**

BRIEF SUMMARY

Based on a study of more than 40 transit systems, a number of general observations are made about recent ridership increases (1991-1993) and the factors that have contributed to those increases.

The study states that it wanted to enlarge the body of information available on issues considered critical to increasing transit ridership in the future.

METHODOLOGY

Interviews with 40 transit system managers.

Uses unlinked trip data from American Public Transit Association Transit Ridership Reports.

Step-by-Step Process:

- Collect and review data and information on recent transit ridership experiences to identify transit systems that have had significant transit ridership increases.
- Conduct telephone interviews with senior staff of transit agencies.
- Gather information to suggest research topics and related activities that might have value in support of initiatives that increase transit ridership.

More than 40 systems were identified that exhibited systemwide or mode-specific ridership increases over the previous three years of 3 percent or greater. Of these, 36 were contacted to discuss their respective experiences and 27 of those provided the basis for the observations reported.

FINDINGS

The study says that we should focus on the subsystem level, rather than on the aggregate level. They find that executives at most agencies attribute increases to various combinations of strategies, programs, and initiatives.

The five main internal reasons for ridership increases are:

- Service adjustments
- Fare and pricing adaptations
- Market and information initiatives
- Planning orientation
- Service coordination, consolidation, and market segmentation.

The main external reasons for ridership increases are:

- Population change
- Development trends
- Regional economic conditions.

The authors argue that external forces frequently have greater effect on ridership than system and service design initiatives.

Service expansion is a primary internal factor where ridership increases were the largest.

Most systems that increased ridership have increased efforts to target specific groups.

The report mentions that the specific effect of each individual strategy and initiative often is not known or easily measured.

Ridership is down in major urban centers but up in areas with less than 250,000 people, probably because these are growing.

COMMENTS

Much like our case studies and the broad overview of transit trends, this paper focuses on the viewpoints of transit system operators and administrators. For this use, the paper is a good example, as it covers a wide variety of questions and discusses agencies with a wide variety of sizes and functions.

Their analysis was based solely on interviews. Interviewees would be subjective about their contributions. Many times, only one person was interviewed. The study says that further research is needed to substantiate their findings.

There is no clear explanation as to why some agencies were studied, but not used in the analysis.

***Transit Cooperative Research Program Research Results Digest*. 1998. Continuing Examination of Successful Transit Ridership Initiatives. Number 29.**

BRIEF SUMMARY

This paper is essentially the continuing study of the original paper (see previous entry), although it expands it a bit in terms of the number of agencies studied.

The paper analyzes all the agencies that responded to the study four years earlier and looks at additional agencies.

METHODOLOGY

Analyzes ridership trends and experiences of the original transit systems from 1994-96 to see if the trends detected from 1991-93 continued or changed.

Identifies other transit systems that experienced significant ridership increases from 1994-96 and evaluates factors that may have been involved in these increases by interviewing managers of the transit agencies.

FINDINGS

The results remained essentially the same as the previous study.

However, there are a few aspects that were particularly relevant to this later study:

- The use of deep discount fare policies helps increase ridership, as does efforts to make passes more widely available in the respective communities.
- The most important external factors are the resurgence of regional and local economies, the combination of public transportation with other program areas, and reductions in federal operations subsidies.
- In terms of internal factors, system expansion begins to play less of a role than in 1991-93, while route and service restructuring played a more prominent role in the later study.

As in the previous study, they find that a focus solely on increasing ridership levels as a measure of success is complicated by the fact that there are many other objectives for a transit agency.

COMMENTS

See previous entry.

Chung, Kyusuk. 1997. "Estimating the Effects of Employment, Development Level, and Parking Availability on CTA Rapid Transit Ridership: From 1976 to 1995 in Chicago." Metropolitan Conference on Public Transportation Research: 1997 Proceedings, May 30. University of Illinois, Chicago. Pp. 255-264.

BRIEF SUMMARY

Controlling for fare policy and service levels, this study examines the effects that employment, development, and parking had on Chicago rail ridership in the 20-year period between 1976 and 1995.

METHODOLOGY

The study used the following data.

- RIDERSHIP = Annual unlinked trips (in millions)
- FARE = Average fare (1996$)

- PARKING = Parking activities (tax receipts divided by tax per car) (in millions)
- EMPLOYMENT = # of employees in City of Chicago (in thousands)
- MILE = Total vehicle miles traveled (in thousands)
- DEVELOPMENT = Occupancy rate of office buildings in CBD.

The following formula was developed:

Ridership = 392 – 2.7 (Parking) + 0.10 (Employment) –29.8 (Fare)
– 0.001 (mile) –2.1 (Development)

FINDINGS

The above formula has an R^2 of 0.90, showing that parking, employment, fares, vehicle travel, and the occupancy rate of downtown buildings explains 90 percent of the variance in Chicago transit ridership over the 20-year period.

COMMENTS

It may not make sense that employment and occupancy would be included in the same formula. This opens up the chance that there could be double-counting. For example, if a company shuts down, you lose that number of employees, and the ratio of occupied office space falls.

There is no place to include information about how many offices are downtown; it only considers the percentage of offices that are filled. If there were one office building downtown and it was filled, the ratio would be 100 percent occupied, while there could be many more workers in the CBD but a lower development ratio if there are more buildings with unoccupied office space. It would make sense to have a figure such as employee per square foot of the CBD.

This study only takes into account rail ridership, and with most rail systems focusing on the downtowns, it may not be appropriate to consider the number of employees in the city of Chicago proper without looking at some measure of the percentage that work downtown.

Although this model only deals with Chicago, it may provide a good framework for ours, even though it would be a cross section of data nationwide rather than time-series data.

Gomez-Ibanez, Jose A. 1996. "Big-city transit ridership, deficits, and politics avoiding reality in Boston." ***Journal of the American Planning Association*** **62(1): 30-50.**

BRIEF SUMMARY

Gomez-Ibanez analyzes the changes in ridership and increased deficits for the Massachusetts Bay Transportation Authority (Boston) in the late 20th century. He completes a statistical analysis that is able to estimate the effects on ridership of fare and service policies, and of various income, demographic, and other forces outside of agencies' control.

METHODOLOGY

The author generates regression and predictive models using the following factors:

- Fares (real average fare paid per passenger)
- Vehicle miles per person (miles of each mode weighted by percentage of passenger-carrying capacity of the vehicles)
- Dummy variable for 1980-81, when service was cut back substantially
- Real per capita income for the Consolidated Metropolitan Statistical Area
- Jobs in the city of Boston.

Fare and service measures are lagged for one year to account for full ridership response to changing policies.

CONCLUSIONS

The regression model finds that the above factors accounted for 89 percent of the variation of MBTA ridership from 1970-90.

The predictive models predicts an 11.9 percent increase in ridership between 1970 and 1990 (using per capita income). The actual increase was 11.8 percent. A model using a simple

for income predicts a 9.9 percent increase.

The model shows that, at least in Boston, transit ridership is strongly affected by forces beyond the agency's control. For example, each percentage decrease in central city jobs reduces MBTA ridership by 1.24 to 1.75 percent, and each percentage increase in real per capita income reduces MBTA ridership by 0.7 percent. On the other hand, a 1 percent increase in service increases ridership by only 0.30 to 0.36 percent and 1 percent reduction in fares increases ridership by only 0.22 to 0.23 percent.

COMMENTS

There were some problems in the measurement of central city population, and the analysis excludes commuter rail figures.

This model—as seen by its very close prediction—could be a good one for us to look at. However, it is unclear if this model would work for cities other than Boston.

Kain, John F., and Zhi Liu. 1995. *Secrets of Success: How Houston and San Diego Transit Providers Achieved Large Increases in Transit Ridership*. Prepared for the Federal Transit Administration, U.S. Department of Transportation, May 25.

BRIEF SUMMARY

Kain and Liu provide a detailed analysis of the successes of San Diego and Houston transit systems in the midst of rapid decline in transit ridership elsewhere in the nation during the early 1990s. They find that much of the increased ridership derived from increased service and efficiencies. They develop ridership models to help explain the variance in transit ridership from year to year, looking at the most important factors.

METHODOLOGY & FINDINGS

They use 1968-92 data provided by the transit agencies.

The dependent variable is boardings (unlinked trips).

Models are developed for both agencies that took into account revenue miles, capacity, average fares, regional employment, car ownership, per capita income, and gasoline prices. For San Diego, the best fit is a model that looked at the following variables:

Ln (Revenue Miles)
Ln (Average Fares)
Ln (Regional Employment)
Ln (Car Ownership)
Ln (Gasoline Prices)

This results in an R^2 of 0.98.

For Houston, they try models for both linked and unlinked trips, but the results are very similar.

They look at the same variables as the San Diego model and come up with an R^2 of 0.99.

COMMENTS

The numbers given by the formulas differ tremendously between Houston and San Diego, although the important factors remain the same. Consequently, while this might provide us a framework to analyze ridership in other cities, one should keep in mind that there could be a tremendous variance between areas.

Kitamura, Ryuichi. 1989. "A causal analysis of car ownership and transit use." *Transportation* 16(2): 155-173.

BRIEF SUMMARY

This paper analyzes the causal relationships between car ownership, car use, and transit use.

METHODOLOGY

Causal analysis conducted on surveys and trip diaries given to nearly 4,000 people in The Netherlands.

FINDINGS

Through causal analysis, the study finds that a change in car ownership leads to a change in car use, which influences transit use. Conversely, it finds that a change in transit use necessarily leads to a change in car use or car ownership.

COMMENTS

First, this study does not provide much guidance to our paper, because it focuses solely on the impact of car ownership and car use on transit use. Second, the results may not be the same in our study because this was based in The Netherlands, which has much different land use and transportation patterns.

Liu, Zhi. 1993. *Determinants of Public Transit Ridership: Analysis of Post World War II Trends and Evaluation of Alternative Networks*. September. Cambridge, MA: Harvard University.

BRIEF SUMMARY

Focusing on Portland, Oregon, Liu constructs a variety of regression models that help explain the variances in transit ridership between 1960-1990, in 10-year increments.

METHODOLOGY

The study has four distinct types of analysis, two of which are important to our study:

- A number of transit demand models are estimated to assess the impacts of changes in per capita income, auto ownership, and suburbanization of residents and jobs on the changes in ridership.

- Spatially disaggregated data are used to quantify the impacts of changes in income, auto ownership, urban land use patterns, and transit service levels on transit's share of the journey to work.

The author focuses on Portland for a number of reasons:

- Its experience in terms of transit ridership is similar to other cities in the South and West.
- The trends in auto ownership and urban land use in the Portland area are similar to other U.S. urban areas.
- The city implemented alternative fixed-route service configurations in order to explore new market opportunities.

Using per capita transit trips as the dependent variable, Liu looks at years 1950-1990 with data from transit agencies preceding the current one.

He explains that few empirical models are capable of fully capturing the interrelationships among income, car ownership, and urban land use on per capita transit use. He tries to develop models that would take into account all these factors, but notes that further difficulties arise from the complicated interrelations among these factors and the absence of reliable empirical estimates of key explanatory variables.

He uses the following variables in both ordinary least squares and first-order correlation procedures.

LPCTR – Log of per capita transit

LAUTO – Log of per capita passenger car registrations

LSUBSIDY – Log of per capita transit subsidies

LINCOME – Log of per capita income

LCPOPS – Log of percentage central city population

LCITYPOP – Log of population of city

LGASP – Log of U.S. price of gas

DWW2 – Dummy number (1 for WWII years, 0 for others)

TREND – A time-trend variable for 1929-90

LTRIP – Annual transit-linked trips (dependent variable)

LVEHMILE – Annual total transit miles

LAVGFARE – Average passenger fare in constant 1990 dollars

LEMPL –The natural logarithm of total employment in Portland SMSA

In Section V he does not have fare and service-supplied information for the early years, so he does the models again for 1949-1990 using fare and service-supplied figures, making these calculations much more relevant to our study.

The models in this section always use the following:

LVEHMILE, LAVGFARE, LEMPL, LGASP

and include one of the following variables:

LINCOME, LAUTO, LCPOPS, TREND

FINDINGS

Some models find that income, auto, and central city populations all have the expected effect on ridership, and all else being equal, Portland would have lost 4 percent of riders per year due to the changes in these factors.

The author has four models explaining the effect of auto ownership on transit usage. The models conclude that:

- Per capita transit use is positively correlated with the population concentration
- Portland’s transit ridership would have decreased 3 percent each year, only taking into account the factors that decrease ridership.
- There is reason to believe that gasoline prices have a strong impact on transit use.

In Chapter 4, he looks at the effects of a new program in Portland and develops a formula that fit Portland's time-series data from 1971-1990. This formula was based on calculations done in Chapter 2.

ýy(Linked Trips) = - 0.008 + 0.606ýy(Revenue Hours of Service)
- 0.285ýy(Average Fares) +0.861ýy(Regional Employment)
+ 0.274ýy(Real Gasoline Prices)

(NOTE: These are all annual percentage changes)

He admits that having auto ownership as a dependent variable in a transit ridership regression can create a simultaneous bias, and he does two simultaneous-equation models and finds that the effect of transit use on auto ownership is much less than the effect of auto ownership on transit use.

RELEVANCE TO OUR STUDY

This chapter provides some interesting models for us to follow. However, he looks at a much longer time-frame than we will in our study. Thus, his model may not be very applicable to our study. For instance, our central city number probably will not change nearly as much in 5 years as if we had done a 30-year study.

Without a doubt, Liu's ridership models are among the most extensive and data-driven that we have come across in the literature review.

His models provide a good example for us, but he bases them only on Portland, while we are dealing with a variety of agencies. The factors that he considers are very good—and unlike most other studies, wide-ranging—and he is able to show the effect that each factor had on ridership.

The most important part for us to look at is Chapter 2, where he develops many regression and simultaneous-equation models. Also important is part of Chapter 4, where he develops a formula (see above) from his analyses in Chapter 2.

McLeod, Malcolm S., Jr., Kevin Flannelly, Laura Flannelly, and Robert W. Behnke. 1991. "Multivariate Time-Series Model of Transit Ridership Based on Historical, Aggregate Data: The Past, Present, and Future of Honolulu." Washington, D.C.: Transportation Research Board. *Transportation Research Record* 1297: 76-84.

BRIEF SUMMARY

The author develops two separate regression models, one for revenue trips and one for linked trips, to determine the main causes of transit ridership variances in Honolulu between 1956 and 1984.

METHODOLOGY

The regression model consists of the following five variables:

Ln of civilian jobs (JOBS)

Ln of per capita income in 1982$ (INCOME)

Ln of fare in 1982$ (FARE)

Ln of number of buses (BUSES)

Dummy variable for strikes

A "linked-trips" model is developed to compensate for free passes (for the elderly and such) that would not be compensated for in the "revenue-trips" model. Linked trips are derived from a formula that the Honolulu Rapid Transit Development Project had developed with a 1986 survey.

FINDINGS

The following formula is developed:

Revenue Trips = -118.9 + 52.2 (JOBS) -60.9 (INCOME)
- 27.8 (FARE) +7.9 (BUSES) - 4.4 (STRIKES)

For the 29 years, the model had an R^2 of 0.97.

They find that the addition of factors such as tourists, registered passenger vehicles, and gasoline prices do not improve the model.

They find that the five factors above determine most of the variance; consequently, the following formula was is developed:

Linked Trips = -118.3 + 38.2 (JOBS) - 44.1 (INCOME) - 36.0 (FARE) + 10.6 (BUSES) - 4.1 (STRIKES)

$R^2 = 0.98$.

They compare the formula results to the actual ridership figures and find a fairly good match, about a 5 percent error in both cases. Both cases overestimate current ridership.

COMMENTS

The model seems to do a good job at predicting ridership, even though it neglected to have a variable measuring land use and its service-supplied variable was questionable (number of buses).

A possible fault with the model is that it is not based on the elasticities encountered in Honolulu but rather those from around the country. It would make sense to find the elasticities of each area before applying a formula, but this was not done in Honolulu.

Since this is a predictive model and a model for one area, it does not seem to apply much to our study. However, it gives a good indicator of what factors are important and provides a good example of a possible model.

Spillar, Robert J., and G. Scott Rutherford. 1998. "The Effects of Population Density and Income on Per Capita Transit Ridership in Western American Cities." ***Institute of Transportation Engineers' Compendium of Technical Papers*****: 60th Annual Meeting. August 5-8, 1998. Pp. 327-331.**

BRIEF SUMMARY

This study examines the relationship between urban residential densities and transit patronage in the western U.S. cities of Seattle, Portland, Salt Lake City, Denver, and San Diego.

It also looks at the effects of income on transit ridership.

METHODOLOGY

The study uses 1980 Census data for the five cities listed above. The following data are used: total population counts within a given geographic area, average annual income levels in that area, and the average area in acres of each zone.

Using only home-to-work data, both per capita transit and per capita zonal transit ridership are regressed against population density

FINDINGS

They find that transit use per person grows with increasing density up to a ceiling at somewhere between 20 and 30 people per acre (0.1 to 0.2 transit trips per person per day).

In terms of income, in higher income neighborhoods (those with less than 18 percent low-income families) density has less of an effect on transit use than in low-income areas, but this could be due to the relatively small number of samples available.

COMMENTS

It is fairly obvious that density has a large effect on transit ridership, but the effect that income and density combined have is less clear.

This paper focuses on the subsystem (neighborhood) level, which would be extremely difficult to do with our database. If we narrow our analysis to a few similar cities (for instance, Western U.S. cities) then his study would be more relevant to ours.

Syed, Sharfuddin. 2000. "Factor Analysis for the Study of Determinants of Public Transit Ridership." ***Journal of Public Transportation*** **3(3), 1-17.**

BRIEF SUMMARY

The author uses a factor analysis approach to determine the key factors in increasing transit ridership. From 47 observable variables contained in the Ottawa-Carleton Transportation Commission (OC Transpo) survey, he finds eight factors that are key in determining transit ridership, with bus information being the number one factor.

METHODOLOGY

He does a detailed factor analysis of 47 variables found in a survey that was given to 2,000 people randomly. He then constructs a logistic regression model to develop and obtain the odds of ridership.

FINDINGS

There are eight underlying factors in determining to ride transit.

Based on the factor analysis of the survey, Syed finds that the following factors are the most important in determining ridership:

1. Bus information is the most important factor (22.1 percent of variance explained)
2. On-street service (10.9 percent)
3. Customer service (5.6 percent)
4. Cleanliness (4.3 percent)
5. General attitude (3.5 percent)
6. Transitway station safety (3.2 percent)
7. Personal security (3.1 percent)

8. Reduced fare (2.6 percent)

   TOTAL = 55.2 percent

   Other factors = 44.8 percent

The logistic regression shows a different order:

1. Bus information
2. On-street service
3. Station safety
4. Customer service
5. Safety en route
6. Reduced fare
7. Cleanliness
8. General attitude.

COMMENTS

The article does not describe all of the 47 factors that were originally considered, so it is difficult to tell where these categories may lie in the whole scheme of things. Additionally, this is based on surveys, not on observation, so it is possible—if not probable—that the results would be altered in the real world.

Also, "on-street service" is lumped into one category, which includes such aspects as on-time performance, expanse of system, or frequency of system. It seems that these should be separated and analyzed individually.

Transit Cooperative Research Program. 1998. *Strategies to Attract Auto Users to Public Transportation*. Number 40.

BRIEF SUMMARY

The report focuses on using parking strategies to increase use of public transit.

METHODOLOGY

Combination of qualitative and case study analyses with modeling exercises.

FINDINGS

The study finds that transit share is influenced more by the probability that people pay to park than by either transit frequency or transit accessibility. It also states that transit frequency has more effect than transit accessibility and that the pay-to-park probability and transit frequency combined have the greatest effect on transit share.

It finds that transit share increases nearly 300 percent, from 6.5 to 24.5 percent, when transit frequency doubles from 1.0 transit revenue hour per capita to 2.0, and when pay-to-park probability doubles from 0.05 to 0.10. Increasing access to a transit stop from 30 percent to 60 percent of the population only increases transit use from 8.6 to 9.3 percent, while an increase from 10 to 15 percent of the population that expects to pay to park at work increases transit share from 21 to 34 percent.

The study notes that the San Francisco County Transportation Authority conducted a travel study in 1995 and found that when parking costs exceeded transit fares by 20 to 30 percent, commuters tended to take transit rather than drive alone, and that 47 percent of the employees who drove alone report that they either park free or are provided employer-paid parking.

COMMENTS

The various studies only look at parking and the different parking strategies that can be used to prompt transit ridership. There are many other determining factors of transit use that are not examined.

Transit Cooperative Research Program. 1996. *Transit and Urban Form*. Washington, D.C.: National Academy Press. TCRP Report 16(1): 1-25.

SUMMARY

Using a variety of studies, this report looked at the relationship between urban form and transit ridership.

METHODOLOGY

Compilation of several studies that used a variety of analytical techniques and processes.

FINDINGS

Residential densities have a significant influence on rail transit ridership (boardings). Both the size and density of the CBD influence light rail ridership, although not as much as they influence commuter rail ridership.

The types and mix of land uses influences the demand for transit as well as the use of nonmotorized modes. It is difficult to sort out the effects of land use mix and urban design, because they are strongly correlated with density.

A study by TCRP found that, for a 25-mile light rail line surrounded by low-density residences, increasing downtown employment from 50,000 to 300,000 for a 3-square mile CBD could increase ridership along that corridor from 18,000 to 85,000 daily boardings.

In an analysis of transit demand in Portland, Oregon, Nelson and Nygaard (1995) note that "of 40 land use and demographic variables studied, the most significant for determining transit demand are the overall housing density per acre and the overall employment density per acre. These two variables alone predict 93 percent of the variance in transit demand among different parts of the region."

An analysis of travel behavior in 11 metropolitan areas surveyed in the 1985 Housing Survey suggests that both land use mix and residential densities contribute to transit mode choice decisions. It determines that the probability of choosing transit is better explained by the overall levels of density rather than by measures of land use. They find that the measures of land use have only 10 percent as much influence on transit choice as density.

The Chicago Transit Authority developed a model to explain station boardings as a function of the presence or absence of specific land uses within 1/2-mile of the station, as well as the numbers and types of jobs, the number of households, and measures of income and transit service.

TCRP reports that the most satisfying results came from the inclusion of measures of both residential and employment densities and land use mix.

COMMENTS

This report provides much general information about the relationship between land use and transit use; however, it does not look at other factors, such as incomes, but only at densities and land uses.

They do not find a way to isolate densities and land uses, and admit that these are particularly difficult categories to look at independently.

Also, the report only looks at rail and transit, but not at buses.

Hendrickson, Chris. 1986. "A Note on the Trends in Transit Commuting in the U.S. Relating to Employment in the CBD." ***Transportation Research, Part A*****: General 20A(1): 33-37.**

BRIEF SUMMARY

Studying the linkage between transit use and downtown employment, Hendrickson finds that use of transit for commuting to work is highly correlated to the percentage of the metropolitan area work force that works in the central business district.

METHODOLOGY

Using Ordinary Least-Squares regression, he looks solely at work trips on transit and only studies the ridership figures for 25 metropolitan areas, which make up 60 percent of all nationwide transit ridership. He reports that the percentage of employees who work in the CBD dropped from 8.5 percent in 1970 to 7.8 percent in 1980, while the percentage of work trips taken on public transit dropped from 19.5 percent in 1960 to 10.5 percent in 1980 (in 1970 the figure was 12.2 percent).

Census data are used for 25 large metropolitan U.S. areas (not necessarily the largest).

The factors used are:

- Percentage of work force in CBD
- Absolute number of workers in CBD

- Absolute number of work transit trips
- Percentage of work trips taken on transit.

FINDINGS

He finds that the model explains 96 percent of the variation of public transit use, signaling a strong relationship between transit use and CBD employment.

He finds that in 1980, 90 percent of the variation is explained given the percentage of jobs based in the CBD.

Both of these numbers are much higher than the correlations between transit use and overall metropolitan employment, indicating that transit use and downtown employment are much more correlated than overall metropolitan employment.

He writes, “In effect, the regression suggests that public transportation commuting increased whenever CBD employment increased and vice versa.” However, he notes that it is not necessarily CBD employment that is prompting transit usage. The supply of transit to the CBD might actually be bolstering downtown employment.

COMMENTS

Hendrickson’s piece is interesting, in that it shows the importance of downtown employment to transit use. However, the data that he uses do not conform to the analysis that our studying is undertaking. We are looking at overall increases in unlinked trips, rather than the percentage of trips taken in the metropolitan area.

Only work trips are analyzed; thus, about 40 percent of transit trips are disregarded.

In addition, the CBD is not a well-defined area. Hendrickson writes:

> Of course, the definition of the CBD area in each city is a matter of judgment. In 1970, CBD areas were designated by the Bureau of the Census as a set of contiguous census tracts that represented a high density of retail sales activity. In 1980, CBD areas were designated in

collaboration by local committees and the Bureau of the Census as areas of very high land valuation.

The areas' growth rates, any economic details, and land use patterns of the city (other than the size of the downtown work force) were not considered.

There is no discussion of the kinds of transit options available. Rather, it is simply a correlation exercise between transit ridership and the size (both absolute and relative) of the CBD.

Kain, John F., and Zhi Liu. "Econometric Analysis of Determinants of Transit Ridership: 1960-1990." Prepared for Volpe National Transport Systems Center, U.S. Department of Transportation, May 25, 1996.

BRIEF SUMMARY

This study examines the changes in ridership levels of 184 systems over a 30-year period (1960-1990). This study is the most similar to ours.

METHODOLOGY & FINDINGS

The study is essentially two different econometric analyses:

- 19 multiple regressions that detail changes in annual boardings from 1960-70, 1970-80, and 1980-90.
- 36 multiple regressions that detail variations in the level of ridership for 1960, 1970, 1980, and 1990.

Control Variables Used

They use only a few variables, such as population, employment, density, area, and fraction of carless households in area (Census data).

They assign a dummy variable for public/private.

They admit that these variables are "crude proxies for a much larger number of factors that determine ridership."

They have trouble with these figures because there is no reliable source for the service area of each agency. They use the central city and metropolitan area figures to represent the service area. Where agencies covered a much smaller area than the entire metropolitan region, they use the service area statistics from the FTA.

Initial analyses are for 1980 and 1990.

Change Models

The change equations are based on the following formula:

$$\text{Ln } B_2 - \text{Ln } B_1 = b_0 + b_1 (\text{Ln } F_2 - \text{Ln } F_1) + b_2 (\text{Ln } M_2 - \text{Ln } M_1) + b_j (R_{j2} - R_{j1}) + \Sigma_j b_j D_j + \Sigma b_k (\text{Ln } X_{k2} - \text{Ln } X_{k1})$$

where B = Transit ridership (boardings)

F = Real fare levels

M = Revenue miles of service

R = Rail share of revenue miles

D_j = Dummy variable indicating public/private

X_k = Vector of exogenous or control variables

Six different scenarios are tested.

- All of them include annual revenue miles, average fares, rail share of annual revenue miles, revenue miles (initial).
- They have some combination of the control factors (changes in metro employment, city population, city employment, city land area, city population density, and households without cars).

The analysis is repeated for 1960-70 and 1970-80.

Cross Section Analyses

The cross section ridership models equations are based on the following formula:

$$\text{Ln } B = b_0 + b_1 (\text{Ln } F) + b_2 (\text{Ln } M) + \Sigma_i b_i \ln S_i + b_e D + \Sigma_j b_j \text{ Ln } X_j$$

where B = Transit Ridership (boardings)

F = Transit fares

M = Service levels

S_j = Other measures of service levels

D = Dummy variable indicating public/private

X_k = Vector of exogenous or control variables.

The cross section analyses yield even higher R^2 results than the change formulas.

Analyses for 1960 and 1970 follow, with the same factors being considered. However, they separate small and large agencies in the 1960 and 1970 studies. This might be something for us to consider.

COMMENTS

This paper provides a great model for our analysis.

Perhaps we should consider other land use factors, such as percentage of jobs in the central city.

One interesting aspect was that they used the percentage of service that is on rail as part of their analyses. The higher the percentage of trips and service on rail, in many cases, the higher the ridership will be. There are traditionally high transfer rates to rail, and when using unlinked trips, these transfers look like additional boardings. So, if there is a large increase in rail revenue service or rail boardings, that should be taken into account when looking at the growth in overall ridership.

Kohn, Harold M. 2000. "Factors Affecting Urban Transit Ridership." Canadian Transportation Research Forum Conference: Bridging the Gaps. Charlottetown, Prince Edward Island, Canada, June 6.

BRIEF SUMMARY

In a study of Canadian cities, Kohn tries various combinations of independent variables and concludes that average fares and revenue vehicle hours are the main variables that should be used to predict ridership.

METHODOLOGY

Data from approximately 85 Canadian urban transit companies were gathered for 1992 to 1998. These companies carry about 97 percent of all transit riders in Canada. Although these are foreign figures, there are no policy variables and Canada's infrastructure is similar to that of the United States. Thus, Kohn claims the data should be legitimate.

Data elements included:

- Passenger boardings (dependent variable)
- Passenger demographics, hours of service, fare structure, vehicle statistics, energy consumption, employment, passenger statistics, revenues, and expenditures.

Kohn uses the following process:

1. Regress the number of passengers (dependent) on average fares (independent).
2. Add population of service area as an independent variable.
3. Add other independent variables, mostly in the form of dummy variables.
4. Despite getting high R^2 values, the residual analyses do not provide good results on a case-by-case basis. Ridership rates are then introduced through another dummy variable.
5. Add service statistics and a series of population variables.
6. Create a model of four independent variables: revenue vehicle hours, average fare, dummy for cities with population over one million, and dummy for cities with population of less than 100,000.

7. Drop the two population dummy variables to leave only average fare and service-supplied numbers.

FINDINGS

The following table is derived from his analysis. He finds that the combination of average fare and revenue vehicle hours has an R^2 value of 0.97, making these the two most important factors in predicting ridership.

Table A-6: Statistical Results of Research Model

Independent Variable	Coefficient	Standard Errors	t-Statistic
Intercept	5,099,953	2,232,952	2.28
Average Fare	-7,976,442	2,024,021	-3.94
Revenue Vehicle Hours	49.58	0.41	119.85
R^2 = 0.97; F Ratio = 7190 (99% significant)			

COMMENTS

Although the author is dealing with Canadian cities, this report is similar to the one that we want to do. It was a cross-sectional analysis of a large number of transit agencies.

Revenue vehicle hours are not compared to any other category, such as population or density. A very dense city would be likely to have many more transit riders than a spread-out city with the same amount of service. A similar situation would occur with a large versus small city.

This model could be oversimplified, as it could have been more effective had he stayed with some of the other variables. Our own cross-sectional analysis finds that revenue vehicle hours and unlinked trips have a very high R^2 on their own. As a result, it is unclear how much this model reveals about the factors increasing ridership.

Morral, John, and Dan Bolger. 1996. "The Relationship Between Downtown Parking Supply and Transit Use." ***ITE Journal*** **66(2): 32-36.**

BRIEF SUMMARY

Looking only at central business districts, this study finds that the number of CBD parking stalls per downtown employee has a significant influence on the percentage of CBD workers that commute to work on transit.

METHODOLOGY

This study uses regression analyses. The main data used are the number of parking spaces per CBD employee and the percentage of CBD work trips made on transit.

Eight Canadian cities and 14 U.S. cities are studied, although it was unclear how they determined which cities to analyze (for instance, in the United States, they looked at Los Angeles, San Diego, Madison, and Pittsburgh, but did not consider New York, Chicago, or San Francisco). It appears as though the largest Canadian cities were the ones studied.

The U.S. data are from the *Urban Transportation Monitor.* The sources for the Canadian data are unclear, but it appears they came from the individual cities .

FINDINGS

Regression analyses show that the relationship between the number of CBD parking stalls per downtown employee and the percentage of downtown employees who commute on transit for Canadian cities has an R^2 of 0.92, while the Canadian and U.S. cities combined result in an R^2 of 0.59.

The following equations are developed:

Canadian Cities: % transit modal split = $109.7e^{(-2.49x)}$

Canadian and U.S. Cities: % transit modal split = $3.6 - 32.97\ln^{(x)}$

where x = downtown parking stalls per CBD employee

COMMENTS

The study only looks at downtown commuter patterns, and unlike Hendrickson's piece, does not consider downtown employment or transit use in the context of the metropolitan area at large. Although this study could help us determine how much of any given city's transit use is attributable to downtown employment, our objectives preclude us from gaining much more insight from this work.

It is not obvious how they determined which U.S. cities to study. Transit hot spots as New York, Chicago, and San Francisco are not examined, while Madison, Indianapolis, Minneapolis, and San Diego are used in the study.

Finally, it does not look at any other statistics, such as transit service supplied or amount of road supply. For instance, if there is not a lot of parking but no transit, what will people do? This study does not help answer that question.

Abdel-Aty, Mohamed A., and Paul P. Jovanis. 1995. "The Effect of ITS on Transit Ridership." ***ITS Quarterly,*** **Fall, 21-25.**

BRIEF SUMMARY

Surveys in Northern California indicate that a large number of people would be more willing to take transit if more information were available, possibly indicating a possible main factor in changes in ridership levels.

METHODOLOGY

Telephone surveys of 1,000 residents in Sacramento and Santa Clara Counties (500 in each county).

FINDINGS

Of the 1,000 commuters surveyed, 38 percent said they might consider transit if more information were available.

COMMENTS

Since this study is based on surveys, it does not have much to do with our analysis of transit ridership increases. However, it suggests some possible factors that we might want to consider in our analysis, such as a measure of the amount of information available.

Taylor, Brian D., and William S. McCullough. 1998. "Lost Riders." ***Access*** **13: 26-31.**

BRIEF SUMMARY

Taylor and McCullough conduct a descriptive analysis of transit ridership declines in the early 1990s.

METHODOLOGY

The study is essentially a descriptive analysis of broad trends both throughout the nation and agency-specific that became evident from 1989 to 1993.

FINDINGS

Between 1989 and 1993, the United States lost 667 million riders out of a total of 9.08 billion. Eighty percent of these losses were from the country's 10 largest transit agencies (New York City alone lost 394 million).

Ridership in the top 10 systems is declining at a staggering rate, much faster than other, smaller agencies in the same areas as the top 10 agencies.

By 1990, only 2 percent of all trips and only 1 percent of all suburban trips were on transit.

Alan Pisarski reports that the largest declines on transit were in traditionally strong markets—women and low-income riders.

There is an overall shift to smaller operators, which increased cost efficiency and permitted more hours of service. The average cost per hour for the ten largest agencies was $96.59/hour, while others were $55.11/hour.

The study mentions that many different factors were at work here, including:

- An eroding market for transit with ongoing suburbanization and increased auto use

- The proliferation of new suburban transit agencies that compete for subsidy dollars
- A great increase in costs.

COMMENTS

The study provides a good model for a descriptive analysis of the recent trends in transit ridership that we are trying to analyze.

APPENDIX B: DATA TABLES

Table B-1: Calculation of Real Average Fare

	Average Fare	CPI (City Average)	CPI (2001=100)	Real Average Fare
1991	$0.72	136.3	76.83	$0.94
1992	$0.74	140.6	79.26	$0.93
1993	$0.82	144.6	81.51	$1.01
1994	$0.84	148.5	83.71	$1.00
1995	$0.86	152.7	86.08	$1.00
1996	$0.92	157.1	88.56	$1.04
1997	$0.90	160.5	90.47	$0.99
1998	$0.90	163.2	92.00	$0.97
1999	$0.87	166.7	93.97	$0.93
2000		172.7	97.35	
2001		177.4	100.0	

Average Fare data from FTA National Transit Database
CPI Data from Bureau of Labor Statistics

Table B-2: Revenue Vehicle Miles

	Unlinked Trips (millions)	RVM (millions)	Trips/Person	RVM/Person
1991	7,738.1	2,499.3	30.7	9.9
1992	7,696.2	2,537.5	30.2	9.9
1993	7,432.7	2,593.2	28.8	10.1
1994	7,701.6	2,679.5	29.6	10.3
1995	7,503,7	2,732.4	28.6	10.4
1996	7,564.6	2,750.6	28.5	10.4
1997	7,954.2	2,853.3	29.7	10.7

Table B-2: Revenue Vehicle Miles (Cont.)

	Unlinked Trips (millions)	RVM (millions)	Trips/Person	RVM/Person
1998	8,115.1	2,970.4	30.0	11.0
1999	8,523.3	3,111.4	31.3	11.4
	Correlation 0.81		Correlation 0.37	
Unlinked Trip data from FTA National Transit Database Population data from Bureau of Economic Analyses				

Table B-3: Unemployment Rate

	Population (thousands)	Unlinked Trips (millions)	Trips/Person	Unemployment Rate
1991	252,153	7,738.1	30.7	6.8
1992	255,030	7,696.2	30.2	7.7
1993	257,783	7,432.7	28.8	6.9
1994	260,327	7,701.6	29.6	6.1
1995	262,803	7,503.7	28.6	5.7
1996	265,229	7,564.6	28.5	5.5
1997	267,784	7,954.2	29.7	4.9
1998	270,248	8,115.1	30.0	4.5
1999	272,691	8,523.3	31.3	4.3
Correlation with Unemployment Rate		-0.70	-0.16	
Unlinked Trip data from FTA National Transit Database Unemployment Rate data from Bureau of Labor Statistics				

Table B-4: Gross Domestic Product

	Unlinked Trips (millions)	Trips/ Person	CPI (U.S. City Average)	CPI (2001= 100)	GDP (billions)	Real GDP ($2001)	Real GDP/ Person ($2001)
1991	7,738	30.7	136.3	76.8	$5986.2	$7,791.28	$30,899.03
1992	7,696	30.2	140.6	79.3	$6318.9	$7,972.78	$31,262.13
1993	7,433	28.8	144.6	81.5	$6,642.3	$8,148.99	$31,611.82
1994	7,702	29.6	148.5	83.7	$7,054.3	$8,427.16	$32,371.43
1995	7,504	28.6	152.7	86.1	$7,400.5	$8,597.57	$32,714.88
1996	7,565	28.5	157.1	88.6	$7,813.2	$8,822.80	$33,264.83
1997	7,954	29.7	160.5	90.5	$8,318.4	$9,194.29	$34,334.74
1998	8,115	30.0	163.2	92.0	$8,781.5	$9,545.58	$35,321.54
1999	8,523	31.3	166.7	94.0	$9,268.6	$9,863.53	$36,171.07
2000			172.7				
2001			177.4				
	0.79	0.24	CORRELATION OF REAL GDP				
	0.82	0.29	CORRELATION OF REAL GDP PER PERSON				

Unlinked Trip data from FTA National Transit Database
GDP data from Bureau of Labor Statistics
CPI from Bureau of Labor Statistics

Table B-5: Average Hourly Wage

	Unlinked Trips (millions)	Trips/ Person	CPI (U.S. City Average)	CPI (2001= 100)	Average Hourly Earning	Average Real Hourly Earning
1991	7,738	30.7	136.3	76.8	$10.35	$13.47
1992	7,696	30.2	140.6	79.3	$10.59	$13.36
1993	7,433	28.8	144.6	81.5	$10.84	$13.30
1994	7,702	29.6	148.5	83.7	$11.12	$13.28
1995	7,504	28.6	152.7	86.1	$11.45	$13.30
1996	7,565	28.5	157.1	88.6	$11.83	$13.36
1997	7,954	29.7	160.5	90.5	$12.26	$13.55
1998	8,115	30.0	163.2	92.0	$12.79	$13.90

Table B-5: Average Hourly Wage

	Unlinked Trips (millions)	Trips/ Person	CPI (U.S. City Average)	CPI (2001= 100)	Average Hourly Earning	Average Real Hourly Earning
1999	8,523	31.3	166.7	94.0	$13.28	$14.13
2000			172.7			
2001			174.4			
	0.96	0.70	Correlation with Average Real Hourly Wage			

Unlinked Trip data from FTA National Transit Database
Average Wage data from Bureau of Labor Statistics
CPI data from Bureau of Labor Statistics

Table B-6: Changes in Ridership Based on Changes in Unemployment for Agencies with Increased Ridership

Unemployment Rate Change	# of Agencies	Unlinked Trips (millions) 1995	1999	% Change
Increased (total)	9	83,643	106,662	27.5
Decreased (total)	210	4,801,365	5,164,678	7.6
Decreased less than 10%	12	75,746	80,945	6.9
Decreased 10-20% (minus NYC Transit)	50	1,279,842	1,423,749	11.2
Decreased 20-30%	59	1,129,440	1,128,521	-0.1
Decreased 30-40%	57	748,016	814,694	8.9
Decreased 40-50%	18	1,123,977	1,236,382	10.0
Decreased more than 50%	14	444,344	480,388	8.1

Transit date from National Transit Database
Unemployment Rate data from Bureau of Labor Statistics

Table B-7: Correlation Coefficients of Various 1999 Factors from Review of Agencies That Increased Ridership from 1995-1999

CORRELATIONS

		UT99	LH99	DENS99	FARE99	RVH99	FOS99	UNEM99	GAS99
UT99	Pearson Corr.	1.000	0.264**	0.186**	-0.021	0.953**	0.239**	-0.014	-0.070
	Sig. (2-tailed)		0.000	0.005	0.752	0.000	0.001	0.831	0.478
	N	226	226	226	226	226	187	219	105
LH99	Pearson Corr.	0.264**	1.000	0.317**	0.248**	0.197**	0.557**	-0.027	-0.003
	Sig. (2-tailed)	0.000		0.000	0.000	0.003	0.000	0.694	0.977
	N	226	226	226	226	226	187	219	105
DENS99	Pearson Corr.	0.186**	0.317**	1.000	0.046	0.141*	0.279**	0.110	0.160
	Sig. (2-tailed)	0.005	0.000		0.491	0.035	0.000	0.104	0.103
	N	226	226	226	226	226	187	219	105
FARE99	Pearson Corr.	-0.021	0.248**	0.046	1.000	-0.026	0.039	0.075	-0.140
	Sig. (2-tailed)	0.752	0.000	0.491		0.696	0.594	0.268	0.153
	N	226	226	226	226	226	187	219	105
RHV99	Pearson Corr.	0.953**	0.197**	0.141*	-0.026	1.000	0.190**	-0.007	-0.101
	Sig. (2-tailed)	0.000	0.003	0.035	0.696		0.009	0.919	0.303
	N	226	226	226	226	226	187	219	105
FOS99	Pearson Corr.	0.239**	0.557*	0.279**	0.039	0.190**	1.000	0.061	0.003
	Sig. (2-tailed)	0.001	0.000	0.000	0.594	0.009		0.414	0.980
	N	187	187	187	187	187	187	184	85
UNEM99	Pearson Corr.	-0.014	-0.027	0.110	0.075	-0.007	0.061	1.000	0.148
	Sig. (2-tailed)	0.831	0.694	0.104	0.268	0.919	0.414		0.131
	N	219	219	219	219	219	184	219	105
GAS99	Pearson Corr.	-0.070	-0.003	0.160	-0.140	-0.101	0.003	0.148	1.000
	Sig. (2-tailed)	0.478	0.977	0.103	0.153	0.303	0.980	0.131	
	N	105	105	105	105	105	85	105	105

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

UT99 Unlinked trips, 1999
LH99 Line-haul miles, 1999
DENS99 Density, 1999 (service area population/service area size in square miles)
FARE99 Average fare ($1999), 1999 (total fare revenues/unlinked trips)
RHV99 Revenue vehicle hours, 1999
FOS99 Frequency of service, 1999 (vehicle revenue miles/route miles)
UNEM99 Unemployment rate, 1999
GAS99 Price of gas (per unleaded gallon), 1999

Table B-8: Correlation Coefficients of Various Change Factors from Review of Agencies that Increased Ridership from 1995-1999

		CORRELATIONS						
		UT change	LH99	DENS change	FARE change	RVH change	FOS change	AGE change
UTchange	Pearson Corr.	1.000	-0.024	-0.011	0.079	0.059	0.002	-0.115
	Sig. (2-tailed)		0.716	0.874	0.296	0.377	0.981	0.116
	N	226	226	226	179	226	185	188
LH99	Pearson Corr.	-0.024	1.000	-0.051	0.255**	-0.046	-0.035	0.078
	Sig. (2-tailed)	0.716		0.447	0.001	0.487	0.632	0.285
	N	226	226	226	179	226	185	188
DENSchange	Pearson Corr.	-0.011	-0.051	1.000	-0.020	-0.030	-0.002	0.063
	Sig. (2-tailed)	0.874	0.447		0.786	0.656	0.976	0.389
	N	226	226	226	179	226	185	188
FAREchange	Pearson Corr.	-0.079	0.255**	-0.020	1.000	-0.034	0.031	0.017
	Sig. (2-tailed)	0.296	0.001	0.786		0.648	0.687	0.825
	N	179	179	179	179	179	176	179
RVHchange	Pearson Corr.	0.059	-0.046	-0.030	-0.034	1.000	0.061	-0.076
	Sig. (2-tailed)	0.377	0.487	0.656	0.648		0.406	0.298
	N	226	226	226	179	226	185	188
FOSchange	Pearson Corr.	0.002	-0.035	-0.002	0.031	0.061	1.000	-0.014
	Sig. (2-tailed)	0.981	0.632	0.976	0.687	0.406		0.852
	N	185	185	185	176	185	185	185
AGEchange	Pearson Corr.	-0.115	0.078	0.063	0.017	-0.076	-0.014	1.000
	Sig. (2-tailed)	0.116	0.285	0.389	0.825	0.298	0.852	
	N	188	188	188	179	188	185	188

** Correlation is significant at the 0.01 level (2-tailed)

UTchange	Change in unlinked trips, 1995 to 1999
LH99	Line-haul miles, 1999
DENSchange	Change in density, 1995 to 1999 (service area population/service area size in square miles)
FAREchange	Change in average fare ($1999), 1995 to 1999
RVHchange	Change in revenue vehicle hours, 1995 to 1999
FOSchange	Change in frequency of service (vehicle revenue miles/route miles), 1995 to1995
AGEchange	Change in average age (in years) of vehicle, 1995 to 1999

APPENDIX C: AGENCIES THAT INCREASED FIXED-ROUTE RIDERSHIP BETWEEN 1995 AND 1999

Table C-1: Agencies Ordered by State, then Agency

State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
AK	Municipality of Anchorage	Medium	West	3,020	3,316	9.8%	158	
AL	Huntsville DOT	Very Small	South	264	264	0.1%	227	
AL	Mobile Transit Authority	Small	South	1,028	1,172	14.0%	137	
AL	Tuscaloosa County Parking and Transit Authority	Very Small	South	91	215	136.3%	4	1
AR	Central Arkansas Transit Authority	Medium	South	2,522	3,546	40.6%	49	2
AZ	City of Mesa	Very Small	West	679	745	9.8%	159	
AZ	Regional Public Transportation Authority (Phoenix)	Medium	West	1,937	3,069	58.5%	26	1
CA	Alameda Ferry Services	Very Small	West	408	589	44.2%	38	2
CA	Antelope Valley Transit	Medium	West	1,447	2,155	48.9%	33	1
CA	BART - San Francisco	Very Large	West	78,674	86,299	9.7%	162	2
CA	Central Contra Costa Transportation Authority	Medium	West	3,988	4,795	20.2%	103	
CA	Chico Area Transit System	Very Small	West	624	847	35.7%	55	
CA	City of Commerce Municipal Bus	Small	West	986	1,012	2.7%	204	
CA	City of Gardena	Large	West	4,492	5,898	31.3%	64	
CA	City of Los Angeles DOT	Large	West	4,603	6,533	41.9%	44	
CA	City of Santa Rosa	Small	West	1,675	1,919	14.6%	129	2
CA	Contra Costa Transportation District	Very Large	West	61,943	65,897	6.4%	182	2
CA	Culver City Municipal Bus	Large	West	4,009	5,104	27.3%	77	
CA	DAVE Transp Services-OCTA	Small	West	120	1,036	760.4%	2	
CA	Fairfield/Suisun Transit	Very Small	West	715	898	25.7%	80	
CA	Fresno Area Express	Large	West	8,553	11,022	28.9%	71	1
CA	Golden Gate Bridge - Hwy&TD	Large	West	10,254	11,173	9.0%	165	2
CA	Laguna Beach Muni Transit	Very Small	West	160	188	17.6%	116	2
CA	Livermore/Amador Valley	Small	West	860	1,594	85.5%	13	2
CA	Long Beach Transit	Very Large	West	21,039	27,119	28.9%	70	C
CA	Los Angeles County MTA	Very Large	West	362,260	398,630	10.0%	157	2
CA	Montebello Bus Lines	Large	West	5,740	6,878	19.8%	106	1
CA	Monterey-MST	Medium	West	3,802	3,967	4.3%	195	
CA	Municipal Railway - San Francisco (*)	Very Large	West	214,048	216,412	1.1%	216	2
CA	North San Diego County Transit	Large	West	10,781	11,128	3.2%	202	
CA	Norwalk Transit System	Small	West	1,036	1,357	31.0%	65	
CA	OMNITRANS	Large	West	8,234	14,630	77.7%	17	C, 1
CA	Orange County Transportation Authority	Very Large	West	41,515	54,620	31.6%	63	1
CA	Peninsula Corridor JPB (Caltrain)	Large	West	5,539	8,622	55.7%	29	C
CA	Redding Area Bus Authority	Very Small	West	604	854	41.4%	45	1
CA	Riverside Transit Agency	Large	West	5,322	6,960	30.8%	66	
CA	Sacramento RTD	Very Large	West	23,088	28,593	23.8%	85	1
CA	San Diego Transit Corp.	Very Large	West	34,834	42,134	21.0%	102	
CA	San Diego Trolley	Very Large	West	15,624	24,567	57.2%	28	
CA	San Joaquin RTD	Medium	West	2,595	3,606	39.0%	50	
CA	Santa Barbara-MTD	Large	West	6,073	6,908	13.7%	139	
CA	Santa Clara Valley Transportation Authority	Very Large	West	45,047	54,849	21.8%	99	2
CA	Santa Maria Area Transit	Very Small	West	353	504	42.7%	40	1
CA	Santa Monica Municipal Bus	Very Large	West	17,770	21,605	21.6%	100	2
CA	Sonoma County Transit	Small	West	1,237	1,450	17.2%	120	2
CA	South Coast Area Transit (SCAT)	Medium	West	2,696	3,418	26.8%	78	2
CA	SunLine Transit Agency	Medium	West	2,614	3,682	40.9%	48	2
CA	Torrance Transit System	Medium	West	3,889	4,441	14.2%	134	1
CA	UNITRANS-Davis	Medium	West	1,765	2,342	32.7%	62	
CA	Vallejo Transit	Medium	West	2,529	3,605	42.5%	41	1
CA	Victor Valley Transit Authority	Very Small	West	508	839	65.1%	21	1
CA	Visalia City Coach	Small	West	906	1,404	55.0%	30	1
CA	Yolo County Transit District	Very Small	West	641	951	48.4%	34	
CA	Yuba-Sutter Transit Authority	Very Small	West	2	424	18523.0%	1	1
CO	City of Fort Collins	Small	West	1,370	1,746	27.4%	76	

Table C-1. (cont'd)

State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
CO	Denver Regional Transportation District	Very Large	West	66,819	67,481	1.0%	218	2
CT	Housatonic Area Regional Transportation	Very Small	East	614	732	19.2%	108	
CT	Northeast Transportation	Small	East	1,725	1,882	9.1%	163	
CT	Norwalk Transit District	Small	East	1,545	1,826	18.2%	112	
CT	Stamford-Connecticut Transit	Medium	East	3,217	3,920	21.9%	97	2
DC	Washington-WMATA	Very Large	East	344,970	355,861	3.2%	203	2
FL	Broward County Mass Transit	Very Large	South	23,967	26,470	10.4%	153	
FL	Central Florida (LYNX)	Large	South	13,452	19,833	47.4%	35	
FL	City of Tallahassee	Medium	South	3,614	4,038	11.7%	145	
FL	Escambia Cnty Area Transit	Small	South	1,456	1,603	10.1%	156	2
FL	Ft. Myers-LeeTran	Small	South	1,619	1,856	14.6%	128	
FL	Gainesville Regional TS	Medium	South	2,047	4,405	115.1%	6	C
FL	Lakeland Area Transit District	Small	South	1,135	1,393	22.7%	93	2
FL	Miami-MDTA	Very Large	South	80,788	81,484	0.9%	219	2
FL	Palm Tran	Large	South	2,715	5,477	101.8%	8	2
FL	Pasco County Public Transportation	Very Small	South	86	172	100.0%	9	1
FL	Pinellas Suncoast Transit	Large	South	8,042	9,280	15.4%	126	2
FL	Sarasota County Transportation Authority	Small	South	1,342	1,718	28.0%	73	1
FL	Space Coast Area Transit	Very Small	South	169	268	58.9%	25	2
FL	VOTRAN (County of Volusia)	Medium	South	3,522	4,116	16.9%	121	2
GA	MARTA - Metro Atlanta	Very Large	South	143,604	163,652	14.0%	138	C
GA	Rome Transit Department	Very Small	South	413	714	72.7%	18	
IA	Des Moines-Metro Transit	Medium	Midwest	3,613	4,307	19.2%	107	
IA	Five Seasons Transportation	Small	Midwest	1,048	1,301	24.1%	84	1
ID	Pocatello Regional Transit	Very Small	West	292	412	41.0%	47	
IL	Bloomington-Normal Public	Very Small	Midwest	687	801	16.5%	122	
IL	Chicago Transit Authority	Very Large	Midwest	441,537	465,536	5.4%	188	2
IL	Chicago-RTA-Metra (*)	Very Large	Midwest	65,871	70,662	7.3%	176	1
IL	Madison County Transit District	Small	Midwest	1,064	1,696	59.3%	23	1
IL	Pace-Chicago	Very Large	Midwest	33,525	37,449	11.7%	146	C
IL	Rock Island Metro Link	Medium	Midwest	1,896	2,556	34.8%	59	1
IL	Rockford MTD	Medium	Midwest	2,191	2,515	14.8%	127	
IN	Bloomington Public Transportation	Small	Midwest	965	1,021	5.8%	185	
IN	East Chicago Public Transit	Very Small	Midwest	137	234	71.1%	20	
IN	Fort Wayne PTC	Small	Midwest	1,305	1,694	29.9%	68	
IN	Gary Public Transportation Corp.	Medium	Midwest	2,082	2,315	11.2%	147	
IN	Greater Lafayette PTC	Medium	Midwest	1,909	2,112	10.6%	151	2
IN	Metro Evansville TS	Small	Midwest	1,245	1,309	5.2%	190	
IN	Muncie Transit	Small	Midwest	1,089	1,247	14.5%	131	
IN	North Indiana Commuter	Medium	Midwest	2,604	3,485	33.8%	61	
IN	South Bend Public Transportation	Medium	Midwest	1,782	2,613	46.7%	36	
KS	Johnson County Transit	Very Small	Midwest	187	230	22.9%	91	
KS	Topeka Metropolitan Transportation Authority	Small	Midwest	1,233	1,263	2.5%	207	
KS	Wichita Transit	Medium	Midwest	2,276	2,420	6.3%	183	2
KY	Lexington-Fayette County Transportation Authority	Medium	South	1,490	3,262	118.9%	5	2
LA	Capital Transp Corp. (Baton Rouge)	Medium	South	4,198	4,654	10.9%	149	
LA	City of Alexandria	Very Small	South	543	669	23.2%	89	
LA	City of Monroe	Very Small	South	830	895	7.8%	173	
MA	Cape Ann Transportation Authority	Very Small	East	245	330	34.8%	58	1
MA	Cape Cod RTA	Very Small	East	176	266	50.8%	31	1
MA	Lowell Regional Transit	Small	East	1,423	1,617	13.6%	140	
MA	Massachusetts Bay Transportation Authority	Very Large	East	295,583	317,963	7.6%	174	2
MA	Merrimack Valley RTA	Small	East	1,438	1,534	6.6%	178	
MA	Montachusett RTA	Very Small	East	755	768	1.8%	212	2
MD	Annapolis Department of Parking and Transportation	Very Small	East	414	764	84.4%	14	1
MD	Montgomery County Ride-On	Large	East	17,989	19,939	10.8%	150	
ME	Casco Bay Island Transit District	Very Small	East	746	920	23.3%	88	
ME	City of Bangor	Very Small	East	402	416	3.3%	201	
ME	Greater Portland Transit	Small	East	1,189	1,221	2.6%	205	2
MI	Ann Arbor Transportation Authority	Medium	Midwest	3,764	4,048	7.5%	175	2

Table C-1. (cont'd)

State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
MI	Capital Area Transporation Authority	Medium	Midwest	3,535	4,621	30.7%	67	
MI	Flint Mass Transportation Authority	Large	Midwest	5,254	6,455	22.9%	92	2
MI	Grand Rapids Area Transporation Authority	Medium	Midwest	3,112	3,904	25.4%	81	2
MI	Kalamazoo-Metro	Medium	Midwest	1,484	2,128	43.3%	39	1
MI	Suburban Mobility Authority RT	Large	Midwest	8,917	9,410	5.5%	187	2
MI	Twin Cities Area Transportation	Very Small	Midwest	25	31	24.8%	82	
MN	City of Rochester	Small	Midwest	816	1,000	22.5%	94	2
MN	Minneapolis-St Paul-Metro	Very Large	Midwest	61,110	71,874	17.6%	117	
MO	Bi-State Development	Very Large	Midwest	51,169	53,179	3.9%	199	
MO	Columbia Area Transit System	Very Small	Midwest	407	561	38.0%	51	2
MO	Kansas City-KCATA	Large	Midwest	14,219	15,145	6.5%	180	
MS	City of Jackson Trans System	Very Small	South	711	788	10.9%	148	
MT	Billings Metro Transit	Very Small	Midwest	669	683	2.1%	209	
MT	Missoula Urban Transport	Very Small	Midwest	549	679	23.5%	87	2
NC	Asheville Transit Authority	Small	South	958	1,092	14.0%	136	
NC	Chapel Hill Transit	Medium	South	2,591	3,186	23.0%	90	
NC	Charlotte DOT	Large	South	11,798	12,849	8.9%	166	2
NC	Durham Area Transit	Medium	South	2,977	3,171	6.5%	179	
NC	Raleigh-CAT	Medium	South	3,426	4,265	24.5%	83	
NH	Nashua Transit System	Very Small	East	255	257	0.5%	221	
NJ	Hudson Transit Lines	Medium	East	2,390	2,776	16.1%	124	
NJ	New Jersey Transit (*)	Very Large	East	185,066	206,968	11.8%	144	2
NJ	Port Authority Transit	Large	East	10,880	10,919	0.4%	223	
NJ	Suburban Transit Corp.	Large	East	3,978	5,665	42.4%	42	
NM	Las Cruces Area Transit	Very Small	West	624	625	0.1%	226	
NV	Las Vegas ATC\VanCom	Very Large	West	28,538	53,262	86.6%	12	C
NY	Capital District Transportation Authority	Large	East	10,636	11,146	4.8%	192	2
NY	Dutchess County Mass Transit	Very Small	East	533	919	72.4%	19	1
NY	Glens Falls Transit	Very Small	East	283	299	5.6%	186	
NY	Long Island Bus	Very Large	East	24,960	29,261	17.2%	119	2
NY	Long Island Rail Road	Very Large	East	97,736	101,191	3.5%	200	
NY	Metro North RR	Very Large	East	62,650	68,778	9.8%	160	
NY	New York Bus Tours, Inc.	Medium	East	2,698	3,840	42.3%	43	
NY	New York City DOT	Large	East	17,379	19,852	14.2%	133	
NY	New York City Transit	Very Large	East	1,893,117	2,428,957	28.3%	72	C
NY	New York-GTJC (Green Bus Line)	Very Large	East	49,438	72,422	46.5%	37	C
NY	Port Authority of New York (*)	Very Large	East	58,900	67,332	14.3%	132	2
NY	Putnam County Transit	Very Small	East	137	141	2.5%	206	2
NY	Queens Surface Corporation	Very Large	East	22,037	24,185	9.7%	161	2
NY	Suffolk County Transit	Medium	East	3,862	4,339	12.4%	143	
NY	Tompkins Area Transit	Medium	East	1,269	2,332	83.8%	15	
NY	Transport of Rockland	Small	East	1,469	1,880	28.0%	74	
OH	Akron Metro Regional Trans Authority	Large	Midwest	4,681	5,671	21.2%	101	
OH	Central Ohio Transit Authority (CORTA)	Large	Midwest	17,533	18,790	7.2%	177	2
OH	Cleveland-LAKETRAN	Very Small	Midwest	243	519	113.5%	7	1
OH	Cleveland-RTA	Very Large	Midwest	57,972	67,339	16.2%	123	
OH	Lorain County Transit	Very Small	Midwest	129	154	18.6%	109	
OH	Miami Valley Regional TA	Large	Midwest	14,384	14,451	0.5%	222	2
OH	Richland County Transit	Very Small	Midwest	324	353	8.9%	167	
OH	Southwest Ohio RTA (SORTA)	Very Large	Midwest	23,765	26,172	10.1%	155	2
OH	Springfield Cty Area Transit	Very Small	Midwest	487	596	22.5%	95	1
OH	Stark Area Regional Transportation Authority	Small	Midwest	1,001	1,639	63.7%	22	
OH	Western Reserve Transportation Authority	Small	Midwest	1,338	1,366	2.1%	208	
OK	Central Oklahoma Transportation	Medium	Midwest	3,674	4,331	17.9%	114	
OK	Tulsa Transit Authority	Medium	Midwest	2,896	3,017	4.2%	197	
OR	Lane Transit District	Large	West	7,056	7,998	13.3%	141	
OR	Portland-Tri-Met	Very Large	West	63,996	81,650	27.6%	75	C, 1
OR	Salem Area Mass Transit District	Medium	West	2,988	4,039	35.2%	57	2
PA	Centre Area Transportation Authority	Medium	East	1,905	3,008	57.9%	27	1
PA	Luzerne County Transportation Authority	Medium	East	1,705	3,268	91.7%	11	

Table C-1 (cont'd)

State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
PA	Mid Mon Valley TA (MMVTA)	Very Small	East	444	451	1.6%	213	
PA	Port Authority Allegheny	Very Large	East	73,549	74,618	1.5%	214	2
PA	Williamsport Bureau Transit	Small	East	1,107	1,178	6.4%	181	
PR	Puerto Rico Dept. of Transportation & Public Works	Very Large	South	55,805	55,998	0.3%	224	
PR	Puerto Rico Ports Authority	Small	South	1,050	1,096	4.3%	196	
PR	San Juan Metropolitan Bus Authority	Very Large	South	17,810	25,139	41.2%	46	C, 1
RI	Rhode Island Public Transit Authority (RIPTA)	Large	East	14,903	15,084	1.2%	215	2
SC	Coastal Rapid Public TA	Very Small	South	203	248	22.2%	96	
SC	Pee Dee RTA	Very Small	South	50	172	244.1%	3	
SC	Spartanburg Transit System	Very Small	South	502	603	20.1%	104	
SD	Rapid City Transit System	Very Small	Midwest	167	181	8.2%	170	
SD	Sioux Falls Transit	Very Small	Midwest	524	571	9.0%	164	2
TN	City of Kingsport - Kingsport Area Transit Service (KATS)	Very Small	South	43	86	100.0%	10	1
TN	Jackson Transit Authority	Very Small	South	376	517	37.5%	52	1
TN	Nashville Metropolitan Transit Authority	Large	South	6,603	6,920	4.8%	193	
TX	Abilene Transit System	Very Small	South	385	441	14.5%	130	1
TX	Amarillo City Transit	Very Small	South	896	901	0.5%	220	
TX	Beaumont Transit System	Small	South	1,449	1,520	4.9%	191	
TX	Citibus (Lubbock)	Medium	South	3,228	3,873	20.0%	105	1
TX	City of San Angelo	Very Small	South	114	156	36.8%	53	
TX	Corpus Christi Regionl Transportation Authority	Large	South	5,089	5,616	10.4%	154	2
TX	Dallas Area Rapid Transit	Very Large	South	43,881	45,936	4.7%	194	
TX	First Transit, Inc - Dallas	Large	South	7,116	9,178	29.0%	69	
TX	Handitran Specialized Transit Division	Very Small	South	76	103	35.5%	56	1
TX	Metro Transportation Authority - Harris County	Very Large	South	79,569	85,937	8.0%	171	
TX	Waco Transit System	Very Small	South	477	757	58.9%	24	
UT	Logan Transit District	Small	West	853	1,002	17.5%	118	1
VA	Charlottesville Transit	Very Small	South	688	701	1.9%	210	
VA	Greater Roanoke Transit	Small	South	1,793	1,827	1.9%	211	2
VA	Peninsula Transportation	Large	South	5,493	6,351	15.6%	125	
VA	Potomac and Rappahannock	Very Small	South	777	961	23.7%	86	2
VA	Tidewater Transportation	Large	South	8,649	11,594	34.0%	60	
WA	Clark County Public Trans	Large	West	5,153	7,750	50.4%	32	1
WA	King County DOT	Very Large	West	81,044	95,877	18.3%	111	
WA	Kitsap Transit	Large	West	4,282	5,041	17.7%	115	
WA	Monorail Transit	Medium	West	2,291	2,430	6.1%	184	2
WA	Pierce County Ferry	Very Small	West	160	177	10.6%	152	
WA	Richland-Ben Franklin	Medium	West	3,337	3,807	14.1%	135	1
WA	Snohomish County Transportation	Large	West	5,911	8,051	36.2%	54	1
WA	Spokane Transit Authority	Large	West	7,467	8,099	8.5%	168	
WA	Tacoma-Pierce Transit	Large	West	11,473	13,532	17.9%	113	2
WA	Washington State Ferries	Large	West	13,354	15,118	13.2%	142	
WA	Whatcom Transp Auth	Medium	West	2,447	2,898	18.4%	110	2
WI	Eau Claire Transit System	Very Small	Midwest	786	852	8.4%	169	2
WI	LaCrosse Municipal Transit	Very Small	Midwest	714	903	26.5%	79	
WI	Madison Metro Transit	Large	Midwest	9,601	10,110	5.3%	189	
WI	Milwaukee County Transportation System	Very Large	Midwest	56,497	68,826	21.8%	98	C
WI	Oshkosh Transit System	Very Small	Midwest	956	967	1.1%	217	
WI	Waukesha County Transit System	Very Small	Midwest	366	672	83.7%	16	2
WI	Waukesha Transit Commission	Very Small	Midwest	698	700	0.2%	225	2
WV	Kanawha Valley RTA	Medium	East	2,038	2,199	7.9%	172	
WV	Tri-State Transit Authority	Very Small	South	629	654	3.9%	198	2

** Agencies that reported corrected ridership data; all other responding agencies verified NTD data*

GUIDE TO CODES
1 = Responded to first survey (distributed 2000)
2 = Responded to second survey (2001)
C = Participated in Detailed Case Study Analysis

Table C-2: Agencies Ordered by Size, Region, State, then Agency

Size	Region	State	Agency	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
Very Small								
	East							
		CT	Housatonic Area Regional Transportation	614	732	19.2%	108	
		MA	Cape Ann Transportation Authority	245	330	34.8%	58	1
		MA	Cape Cod RTA	176	266	50.8%	31	1
		MA	Montachusett RTA	755	768	1.8%	212	2
		MD	Annapolis Department of Parking and Transportation	414	764	84.4%	14	1
		ME	Casco Bay Island Transit District	746	920	23.3%	88	
		ME	City of Bangor	402	416	3.3%	201	
		NH	Nashua Transit System	255	257	0.5%	221	
		NY	Dutchess County Mass Transit	533	919	72.4%	19	1
		NY	Glens Falls Transit	283	299	5.6%	186	
		NY	Putnam County Transit	137	141	2.5%	206	2
		PA	Mid Mon Valley TA (MMVTA)	444	451	1.6%	213	
	Midwest							
		IL	Bloomington-Normal Public	687	801	16.5%	122	
		IN	East Chicago Public Transit	137	234	71.1%	20	
		KS	Johnson County Transit	187	230	22.9%	91	
		MI	Twin Cities Area Transportation	25	31	24.8%	82	
		MO	Columbia Area Transit System	407	561	38.0%	51	2
		MT	Billings Metro Transit	669	683	2.1%	209	
		MT	Missoula Urban Transport	549	679	23.5%	87	2
		OH	Cleveland-LAKETRAN	243	519	113.5%	7	1
		OH	Lorain County Transit	129	154	18.6%	109	
		OH	Richland County Transit	324	353	8.9%	167	
		OH	Springfield Cty Area Transit	487	596	22.5%	95	1
		SD	Rapid City Transit System	167	181	8.2%	170	
		SD	Sioux Falls Transit	524	571	9.0%	164	2
		WI	Eau Claire Transit System	786	852	8.4%	169	2
		WI	LaCrosse Municipal Transit	714	903	26.5%	79	
		WI	Oshkosh Transit System	956	967	1.1%	217	
		WI	Waukesha County Transit System	366	672	83.7%	16	2
		WI	Waukesha Transit Commission	698	700	0.2%	225	2
	South							
		AL	Huntsville DOT	264	264	0.1%	227	
		AL	Tuscaloosa County Parking and Transit Authority	91	215	136.3%	4	1
		FL	Pasco County Public Transportation	86	172	100.0%	9	1
		FL	Space Coast Area Transit	169	268	58.9%	25	2
		GA	Rome Transit Department	413	714	72.7%	18	
		LA	City of Alexandria	543	669	23.2%	89	
		LA	City of Monroe	830	895	7.8%	173	
		MS	City of Jackson Trans System	711	788	10.9%	148	
		SC	Coastal Rapid Public TA	203	248	22.2%	96	
		SC	Pee Dee RTA	50	172	244.1%	3	
		SC	Spartanburg Transit System	502	603	20.1%	104	
		TN	City of Kingsport - Kingsport Area Transit Service (KATS)	43	86	100.0%	10	1
		TN	Jackson Transit Authority	376	517	37.5%	52	1
		TX	Abilene Transit System	385	441	14.5%	130	1
		TX	Amarillo City Transit	896	901	0.5%	220	
		TX	City of San Angelo	114	156	36.8%	53	
		TX	Handitran Specialized Transit Division	76	103	35.5%	56	1
		TX	Waco Transit System	477	757	58.9%	24	
		VA	Charlottesville Transit	688	701	1.9%	210	
		VA	Potomac and Rappahannock	777	961	23.7%	86	2
		WV	Tri-State Transit Authority	629	654	3.9%	198	2
	West							

Table C-2. (cont'd)

Size	Region	State	Agency	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
		AZ	City of Mesa	679	745	9.8%	159	
		CA	Alameda Ferry Services	408	589	44.2%	38	2
		CA	Chico Area Transit System	624	847	35.7%	55	
		CA	Fairfield/Suisun Transit	715	898	25.7%	80	
		CA	Laguna Beach Muni Transit	160	188	17.6%	116	2
		CA	Redding Area Bus Authority	604	854	41.4%	45	1
		CA	Santa Maria Area Transit	353	504	42.7%	40	1
		CA	Victor Valley Transit Authority	508	839	65.1%	21	1
		CA	Yolo County Transit District	641	951	48.4%	34	
		CA	Yuba-Sutter Transit Authority	2	424	18523.0%	1	1
		ID	Pocatello Regional Transit	292	412	41.0%	47	
		NM	Las Cruces Area Transit	624	625	0.1%	226	
		WA	Pierce County Ferry	160	177	10.6%	152	
Small								
	East							
		CT	Northeast Transportation	1,725	1,882	9.1%	163	
		CT	Norwalk Transit District	1,545	1,826	18.2%	112	
		MA	Lowell Regional Transit	1,423	1,617	13.6%	140	
		MA	Merrimack Valley RTA	1,438	1,534	6.6%	178	
		ME	Greater Portland Transit	1,189	1,221	2.6%	205	2
		NY	Transport of Rockland	1,469	1,880	28.0%	74	
		PA	Williamsport Bureau Transit	1,107	1,178	6.4%	181	
	Midwest							
		IA	Five Seasons Transportation	1,048	1,301	24.1%	84	1
		IL	Madison County Transit District	1,064	1,696	59.3%	23	1
		IN	Bloomington Public Transportation	965	1,021	5.8%	185	
		IN	Fort Wayne PTC	1,305	1,694	29.9%	68	
		IN	Metro Evansville TS	1,245	1,309	5.2%	190	
		IN	Muncie Transit	1,089	1,247	14.5%	131	
		KS	Topeka Metropolitan Transportation Authority	1,233	1,263	2.5%	207	
		MN	City of Rochester	816	1,000	22.5%	94	2
		OH	Stark Area Regional Transportation Authority	1,001	1,639	63.7%	22	
		OH	Western Reserve Transportation Authority	1,338	1,366	2.1%	208	
	South							
		AL	Mobile Transit Authority	1,028	1,172	14.0%	137	
		FL	Escambia Cnty Area Transit	1,456	1,603	10.1%	156	2
		FL	Ft. Myers-LeeTran	1,619	1,856	14.6%	128	
		FL	Lakeland Area Transit District	1,135	1,393	22.7%	93	2
		FL	Sarasota County Transportation Authority	1,342	1,718	28.0%	73	1
		NC	Asheville Transit Authority	958	1,092	14.0%	136	
		PR	Puerto Rico Ports Authority	1,050	1,096	4.3%	196	
		TX	Beaumont Transit System	1,449	1,520	4.9%	191	
		VA	Greater Roanoke Transit	1,793	1,827	1.9%	211	2
	West							
		CA	City of Commerce Municipal Bus	986	1,012	2.7%	204	
		CA	City of Santa Rosa	1,675	1,919	14.6%	129	2
		CA	DAVE Transp Services-OCTA	120	1,036	760.4%	2	
		CA	Livermore/Amador Valley	860	1,594	85.5%	13	2
		CA	Norwalk Transit System	1,036	1,357	31.0%	65	
		CA	Sonoma County Transit	1,237	1,450	17.2%	120	2
		CA	Visalia City Coach	906	1,404	55.0%	30	1
		CO	City of Fort Collins	1,370	1,746	27.4%	76	
		UT	Logan Transit District	853	1,002	17.5%	118	1
Medium								
	East							
		CT	Stamford-Connecticut Transit	3,217	3,920	21.9%	97	2
		NJ	Hudson Transit Lines	2,390	2,776	16.1%	124	
		NY	New York Bus Tours, Inc.	2,698	3,840	42.3%	43	

Table C-2. (cont'd)

Size	Region	State	Agency	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
		NY	Suffolk County Transit	3,862	4,339	12.4%	143	
		NY	Tompkins Area Transit	1,269	2,332	83.8%	15	
		PA	Centre Area Transportation Authority	1,905	3,008	57.9%	27	1
		PA	Luzerne County Transportation Authority	1,705	3,268	91.7%	11	
		WV	Kanawha Valley RTA	2,038	2,199	7.9%	172	
	Midwest							
		IA	Des Moines-Metro Transit	3,613	4,307	19.2%	107	
		IL	Rock Island Metro Link	1,896	2,556	34.8%	59	1
		IL	Rockford MTD	2,191	2,515	14.8%	127	
		IN	Gary Public Transportation Corp.	2,082	2,315	11.2%	147	
		IN	Greater Lafayette PTC	1,909	2,112	10.6%	151	2
		IN	North Indiana Commuter	2,604	3,485	33.8%	61	
		IN	South Bend Public Transportation	1,782	2,613	46.7%	36	
		KS	Wichita Transit	2,276	2,420	6.3%	183	2
		MI	Ann Arbor Transportation Authority	3,764	4,048	7.5%	175	2
		MI	Capital Area Transporation Authority	3,535	4,621	30.7%	67	
		MI	Grand Rapids Area Transporation Authority	3,112	3,904	25.4%	81	2
		MI	Kalamazoo-Metro	1,484	2,128	43.3%	39	1
		OK	Central Oklahoma Transportation	3,674	4,331	17.9%	114	
		OK	Tulsa Transit Authority	2,896	3,017	4.2%	197	
	South							
		AR	Central Arkansas Transit Authority	2,522	3,546	40.6%	49	2
		FL	City of Tallahassee	3,614	4,038	11.7%	145	
		FL	Gainesville Regional TS	2,047	4,405	115.1%	6	C
		FL	VOTRAN (County of Volusia)	3,522	4,116	16.9%	121	2
		KY	Lexington-Fayette County Transportation Authority	1,490	3,262	118.9%	5	2
		LA	Capital Transp Corp. (Baton Rouge)	4,198	4,654	10.9%	149	
		NC	Chapel Hill Transit	2,591	3,186	23.0%	90	
		NC	Durham Area Transit	2,977	3,171	6.5%	179	
		NC	Raleigh-CAT	3,426	4,265	24.5%	83	
		TX	Citibus (Lubbock)	3,228	3,873	20.0%	105	1
	West							
		AK	Municipality of Anchorage	3,020	3,316	9.8%	158	
		AZ	Regional Public Transportation Authority (Phoenix)	1,937	3,069	58.5%	26	1
		CA	Antelope Valley Transit	1,447	2,155	48.9%	33	1
		CA	Central Contra Costa Transportation Authority	3,988	4,795	20.2%	103	
		CA	Monterey-MST	3,802	3,967	4.3%	195	
		CA	San Joaquin RTD	2,595	3,606	39.0%	50	
		CA	South Coast Area Transit (SCAT)	2,696	3,418	26.8%	78	2
		CA	SunLine Transit Agency	2,614	3,682	40.9%	48	2
		CA	Torrance Transit System	3,889	4,441	14.2%	134	1
		CA	UNITRANS-Davis	1,765	2,342	32.7%	62	
		CA	Vallejo Transit	2,529	3,605	42.5%	41	1
		OR	Salem Area Mass Transit District	2,988	4,039	35.2%	57	2
		WA	Monorail Transit	2,291	2,430	6.1%	184	2
		WA	Richland-Ben Franklin	3,337	3,807	14.1%	135	1
		WA	Whatcom Transp Auth	2,447	2,898	18.4%	110	2
Large								
	East							
		MD	Montgomery County Ride-On	17,989	19,939	10.8%	150	
		NJ	Port Authority Transit	10,880	10,919	0.4%	223	
		NJ	Suburban Transit Corp.	3,978	5,665	42.4%	42	
		NY	Capital District Transportation Authority	10,636	11,146	4.8%	192	2
		NY	New York City DOT	17,379	19,852	14.2%	133	
		RI	Rhode Island Public Transit Authority (RIPTA)	14,903	15,084	1.2%	215	2
	Midwest							
		MI	Flint Mass Transportation Authority	5,254	6,455	22.9%	92	2
		MI	Suburban Mobility Authority RT	8,917	9,410	5.5%	187	2
		MO	Kansas City-KCATA	14,219	15,145	6.5%	180	

Table C-2. (cont'd)

Size	Region	State	Agency	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
		OH	Akron Metro Regional Trans Authority	4,681	5,671	21.2%	101	
		OH	Central Ohio Transit Authority (CORTA)	17,533	18,790	7.2%	177	2
		OH	Miami Valley Regional TA	14,384	14,451	0.5%	222	2
		WI	Madison Metro Transit	9,601	10,110	5.3%	189	
	South							
		FL	Central Florida (LYNX)	13,452	19,833	47.4%	35	
		FL	Palm Tran	2,715	5,477	101.8%	8	2
		FL	Pinellas Suncoast Transit	8,042	9,280	15.4%	126	2
		NC	Charlotte DOT	11,798	12,849	8.9%	166	2
		TN	Nashville Metropolitan Transit Authority	6,603	6,920	4.8%	193	
		TX	Corpus Christi Regionl Transportation Authority	5,089	5,616	10.4%	154	2
		TX	First Transit, Inc - Dallas	7,116	9,178	29.0%	69	
		VA	Peninsula Transportation	5,493	6,351	15.6%	125	
		VA	Tidewater Transportation	8,649	11,594	34.0%	60	
	West							
		CA	City of Gardena	4,492	5,898	31.3%	64	
		CA	City of Los Angeles DOT	4,603	6,533	41.9%	44	
		CA	Culver City Municipal Bus	4,009	5,104	27.3%	77	
		CA	Fresno Area Express	8,553	11,022	28.9%	71	1
		CA	Golden Gate Bridge - Hwy&TD	10,254	11,173	9.0%	165	2
		CA	Montebello Bus Lines	5,740	6,878	19.8%	106	1
		CA	North San Diego County Transit	10,781	11,128	3.2%	202	
		CA	OMNITRANS	8,234	14,630	77.7%	17	C, 1
		CA	Peninsula Corridor JPB (Caltrain)	5,539	8,622	55.7%	29	C
		CA	Riverside Transit Agency	5,322	6,960	30.8%	66	
		CA	Santa Barbara-MTD	6,073	6,908	13.7%	139	
		OR	Lane Transit District	7,056	7,998	13.3%	141	
		WA	Clark County Public Trans	5,153	7,750	50.4%	32	1
		WA	Kitsap Transit	4,282	5,041	17.7%	115	
		WA	Snohomish County Transportation	5,911	8,051	36.2%	54	1
		WA	Spokane Transit Authority	7,467	8,099	8.5%	168	
		WA	Tacoma-Pierce Transit	11,473	13,532	17.9%	113	2
		WA	Washington State Ferries	13,354	15,118	13.2%	142	
Very Large								
	East							
		DC	Washington-WMATA	344,970	355,861	3.2%	203	2
		MA	Massachusetts Bay Transportation Authority	295,583	317,963	7.6%	174	2
		NJ	New Jersey Transit (*)	185,066	206,968	11.8%	144	2
		NY	Long Island Bus	24,960	29,261	17.2%	119	2
		NY	Long Island Rail Road	97,736	101,191	3.5%	200	
		NY	Metro North RR	62,650	68,778	9.8%	160	
		NY	New York City Transit	1,893,117	2,428,957	28.3%	72	C
		NY	New York-GTJC (Green Bus Line)	49,438	72,422	46.5%	37	C
		NY	Port Authority of New York (*)	58,900	67,332	14.3%	132	2
		NY	Queens Surface Corporation	22,037	24,185	9.7%	161	2
		PA	Port Authority Allegheny	73,549	74,618	1.5%	214	2
	Midwest							
		IL	Chicago Transit Authority	441,537	465,536	5.4%	188	2
		IL	Chicago-RTA-Metra (*)	65,871	70,662	7.3%	176	1
		IL	Pace-Chicago	33,525	37,449	11.7%	146	C
		MN	Minneapolis-St Paul-Metro	61,110	71,874	17.6%	117	
		MO	Bi-State Development	51,169	53,179	3.9%	199	
		OH	Cleveland-RTA	57,972	67,339	16.2%	123	
		OH	Southwest Ohio RTA (SORTA)	23,765	26,172	10.1%	155	2
		WI	Milwaukee County Transportation System	56,497	68,826	21.8%	98	C
	South							
		FL	Broward County Mass Transit	23,967	26,470	10.4%	153	
		FL	Miami-MDTA	80,788	81,484	0.9%	219	2
		GA	MARTA - Metro Atlanta	143,604	163,652	14.0%	138	C

Table C-2. (cont'd)

Size	Region	State	Agency	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Overall Rank	Code
		PR	Puerto Rico Dept. of Transportation & Public Works	55,805	55,998	0.3%	224	
		PR	San Juan Metropolitan Bus Authority	17,810	25,139	41.2%	46	C, 1
		TX	Dallas Area Rapid Transit	43,881	45,936	4.7%	194	
		TX	Metro Transportation Authority - Harris County	79,569	85,937	8.0%	171	
	West							
		CA	BART - San Francisco	78,674	86,299	9.7%	162	2
		CA	Contra Costa Transportation District	61,943	65,897	6.4%	182	2
		CA	Long Beach Transit	21,039	27,119	28.9%	70	C
		CA	Los Angeles County MTA	362,260	398,630	10.0%	157	2
		CA	Municipal Railway - San Francisco (*)	214,048	216,412	1.1%	216	2
		CA	Orange County Transportation Authority	41,515	54,620	31.6%	63	1
		CA	Sacramento RTD	23,088	28,593	23.8%	85	1
		CA	San Diego Transit Corp.	34,834	42,134	21.0%	102	
		CA	San Diego Trolley	15,624	24,567	57.2%	28	
		CA	Santa Clara Valley Transportation Authority	45,047	54,849	21.8%	99	2
		CA	Santa Monica Municipal Bus	17,770	21,605	21.6%	100	2
		CO	Denver Regional Transportation District	66,819	67,481	1.0%	218	2
		NV	Las Vegas ATC\VanCom	28,538	53,262	86.6%	12	C
		OR	Portland-Tri-Met	63,996	81,650	27.6%	75	C, 1
		WA	King County DOT	81,044	95,877	18.3%	111	

** Agencies that reported corrected ridership data; all other responding agencies verified NTD data*

GUIDE TO CODES
1 = Responded to first survey (distributed 2000)
2 = Responded to second survey (2001)
C = Participated in Detailed Case Study Analysis

Table C-3: Agencies Ordered by Percent Increase in Unlinked Trips

Overall Rank	State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Code
1	CA	Yuba-Sutter Transit Authority	Very Small	West	2	424	18523.0%	1
2	CA	DAVE Transp Services-OCTA	Small	West	120	1,036	760.4%	
3	SC	Pee Dee RTA	Very Small	South	50	172	244.1%	
4	AL	Tuscaloosa County Parking and Transit Authority	Very Small	South	91	215	136.3%	1
5	KY	Lexington-Fayette County Transportation Authority	Medium	South	1,490	3,262	118.9%	2
6	FL	Gainesville Regional TS	Medium	South	2,047	4,405	115.1%	C
7	OH	Cleveland-LAKETRAN	Very Small	Midwest	243	519	113.5%	1
8	FL	Palm Tran	Large	South	2,715	5,477	101.8%	2
9	FL	Pasco County Public Transportation	Very Small	South	86	172	100.0%	1
10	TN	City of Kingsport - Kingsport Area Transit Service (KATS)	Very Small	South	43	86	100.0%	1
11	PA	Luzerne County Transportation Authority	Medium	East	1,705	3,268	91.7%	
12	NV	Las Vegas ATC\VanCom	Very Large	West	28,538	53,262	86.6%	C
13	CA	Livermore/Amador Valley	Small	West	860	1,594	85.5%	2
14	MD	Annapolis Department of Parking and Transportation	Very Small	East	414	764	84.4%	1
15	NY	Tompkins Area Transit	Medium	East	1,269	2,332	83.8%	
16	WI	Waukesha County Transit System	Very Small	Midwest	366	672	83.7%	2
17	CA	OMNITRANS	Large	West	8,234	14,630	77.7%	C, 1
18	GA	Rome Transit Department	Very Small	South	413	714	72.7%	
19	NY	Dutchess County Mass Transit	Very Small	East	533	919	72.4%	1
20	IN	East Chicago Public Transit	Very Small	Midwest	137	234	71.1%	
21	CA	Victor Valley Transit Authority	Very Small	West	508	839	65.1%	1
22	OH	Stark Area Regional Transportation Authority	Small	Midwest	1,001	1,639	63.7%	
23	IL	Madison County Transit District	Small	Midwest	1,064	1,696	59.3%	1
24	TX	Waco Transit System	Very Small	South	477	757	58.9%	
25	FL	Space Coast Area Transit	Very Small	South	169	268	58.9%	2
26	AZ	Regional Public Transportation Authority (Phoenix)	Medium	West	1,937	3,069	58.5%	1
27	PA	Centre Area Transportation Authority	Medium	East	1,905	3,008	57.9%	1
28	CA	San Diego Trolley	Very Large	West	15,624	24,567	57.2%	
29	CA	Peninsula Corridor JPB (Caltrain)	Large	West	5,539	8,622	55.7%	C
30	CA	Visalia City Coach	Small	West	906	1,404	55.0%	1
31	MA	Cape Cod RTA	Very Small	East	176	266	50.8%	1
32	WA	Clark County Public Trans	Large	West	5,153	7,750	50.4%	1
33	CA	Antelope Valley Transit	Medium	West	1,447	2,155	48.9%	1
34	CA	Yolo County Transit District	Very Small	West	641	951	48.4%	
35	FL	Central Florida (LYNX)	Large	South	13,452	19,833	47.4%	
36	IN	South Bend Public Transportation	Medium	Midwest	1,782	2,613	46.7%	
37	NY	New York-GTJC (Green Bus Line)	Very Large	East	49,438	72,422	46.5%	C
38	CA	Alameda Ferry Services	Very Small	West	408	589	44.2%	2
39	MI	Kalamazoo-Metro	Medium	Midwest	1,484	2,128	43.3%	1
40	CA	Santa Maria Area Transit	Very Small	West	353	504	42.7%	1
41	CA	Vallejo Transit	Medium	West	2,529	3,605	42.5%	1
42	NJ	Suburban Transit Corp.	Large	East	3,978	5,665	42.4%	
43	NY	New York Bus Tours, Inc.	Medium	East	2,698	3,840	42.3%	
44	CA	City of Los Angeles DOT	Large	West	4,603	6,533	41.9%	
45	CA	Redding Area Bus Authority	Very Small	West	604	854	41.4%	1
46	PR	San Juan Metropolitan Bus Authority	Very Large	South	17,810	25,139	41.2%	C, 1
47	ID	Pocatello Regional Transit	Very Small	West	292	412	41.0%	
48	CA	SunLine Transit Agency	Medium	West	2,614	3,682	40.9%	2
49	AR	Central Arkansas Transit Authority	Medium	South	2,522	3,546	40.6%	2
50	CA	San Joaquin RTD	Medium	West	2,595	3,606	39.0%	
51	MO	Columbia Area Transit System	Very Small	Midwest	407	561	38.0%	2
52	TN	Jackson Transit Authority	Very Small	South	376	517	37.5%	1
53	TX	City of San Angelo	Very Small	South	114	156	36.8%	
54	WA	Snohomish County Transportation	Large	West	5,911	8,051	36.2%	1
55	CA	Chico Area Transit System	Very Small	West	624	847	35.7%	

Table C-3 (cont'd)

Overall Rank	State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Code
56	TX	Handitran Specialized Transit Division	Very Small	South	76	103	35.5%	1
57	OR	Salem Area Mass Transit District	Medium	West	2,988	4,039	35.2%	2
58	MA	Cape Ann Transportation Authority	Very Small	East	245	330	34.8%	1
59	IL	Rock Island Metro Link	Medium	Midwest	1,896	2,556	34.8%	1
60	VA	Tidewater Transportation	Large	South	8,649	11,594	34.0%	
61	IN	North Indiana Commuter	Medium	Midwest	2,604	3,485	33.8%	
62	CA	UNITRANS-Davis	Medium	West	1,765	2,342	32.7%	
63	CA	Orange County Transportation Authority	Very Large	West	41,515	54,620	31.6%	1
64	CA	City of Gardena	Large	West	4,492	5,898	31.3%	
65	CA	Norwalk Transit System	Small	West	1,036	1,357	31.0%	
66	CA	Riverside Transit Agency	Large	West	5,322	6,960	30.8%	
67	MI	Capital Area Transporation Authority	Medium	Midwest	3,535	4,621	30.7%	
68	IN	Fort Wayne PTC	Small	Midwest	1,305	1,694	29.9%	
69	TX	First Transit, Inc - Dallas	Large	South	7,116	9,178	29.0%	
70	CA	Long Beach Transit	Very Large	West	21,039	27,119	28.9%	C
71	CA	Fresno Area Express	Large	West	8,553	11,022	28.9%	1
72	NY	New York City Transit	Very Large	East	1,893,117	2,428,957	28.3%	C
73	FL	Sarasota County Transportation Authority	Small	South	1,342	1,718	28.0%	1
74	NY	Transport of Rockland	Small	East	1,469	1,880	28.0%	
75	OR	Portland-Tri-Met	Very Large	West	63,996	81,650	27.6%	C, 1
76	CO	City of Fort Collins	Small	West	1,370	1,746	27.4%	
77	CA	Culver City Municipal Bus	Large	West	4,009	5,104	27.3%	
78	CA	South Coast Area Transit (SCAT)	Medium	West	2,696	3,418	26.8%	2
79	WI	LaCrosse Municipal Transit	Very Small	Midwest	714	903	26.5%	
80	CA	Fairfield/Suisun Transit	Very Small	West	715	898	25.7%	
81	MI	Grand Rapids Area Transporation Authority	Medium	Midwest	3,112	3,904	25.4%	2
82	MI	Twin Cities Area Transportation	Very Small	Midwest	25	31	24.8%	
83	NC	Raleigh-CAT	Medium	South	3,426	4,265	24.5%	
84	IA	Five Seasons Transportation	Small	Midwest	1,048	1,301	24.1%	1
85	CA	Sacramento RTD	Very Large	West	23,088	28,593	23.8%	1
86	VA	Potomac and Rappahannock	Very Small	South	777	961	23.7%	2
87	MT	Missoula Urban Transport	Very Small	Midwest	549	679	23.5%	2
88	ME	Casco Bay Island Transit District	Very Small	East	746	920	23.3%	
89	LA	City of Alexandria	Very Small	South	543	669	23.2%	
90	NC	Chapel Hill Transit	Medium	South	2,591	3,186	23.0%	
91	KS	Johnson County Transit	Very Small	Midwest	187	230	22.9%	
92	MI	Flint Mass Transportation Authority	Large	Midwest	5,254	6,455	22.9%	2
93	FL	Lakeland Area Transit District	Small	South	1,135	1,393	22.7%	2
94	MN	City of Rochester	Small	Midwest	816	1,000	22.5%	2
95	OH	Springfield Cty Area Transit	Very Small	Midwest	487	596	22.5%	1
96	SC	Coastal Rapid Public TA	Very Small	South	203	248	22.2%	
97	CT	Stamford-Connecticut Transit	Medium	East	3,217	3,920	21.9%	2
98	WI	Milwaukee County Transportation System	Very Large	Midwest	56,497	68,826	21.8%	C
99	CA	Santa Clara Valley Transportation Authority	Very Large	West	45,047	54,849	21.8%	2
100	CA	Santa Monica Municipal Bus	Very Large	West	17,770	21,605	21.6%	2
101	OH	Akron Metro Regional Trans Authority	Large	Midwest	4,681	5,671	21.2%	
102	CA	San Diego Transit Corp.	Very Large	West	34,834	42,134	21.0%	
103	CA	Central Contra Costa Transportation Authority	Medium	West	3,988	4,795	20.2%	
104	SC	Spartanburg Transit System	Very Small	South	502	603	20.1%	
105	TX	Citibus (Lubbock)	Medium	South	3,228	3,873	20.0%	1
106	CA	Montebello Bus Lines	Large	West	5,740	6,878	19.8%	1
107	IA	Des Moines-Metro Transit	Medium	Midwest	3,613	4,307	19.2%	
108	CT	Housatonic Area Regional Transportation	Very Small	East	614	732	19.2%	
109	OH	Lorain County Transit	Very Small	Midwest	129	154	18.6%	
110	WA	Whatcom Transp Auth	Medium	West	2,447	2,898	18.4%	2
111	WA	King County DOT	Very Large	West	81,044	95,877	18.3%	
112	CT	Norwalk Transit District	Small	East	1,545	1,826	18.2%	
113	WA	Tacoma-Pierce Transit	Large	West	11,473	13,532	17.9%	2
114	OK	Central Oklahoma Transportation	Medium	Midwest	3,674	4,331	17.9%	
115	WA	Kitsap Transit	Large	West	4,282	5,041	17.7%	

Table C-3 (cont'd)

Overall Rank	State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Code
116	CA	Laguna Beach Muni Transit	Very Small	West	160	188	17.6%	2
117	MN	Minneapolis-St Paul-Metro	Very Large	Midwest	61,110	71,874	17.6%	
118	UT	Logan Transit District	Small	West	853	1,002	17.5%	1
119	NY	Long Island Bus	Very Large	East	24,960	29,261	17.2%	2
120	CA	Sonoma County Transit	Small	West	1,237	1,450	17.2%	2
121	FL	VOTRAN (County of Volusia)	Medium	South	3,522	4,116	16.9%	2
122	IL	Bloomington-Normal Public	Very Small	Midwest	687	801	16.5%	
123	OH	Cleveland-RTA	Very Large	Midwest	57,972	67,339	16.2%	
124	NJ	Hudson Transit Lines	Medium	East	2,390	2,776	16.1%	
125	VA	Peninsula Transportation	Large	South	5,493	6,351	15.6%	
126	FL	Pinellas Suncoast Transit	Large	South	8,042	9,280	15.4%	2
127	IL	Rockford MTD	Medium	Midwest	2,191	2,515	14.8%	
128	FL	Ft. Myers-LeeTran	Small	South	1,619	1,856	14.6%	
129	CA	City of Santa Rosa	Small	West	1,675	1,919	14.6%	2
130	TX	Abilene Transit System	Very Small	South	385	441	14.5%	1
131	IN	Muncie Transit	Small	Midwest	1,089	1,247	14.5%	
132	NY	Port Authority of New York (*)	Very Large	East	58,900	67,332	14.3%	2
133	NY	New York City DOT	Large	East	17,379	19,852	14.2%	
134	CA	Torrance Transit System	Medium	West	3,889	4,441	14.2%	1
135	WA	Richland-Ben Franklin	Medium	West	3,337	3,807	14.1%	1
136	NC	Asheville Transit Authority	Small	South	958	1,092	14.0%	
137	AL	Mobile Transit Authority	Small	South	1,028	1,172	14.0%	
138	GA	MARTA - Metro Atlanta	Very Large	South	143,604	163,652	14.0%	C
139	CA	Santa Barbara-MTD	Large	West	6,073	6,908	13.7%	
140	MA	Lowell Regional Transit	Small	East	1,423	1,617	13.6%	
141	OR	Lane Transit District	Large	West	7,056	7,998	13.3%	
142	WA	Washington State Ferries	Large	West	13,354	15,118	13.2%	
143	NY	Suffolk County Transit	Medium	East	3,862	4,339	12.4%	
144	NJ	New Jersey Transit (*)	Very Large	East	185,066	206,968	11.8%	2
145	FL	City of Tallahassee	Medium	South	3,614	4,038	11.7%	
146	IL	Pace-Chicago	Very Large	Midwest	33,525	37,449	11.7%	C
147	IN	Gary Public Transportation Corp.	Medium	Midwest	2,082	2,315	11.2%	
148	MS	City of Jackson Trans System	Very Small	South	711	788	10.9%	
149	LA	Capital Transp Corp. (Baton Rouge)	Medium	South	4,198	4,654	10.9%	
150	MD	Montgomery County Ride-On	Large	East	17,989	19,939	10.8%	
151	IN	Greater Lafayette PTC	Medium	Midwest	1,909	2,112	10.6%	2
152	WA	Pierce County Ferry	Very Small	West	160	177	10.6%	
153	FL	Broward County Mass Transit	Very Large	South	23,967	26,470	10.4%	
154	TX	Corpus Christi Regionl Transportation Authority	Large	South	5,089	5,616	10.4%	2
155	OH	Southwest Ohio RTA (SORTA)	Very Large	Midwest	23,765	26,172	10.1%	2
156	FL	Escambia Cnty Area Transit	Small	South	1,456	1,603	10.1%	2
157	CA	Los Angeles County MTA	Very Large	West	362,260	398,630	10.0%	2
158	AK	Municipality of Anchorage	Medium	West	3,020	3,316	9.8%	
159	AZ	City of Mesa	Very Small	West	679	745	9.8%	
160	NY	Metro North RR	Very Large	East	62,650	68,778	9.8%	
161	NY	Queens Surface Corporation	Very Large	East	22,037	24,185	9.7%	2
162	CA	BART - San Francisco	Very Large	West	78,674	86,299	9.7%	2
163	CT	Northeast Transportation	Small	East	1,725	1,882	9.1%	
164	SD	Sioux Falls Transit	Very Small	Midwest	524	571	9.0%	2
165	CA	Golden Gate Bridge - Hwy&TD	Large	West	10,254	11,173	9.0%	2
166	NC	Charlotte DOT	Large	South	11,798	12,849	8.9%	2
167	OH	Richland County Transit	Very Small	Midwest	324	353	8.9%	
168	WA	Spokane Transit Authority	Large	West	7,467	8,099	8.5%	
169	WI	Eau Claire Transit System	Very Small	Midwest	786	852	8.4%	2
170	SD	Rapid City Transit System	Very Small	Midwest	167	181	8.2%	
171	TX	Metro Transportation Authority - Harris County	Very Large	South	79,569	85,937	8.0%	
172	WV	Kanawha Valley RTA	Medium	East	2,038	2,199	7.9%	
173	LA	City of Monroe	Very Small	South	830	895	7.8%	
174	MA	Massachusetts Bay Transportation Authority	Very Large	East	295,583	317,963	7.6%	2
175	MI	Ann Arbor Transportation Authority	Medium	Midwest	3,764	4,048	7.5%	2

Table C-3 (cont'd)

Overall Rank	State	Agency	Size	Region	Unlinked Trips (in thousands) 1994-95	1998-99	% Increase	Code
176	IL	Chicago-RTA-Metra (*)	Very Large	Midwest	65,871	70,662	7.3%	1
177	OH	Central Ohio Transit Authority (CORTA)	Large	Midwest	17,533	18,790	7.2%	2
178	MA	Merrimack Valley RTA	Small	East	1,438	1,534	6.6%	
179	NC	Durham Area Transit	Medium	South	2,977	3,171	6.5%	
180	MO	Kansas City-KCATA	Large	Midwest	14,219	15,145	6.5%	
181	PA	Williamsport Bureau Transit	Small	East	1,107	1,178	6.4%	
182	CA	Contra Costa Transportation District	Very Large	West	61,943	65,897	6.4%	2
183	KS	Wichita Transit	Medium	Midwest	2,276	2,420	6.3%	2
184	WA	Monorail Transit	Medium	West	2,291	2,430	6.1%	2
185	IN	Bloomington Public Transportation	Small	Midwest	965	1,021	5.8%	
186	NY	Glens Falls Transit	Very Small	East	283	299	5.6%	
187	MI	Suburban Mobility Authority RT	Large	Midwest	8,917	9,410	5.5%	2
188	IL	Chicago Transit Authority	Very Large	Midwest	441,537	465,536	5.4%	2
189	WI	Madison Metro Transit	Large	Midwest	9,601	10,110	5.3%	
190	IN	Metro Evansville TS	Small	Midwest	1,245	1,309	5.2%	
191	TX	Beaumont Transit System	Small	South	1,449	1,520	4.9%	
192	NY	Capital District Transportation Authority	Large	East	10,636	11,146	4.8%	2
193	TN	Nashville Metropolitan Transit Authority	Large	South	6,603	6,920	4.8%	
194	TX	Dallas Area Rapid Transit	Very Large	South	43,881	45,936	4.7%	
195	CA	Monterey-MST	Medium	West	3,802	3,967	4.3%	
196	PR	Puerto Rico Ports Authority	Small	South	1,050	1,096	4.3%	
197	OK	Tulsa Transit Authority	Medium	Midwest	2,896	3,017	4.2%	
198	WV	Tri-State Transit Authority	Very Small	South	629	654	3.9%	2
199	MO	Bi-State Development	Very Large	Midwest	51,169	53,179	3.9%	
200	NY	Long Island Rail Road	Very Large	East	97,736	101,191	3.5%	
201	ME	City of Bangor	Very Small	East	402	416	3.3%	
202	CA	North San Diego County Transit	Large	West	10,781	11,128	3.2%	
203	DC	Washington-WMATA	Very Large	East	344,970	355,861	3.2%	2
204	CA	City of Commerce Municipal Bus	Small	West	986	1,012	2.7%	
205	ME	Greater Portland Transit	Small	East	1,189	1,221	2.6%	2
206	NY	Putnam County Transit	Very Small	East	137	141	2.5%	2
207	KS	Topeka Metropolitan Transportation Authority	Small	Midwest	1,233	1,263	2.5%	
208	OH	Western Reserve Transportation Authority	Small	Midwest	1,338	1,366	2.1%	
209	MT	Billings Metro Transit	Very Small	Midwest	669	683	2.1%	
210	VA	Charlottesville Transit	Very Small	South	688	701	1.9%	
211	VA	Greater Roanoke Transit	Small	South	1,793	1,827	1.9%	2
212	MA	Montachusett RTA	Very Small	East	755	768	1.8%	2
213	PA	Mid Mon Valley TA (MMVTA)	Very Small	East	444	451	1.6%	
214	PA	Port Authority Allegheny	Very Large	East	73,549	74,618	1.5%	2
215	RI	Rhode Island Public Transit Authority (RIPTA)	Large	East	14,903	15,084	1.2%	2
216	CA	Municipal Railway - San Francisco (*)	Very Large	West	214,048	216,412	1.1%	2
217	WI	Oshkosh Transit System	Very Small	Midwest	956	967	1.1%	
218	CO	Denver Regional Transportation District	Very Large	West	66,819	67,481	1.0%	2
219	FL	Miami-MDTA	Very Large	South	80,788	81,484	0.9%	2
220	TX	Amarillo City Transit	Very Small	South	896	901	0.5%	
221	NH	Nashua Transit System	Very Small	East	255	257	0.5%	
222	OH	Miami Valley Regional TA	Large	Midwest	14,384	14,451	0.5%	2
223	NJ	Port Authority Transit	Large	East	10,880	10,919	0.4%	
224	PR	Puerto Rico Dept. of Transportation & Public Works	Very Large	South	55,805	55,998	0.3%	
225	WI	Waukesha Transit Commission	Very Small	Midwest	698	700	0.2%	2
226	NM	Las Cruces Area Transit	Very Small	West	624	625	0.1%	
227	AL	Huntsville DOT	Very Small	South	264	264	0.1%	

** Agencies that reported corrected ridership data; all other responding agencies verified NTD data*

GUIDE TO CODES
1 = Responded to first survey (distributed 2000)
2 = Responded to second survey (2001)
C = Participated in Detailed Case Study Analysis

APPENDIX D: SAMPLE SURVEY

Increasing Transit Ridership Survey

1. The attached table contains ridership data for your transit system, among others, between FY 1995 and 1999. Do these data, which indicate that your system has increased ridership during this time, look generally correct to you?

   o Yes, the ridership data for my system are generally correct.

   o No, the ridership data should be amended as follows: _______________
   ____
   ____

2. To which of the factors listed below do you attribute the growth in ridership?

	A Lot	A Little	Not at All	N/A	Briefly Explain:
A. Fare decrease	o	o	o	o	______________________
B. New payment options	o	o	o	o	______________________
C. Route restructuring	o	o	o	o	______________________
D. Service expansion	o	o	o	o	______________________
E. Introduction of new or specialized services	o	o	o	o	______________________
F. Employer-based programs	o	o	o	o	______________________
G. University-based programs	o	o	o	o	______________________
H. Marketing/ Advertising campaigns	o	o	o	o	______________________
I. Combination or merger of transit systems	o	o	o	o	______________________

3. Are there any factors not listed above (such as high population growth), that you think explain the large increase in ridership on your system?

___

___

___

4. How does your agency balance efforts to increase ridership with other goals (such as cost efficiency or wide service area coverage)?

___

___

___

5. If you attribute a significant share of the ridership increase on your system to one or two efforts or programs, what is the approximate cost of this/these efforts or programs? How is it/are they financed?

___

___

___

6. What significant obstacles and/or questions did you encounter in promulgating the efforts or programs described in Question 5?

___

___

___

7. In what ways do you think that efforts or programs described in Question 5 have been successful? Specifically, how has it/have they benefited your transit system and/or your community?

___

___

___

8. What are your transit system's future plans for increasing ridership?

____
____
____

Please provide us with the following information about yourself. We may contact you by telephone or e-mail to conduct a brief follow-up interview to learn more about the secrets of success in increasing ridership on your system.

Contact Name: ____

Title: ____

Department: ____

Agency: ____

Address: ____

____

____

Telephone: ____

Fax: ____

E-mail: ____

Thank you for your help. Please return this survey in the enclosed envelope by July 30.

END NOTES

1. While the term “public transit” can be used broadly to refer to a wide variety of transportation services, in this research we limit our discussion to the public transit systems that receive at least some federal subsidy and that annually report data to the Federal Transit Administration’s National Transit Database (NTD). The systems excluded from this database are primarily for-profit systems (like taxis and airport shuttles), specialized transit systems (such as those exclusively serving the elderly and/or disabled), and (generally small) transit operators that do not receive federal funding. In addition, our analysis excludes non-fixed route service and ridership from the systems reporting to the NTD.

2. In this study, increased patronage is measured by increases in the number of unlinked passenger trips.

3. The rail share in revenue miles represents the percentage of service that is on rail. This variable was used with an assumption that the higher the percentage of trips and service is on rail, in many cases, the higher the ridership will be. There are traditionally high transfer rates to rail, and when using unlinked trips, these transfers look like additional boardings.

4. Kain and Liu (1996, p. 2-6) acknowledge these are “crude proxies for a much larger number of factors that determine ridership.”

5. In 1970, CBD areas were designated by the Bureau of the Census as a set of contiguous census tracts that represented a high density of retail sales activity. In 1980, CBD areas were designated in collaboration by local committees and the Bureau of the Census as areas of very high land valuation.

6. Each time a passenger boards a transit vehicle, it is counted as an unlinked trip. Each time a passenger reaches his or her destination, it is counted as a linked trip. Thus, a linked trip can comprise one, two, or more unlinked trips, such as when a passenger transfers betwen lines or modes during a journey. Unlinked trip data, therefore, can exaggerate overall levels of transit use, especially on systems with frequent transfers. Although linked trips give a more accurate picture of transit use, such data are difficult and expensive to collect; thus, they usually are not available.

7. These numbers are based on information supplied by the Federal Transit Administration’s National Transit Database (NTD) and differ somewhat from the longer-term ridership statistics provided by the American Public Transit Association cited earlier in the chapter. This is because the NTD includes only those agencies that receive federal funds and, thus, report to the FTA, while APTA reports all ridership. All the data cited in the remainder of this chapter are drawn from data contained in the NTD.

8. We estimate that, nationwide, 93 percent of all transit ridership is counted in the NTD. The American Public Transit Association (APTA) estimates a grand total and reports 9.17 billion unlinked passenger trips taken in 1999; the Federal Transit Administration’s National Transit Database reports that 8.52 billion unlinked passenger trips were taken ($8.52 \div 9.17 = 0.93$). APTA’s ridership estimates are available online at http://www.apta.com/stats/ridership.

9. We eliminated the Yuba-Sutter Transit Authority (CA) from this correlation calculation because, according to the NTD, this agency experienced a one-year ridership increase of over 18,000 percent. This obvious data reporting or coding error skewed the data significantly. Unlike NY MTA, however, the Yuba-Sutter data were not high enough to have any effect on the combined ridership data in the tables (since they reported only 2,000 unlinked trips in 1995), so the Yuba-Sutter data are included in the various tables in this chapter.

10. Increasing ridership was seldom reported to be an explicit goal of transit systems, since it often conflicts with service utilization and budgetary goals. Nevertheless, some transit systems report that increasing ridership is among their objectives. For example, Cleveland's LAKETRAN (OH) has a goal of serving 1 million riders in 2001; the Antelope Valley Transit Authority (CA) intends to increase transit ridership by 5 percent per year; Chicago Metra hopes to increase growth 2 to 3 percent per year; Vallejo Transit (CA) intends to increase midday and weekend ridership on its ferry system; and the Orange County Transportation Authority (CA) estimated that the system must grow by 50 percent in the next 5 or 6 years to accommodate forecasted ridership.

11. See Meyer and Miller (1999) for estimates of service elasticities for headway, vehicle-miles, total travel time, in-vehicle time, and other measure of service as perceived by transit passengers.

12. Because partnerships were reported mostly in discussion of other programs and service changes, respondents often did not specify the degrees of effectiveness of partnership efforts. Therefore, Table 19 on page 67 does not include the relative effectiveness of each program.

13. Three transit systems responded on the questionnaire that they plan to build intermodal transportation centers. The Cape Cod Regional Transit Authority (MA) plans to construct a "fully-integrated multi modal centrally located Transportation Center in Hyannis." The Sarasota County Transportation Authority (FL) plans to construct a new downtown bus terminal that includes Amtrak service. The Jackson Transit Authority (TN) plans to build a joint transfer center and day-care facility.

14. As discussed beginning on page 15, Gomez-Ibanez (1996) found that transit ridership is strongly affected by forces beyond the transit system's control. For example, each percentage decrease in Boston jobs reduces MBTA ridership by 1.24 to 1.75 percent, and each percentage increase in real per capital income reduces MBTA ridership by 0.7 percent. The effects of fare and service policies are, by contrast, relatively small. A 1 percent increase in service increases ridership by only 0.30 to 0.36 percent, and a 1 percent reduction in fares increases ridership by 0.22 to 0.23 percent.

15. This relationship between fast-food consumption and transit ridership has, to our knowledge, been completely ignored in the previous research on transit ridership.

ACRONYMS

Acronym	Definition
AFC	Automated Fare Collection
AMA	Autoridad Metropolitana de Autobuses
APTA	American Public Transit Association
ATC	private transit company in Clark County, Nevada
BLS	Bureau of Labor Statistics
CAA	Clean Air Act Amendments of 1990
CBD	central business district
CMAQ	Congestion Mitigation Air Quality
CMSA	Consolidated MSA
CPI	Consumer Price Index
CTA	Chicago Transit Authority
FTA	Federal Transit Administration
GDP	Gross Domestic Product
GRTS	Gainesville Regional Transit System
JARC	Joint Access Reverse Commute
LBT	Long Beach Transit
MARTA	Metropolitan Atlanta Rapid Transit Authority
MBTA	Massachusetts Bay Transportation Authority
MSA	Metropolitan Statistical Area
MTA	Metropolitan Transit Authority
NPTS	Nationwide Personal Transportation Survey
NTD	National Transit Database
NYCT	New York City Transit

Acronym	Definition
NYCDOT	New York City Department of Transportation
NTD	National Transit Database
OC Transpo	Ottawa-Carleton Transportation Commission
OLS	Ordinary Least Squares
PMSA	Primary MSA
REIS	Regional Economic Information System
SJSU	San José State University
TEA-21	Transportation Equity Act for the 21st Century
TCRP	Transit Cooperative Research Program
UCLA	University of California, Los Angeles
UMTA	Urban Mass Transportation Administration

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