CHAPTER 5

TCRP

REPORT 95

TRANSIT COOPERATIVE
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Vanpools and Buspools

Traveler Response to Transportation System Changes

TRANSPORTATION RESEARCH BOARD
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TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 95

Traveler Response to Transportation System Changes

Chapter 5—Vanpools and Buspools

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA; the National Academies, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Special Notice

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FOREWORD

By Stephan A. Parker
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This "Vanpools and Buspools" chapter highlights the travel demand findings for vanpooling and buspooling. The chapter examines the effects of travel times, pricing, and a number of related tangibles and intangibles on the decision to vanpool in particular; quantifies vanpooling and buspooling as best can be done; looks at vanpooling trends; examines rider survey information; identifies indicators of market potential; and explores cost implications, among other subjects.

Vanpools generally consist of 5 to 15 people, including a volunteer driver-member, that elect to commute together in a van. Vanpooling is distinguished from carpooling by not only size, but also the greater degree of management and institutional involvement required. Meanwhile, buspool programs offer a neighborhood-based demand responsive service similar to vanpooling, but with professional or, at least, appropriately licensed bus drivers and the use of buses, mini-buses, or large vans. The information presented in Chapter 5 on vanpools and buspools covers both traveler response and implications for program success

This chapter has limited overlap with several others. Chapter 2, "HOV Facilities," Chapter 3, "Park and Ride/Pool," and Chapter 11, "Transit Information and Promotion," have relevance. Chapter 6, "Demand Responsive/ADA," covers dial-a-ride, a complementary form of transit service for low-density areas that can address non-work travel in particular. Chapter 12, "Transit Pricing and Fares," and Chapter 19, "Employer and Institutional TDM Strategies," contain examples of vanpooling as a component of travel demand management (TDM) programs.

TCRP Report 95: Chapter 5, Vanpools and Buspools will be of interest to transit and transportation planning practitioners; educators and researchers; and professionals across a broad spectrum of transportation and planning agencies, MPOs, and local, state, and federal government agencies.

The overarching objective of the *Traveler Response to Transportation System Changes Handbook* is to equip members of the transportation profession with a comprehensive, readily accessible, interpretive documentation of results and experience obtained across the United States and elsewhere from (1) different types of transportation system changes and policy actions and (2) alternative land use and site development design approaches. While the focus is on contemporary observations and assessments of traveler responses as expressed in travel demand changes, the presentation is seasoned with earlier experiences and findings to identify trends or stability, and to fill information gaps that would otherwise exist. Comprehensive referencing of additional reference materials is provided to facilitate and encourage in-depth exploration of topics of interest. Travel demand and related impacts are expressed using such measures as usage of transportation facilities and services, before-and-after market shares and percentage changes, and elasticity.

The findings in the *Handbook* are intended to aid—as a general guide—in preliminary screening activities and quick turn-around assessments. The *Handbook* is not intended for use as a substitute for regional or project-specific travel demand evaluations and model applications, or other independent surveys and analyses.

The Second Edition of the handbook *Traveler Response to Transportation System Changes* was published by USDOT in July 1981, and it has been a valuable tool for transportation professionals, providing documentation of results from different types of transportation actions. This Third Edition of the *Handbook* covers 18 topic areas, including essentially all of the nine topic areas in the 1981 edition, modified slightly in scope, plus nine new topic areas. Each topic is published as a chapter of *TCRP Report 95*. To access the chapters, select "TCRP, All Projects, B-12A" from the TCRP website: http://www.trb.org/tcrp.

A team led by Richard H. Pratt, Consultant, Inc. is responsible for the *Traveler Response to Transportation System Changes Handbook, Third Edition*, through work conducted under TCRP Projects B-12, B-12A, and B-12B.

REPORT ORGANIZATION

The *Handbook*, organized for simultaneous print and electronic chapter-by-chapter publication, treats each chapter essentially as a stand-alone document. Each chapter includes text and self-contained references and sources on that topic. For example, the references cited in the text of Chapter 6, "Demand Responsive/ADA," refer to the Reference List at the end of that chapter. The *Handbook* user should, however, be conversant with the background and guidance provided in *TCRP Report 95: Chapter 1, Introduction*.

Upon completion of the *Report 95* series, the final Chapter 1 publication will include a CD-ROM of all 19 chapters. The complete outline of chapters is provided below.

Handbook Outline Showing Publication and Source-Data-Cutoff Dates

General Sections and Topic Area Chapters (TCRP Report 95 Nomenclature)	U.S. DOT Publication		TCRP Report 95	
	First Edition	Second Edition	Source Data Cutoff Date	Estimated Publication Date
Ch. 1 – Introduction (with Appendices A, B)	1977	1981	2003[a]	2000/03/05[a]
Multimodal/Intermodal Facilities				
Ch. 2 – HOV Facilities	1977	1981	1999-05[f]	2000/05[b]
Ch. 3 – Park-and-Ride/Pool	—	1981	2003[c]	2004
Transit Facilities and Services				
Ch. 4 – Busways, BRT and Express Bus	1977[e]	1981	2004[c]	2005[d]
Ch. 5 – Vanpools and Buspools	1977	1981	1999-04[f]	2005
Ch. 6 – Demand Responsive/ADA	—	—	1999	2004
Ch. 7 – Light Rail Transit	—	—	2005	2005[d]
Ch. 8 – Commuter Rail	—	—	2005	2005[d]
Public Transit Operations				
Ch. 9 – Transit Scheduling and Frequency	1977	1981	1999	2004
Ch. 10 – Bus Routing and Coverage	1977	1981	1999	2004
Ch. 11 – Transit Information and Promotion	1977	1981	2002	2003
Transportation Pricing				
Ch. 12 – Transit Pricing and Fares	1977	1981	1999	2004
Ch. 13 – Parking Pricing and Fees	1977[e]	—	1999	2005
Ch. 14 – Road Value Pricing	1977[e]	—	2002-03[f]	2003
Land Use and Non-Motorized Travel				
Ch. 15 – Land Use and Site Design	—	—	2001-02[f]	2003
Ch. 16 – Pedestrian and Bicycle Facilities	—	—	2004	2005[d]
Ch. 17 – Transit Oriented Design	—	—	2004[d]	2005[d]
Transportation Demand Management				
Ch. 18 – Parking Management and Supply	—	—	2000-02[f]	2003
Ch. 19 – Employer and Institutional TDM Strategies	1977[e]	1981[e]	2005	2005[d]

NOTES: [a] Published in TCRP Web Document 12, *Interim Handbook* (March 2000), without Appendix B. The "Interim Introduction," published as Research Results Digest 61 (September 2003), is a replacement, available at http://www4.trb.org/trb/crp.nsf/All+Projects/TCRP+B-12A,+Phase+II. Publication of the final version of Chapter 1, "Introduction," as part of the TCRP Report 95 series, is anticipated for 2005.
[b] Published in TCRP Web Document 12, *Interim Handbook,* in March 2000. Available now at http://www4.nas.edu/trb/crp.nsf/All+Projects/TCRP+B-12. Publication as part of the TCRP Report 95 series is anticipated in 2005.
[c] The source data cutoff date for certain components of this chapter was 1999.
[d] Estimated.
[e] The edition in question addressed only certain aspects of later edition topical coverage.
[f] Primary cutoff was first year listed, but with selected information from second year listed.

CHAPTER 5 AUTHOR AND CONTRIBUTOR ACKNOWLEDGMENTS

TCRP Report 95, in essence the Third Edition of the "Traveler Response to Transportation System Changes" Handbook, is being prepared under Transit Cooperative Research Program Projects B-12, B-12A and B-12B by Richard H. Pratt, Consultant, Inc. in association with Jay Evans Consulting LLC; the Texas Transportation Institute; Parsons Brinckerhoff Quade & Douglas, Inc./PB Consult Inc.; Cambridge Systematics, Inc.; J. Richard Kuzmyak, L.L.C.; BMI-SG: a VHB company; Gallop Corporation; McCollom Management Consulting, Inc.; Herbert S. Levinson, Transportation Consultant; and K.T. Analytics, Inc.

Richard H. Pratt is the Principal Investigator. Dr. Katherine F. Turnbull of the Texas Transportation Institute assisted as co-Principal Investigator during initial Project B-12 phases, leading up to the Phase I Interim Report and the Phase II Draft Interim Handbook. With the addition of Project B-12B research, John E. (Jay) Evans, IV, of Jay Evans Consulting LLC was appointed the co-Principal Investigator. Lead Handbook chapter authors and co-authors, in addition to Mr. Pratt, are Mr. Evans (initially with Parsons Brinckerhoff); Dr. Turnbull; Frank Spielberg of BMI-SG; Brian E. McCollom of McCollom Management Consulting, Inc.; Erin Vaca of Cambridge Systematics, Inc.; J. Richard Kuzmyak, initially of Cambridge Systematics and now of J. Richard Kuzmyak, L.L.C.; and Dr. G. Bruce Douglas of PB Consult. Contributing authors include Herbert S. Levinson, Transportation Consultant; Dr. Kiran U. Bhatt, K.T. Analytics, Inc.; Shawn M. Turner, Texas Transportation Institute; Dr. Rachel Weinberger, Cambridge Systematics (now with the University of Pennsylvania); Andrew Stryker, PB Consult; and Dr. C. Y. Jeng, Gallop Corporation.

Other research agency team members contributing to the preparatory research, synthesis of information, and development of this Handbook have been Stephen Farnsworth, Laura Higgins, and Rachel Donovan of the Texas Transportation Institute; Nick Vlahos, Vicki Ruiter, and Karen Higgins of Cambridge Systematics, Inc.; Lydia Wong, Gordon Schultz, Bill Davidson, and G.B. Arrington of Parsons Brinckerhoff Quade & Douglas, Inc./PB Consult Inc.; Kris Jagarapu of BMI-SG; Sarah Dowling of Jay Evans Consulting LLC; and Laura C. (Peggy) Pratt of Richard H. Pratt, Consultant, Inc. As Principal Investigator, Mr. Pratt has participated iteratively and substantively in the development of each chapter. Dr. C. Y. Jeng of Gallop Corporation has provided pre-publication numerical quality control review. By special arrangement, Dr. Daniel B. Rathbone of The Urban Transportation Monitor searched past issues. Assistance in word processing, graphics and other essential support has been provided by Bonnie Duke and Pam Rowe of the Texas Transportation Institute; Karen Applegate, Laura Reseigh, Stephen Bozik, and Jeff Waclawski of Parsons Brinckerhoff; others too numerous to name but fully appreciated; and lastly the warmly remembered late Susan Spielberg of SG Associates (now BMI-SG).

Special thanks go to all involved for supporting the cooperative process adopted for topic area chapter development. Members of the TCRP Project B-12/B-12A/B-12B Project Panel, named elsewhere, are providing review and comments for what will total over 20 individual publication documents/chapters. They have gone the extra mile in providing support on call including leads, reports, documentation, advice, and direction over what will be the eight-year duration of the project. Four consecutive appointed or acting TCRP Senior Program Officers have given their support: Stephanie N. Robinson, who took the project through scope development and contract negotiation; Stephen J. Andrle, who led the work during the Project B-12 Phase and on into the TCRP B-12A Project Continuation; Harvey Berlin, who saw the Interim Handbook through to Website publication; and Stephan A. Parker, who is guiding the entire project to its complete fruition. Editor Natassja Linzau is providing her careful examination and fine touch, while Managing Editor Eileen Delaney and her team are handling all the numerous publication details. The efforts of all are greatly appreciated.

Continued recognition is due to the participants in the development of the First and Second Editions, key elements of which are retained. Co-authors to Mr. Pratt were Neil J. Pedersen and Joseph J. Mather for the First Edition, and John N. Copple for the Second Edition. Crucial support and guidance for both editions was provided by the Federal Highway Administration's Technical Representative (COTR), Louise E. Skinner.

In the *TCRP Report 95* edition, John (Jay) Evans is the lead author for this volume: Chapter 5, "Vanpools and Buspools." Contributing author for Chapter 5 is Richard H. Pratt.

Participation by the profession at large has been absolutely essential to the development of the Handbook and this chapter. Members of volunteer Review Groups, established for each chapter, reviewed outlines, provided leads, and in many cases undertook substantive reviews. Though all members who assisted are not listed here in the interests of brevity, their contribution is truly valued. A Chapter 5 review was undertaken by Review Group member Don Ward, and William G. Allen, Jr., stepped in to provide an additional outside review.

Finally, sincere thanks are due to the many practitioners and researchers who were contacted for information and unstintingly supplied both that and all manner of statistics, data compilations, and reports. Though not feasible to list here, many appear in the "References" section entries of this and other chapters.

CHAPTER 5—VANPOOLS AND BUSPOOLS

CONTENTS

5 – Vanpools and Buspools

OVERVIEW AND SUMMARY

Vanpools generally consist of 5 to 15 people, including a volunteer driver-member, that elect to commute together in a van. Vanpooling is distinguished from carpooling not only by size, but also by the greater degree of management and institutional involvement required. Meanwhile, buspool programs offer a neighborhood based demand responsive service similar to vanpooling, but with professional or at least appropriately licensed bus drivers, and using buses, mini-buses or large vans. The information presented here in Chapter 5 on vanpools and buspools covers both traveler response and implications for program success.

Within this "Overview and Summary" section:

- "Objectives of Vanpool and Buspool Programs" outlines the general focus and purposes of vanpooling and buspooling.

- "Types of Vanpool and Buspool Programs" defines vanpool and buspool programs and identifies the different approaches to organizing vanpools.

- "Analytical Considerations" outlines the state of knowledge about vanpooling and buspooling, and the implications for quantitative analysis.

- "Traveler Response Summary" highlights the travel demand findings for vanpooling and buspooling. The reader should first absorb the context provided by the first three sections of this "Overview and Summary" before attempting use of either the "Traveler Response Summary" or the remainder of the chapter.

Following the four-part "Overview and Summary," greater depth and detail are provided:

- "Response to Vanpool and Buspool Programs" provides various examples.

- "Underlying Traveler Response Factors" examines the effects of travel times, pricing, and a number of related tangibles and intangibles on the decision to vanpool in particular.

- "Related Information and Impacts" quantifies vanpooling and buspooling as best can be done, looks at vanpooling trends, examines rider survey information, identifies indicators of market potential, and explores cost implications, among other subjects.

- "Case Studies" covers four illustrative vanpooling applications, one including buspooling.

This chapter has some overlap with several others. Chapter 2, "HOV Facilities," Chapter 3, "Park and Ride/Pool," and Chapter 11, "Transit Information and Promotion," have relevance. Chapter 6, "Demand Responsive/ADA," covers dial-a-ride, a complementary form of transit service for low density areas that can address non-work travel in particular. Chapter 12, "Transit Pricing and

Fares," and Chapter 19, "Employer and Institutional TDM Strategies," contain examples of vanpooling as a component of travel demand management (TDM) programs.[1]

Objectives of Vanpool and Buspool Programs

The primary focus of vanpool and buspool programs has typically been provision of an attractive door-to-door or neighborhood-based paratransit alternative to the private automobile for home-to-work travel. Vanpool or buspool service may be designed to provide formalized, higher capacity ridesharing where conventional transit service does not exist and is unlikely to be cost-effective. Alternatively, vanpooling or buspooling may be designed to supplement existing fixed route transit services, or made part of a paratransit package to replace those that are particularly unattractive or costly to operate.

The general objectives are to satisfy work commute travel requirements more efficiently than can be done with either low-occupancy auto usage on the one hand, or thinly spread conventional bus services on the other, and to do so without severely restricting personal mobility or incurring unduly high operating subsidies. Specific intended benefits to employers and the general public include reduction of automobile congestion around major employment centers, reduction of parking requirements at employment sites, conservation of energy, and reduction of air pollution. Experience suggests that vanpooling may also be considered a strategy in reserve for fuel shortage emergencies. Intended user benefits for the journey-to-work trip include low costs, acceptable travel time, ability to read and relax, and convenience.

Increased use of vanpooling as a transit agency operating mode is resulting in expansion of program objectives beyond their original focus. A circa-2001 transit provider vanpooling survey suggests increasing use of the vanpool paradigm to meet needs for transporting disadvantaged commuters, often to sheltered workshops, and serving welfare-to-work transportation requirements (Higgins and Rabinowitz, 2002).

Types of Vanpool and Buspool Programs

Vanpool and buspool programs focus on serving specific home to work travel markets. They are demand responsive in the sense that the route of the vanpool or buspool is custom-tailored to the individual riders, and may change in response to rider turnover. They are typically not demand responsive in a real-time mode as presently constituted, although that would not appear to be out of the question with advancing Intelligent Transportation System (ITS) technologies.

The vast majority of vanpool and buspool programs could be considered subscription services, wherein each commuter essentially rents a seat on the van or bus on a monthly or sometimes weekly basis, with no refund for times when the service is not used. This approach allows the service provider, be it an employer, an individual, or a transit operator or other third-party agency, to be assured of a steady income. In some cases provisions are made for vacations, part-time riding, or even trip-based fares. Part-time or trip-based arrangements are rare although possibly growing in prevalence.

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[1] Results of vanpool fare elasticity research (Wambalaba, Concas, and Chavarria, 2004), U.S. Federal Transit Administration National Transit Database (NTD) reports through 2002, and other selected post-1999 sources have been drawn upon to update a number of Chapter 5 findings as of this *TCRP Report 95* republication. Nevertheless, Chapter 5 users should consult Chapter 19 for information updates presented in the specific context of overall employer and institutional TDM strategies.

Vanpool Programs

Vanpools have traditionally served commuters whose residences are geographically grouped and whose common destination can be served with 7 to 15 passenger vans (VPSI, 1999). Increased use of mini-vans and legislation such as Washington State's Commute Trip Reduction Act of the early 1990s, which established a vanpool ridership minimum of 5 persons, has broadened this range to 5 to 15 passengers (Enoch, 2003). Usually, the van is driven by a member of the pool who undertakes this and related responsibilities in exchange for a free ride. Passengers generally pay a monthly charge for the service. There are three primary vanpooling organizational strategies:

Employer-Sponsored Vanpool Programs. Employer-sponsored vanpool programs entail an employer purchasing or leasing vans for employee use, often subsidizing the cost of at least program administration, if not more. The driver usually receives free passage and limited personal use of the van, often for a mileage fee. Scheduling is within the employer's purview, and rider charges are normally set on the basis of vehicle and operating cost.

Third-Party Vanpool Programs. "Public interest" third-party programs are run by organizations such as non-profit corporations, public transit agencies (now the most common), or other public entities. The third-party organization enters into an agreement with the driver similar to employer program agreements. Rider charges normally cover vehicle cost, maintenance, fuel, and insurance and may cover program administration costs. Privately held third-party operators now exist as well, acting as vanpool service organizations, and bridging the gap between more traditional vanpool operators and leasing companies. Rider charges in this case cover all costs and profit unless subsidized externally. Individual employers often subsidize the third-party program fares of their employees, and transit agencies may subsidize operations including those they contract out to private providers.

Owner-Operator Vanpools. Owner-operator vanpools are often viewed as "big carpools," where the individual owner or lessee takes all financial risks and has complete control except for requirements imposed by some regulatory commissions. Information on such vanpools is extremely limited; almost no separately categorized traveler response information is provided for them here.

Buspool Programs

Buspool programs offer a demand responsive neighborhood-based service similar to vanpooling, but utilizing buses, mini-buses or large vans driven by bus drivers. They typically connect with a single, large employment center. Riders are offered either one express bus trip that matches work schedules, or a series of peak-period trips. The two primary organizational modes are:

- Operation by the local transit provider as an adjunct to traditional public bus service.
- Management by commuters who have joined together as individuals, or in close cooperation with a private corporation formed for the purpose, or by an employer.

Management by commuters or employers has grown less common as buspooling itself has become a strategy with a smaller niche in the transportation market, particularly relative to vanpooling. Buspool buses and/or operation, including drivers, are often contracted for or chartered from private bus companies, even when managed by the local transit provider.

Analytical Considerations

Concrete information on the universe of vanpooling and buspooling is hard to come by. The informal, individual owner operated component has never lent itself to census taking. Indeed, for rea-

sons of insurance, liability, taxation, and franchise regulations, informal arrangements have often been "kept quiet" (Comsis and ITE, 1993). There are detailed tallies for certain *components.* Operations and usage statistics for vanpools operated by or for transit agencies have in recent years been tabulated in the National Transit Database (NTD). This provides a partial picture, which in itself is subject to some degree of underreporting. The lack of identification of buspools separate from regular service buses in national databases and the non-inclusion of either vanpools or buspools as listed modes in many broad-based travel surveys further impede quantification.

For these reasons, in preference to providing no information at all, it has been necessary here to include certain compilations that are scarcely better than anecdotal, while acknowledging that the full scope of vanpooling and buspooling is somewhat uncertain. Fortunately, there have over time been careful examinations of individual programs and components, such that at least a limited array of travel demand characteristics and responses can be examined from a program perspective. These examinations in turn provide useful guidance for program designs and expectations.

Vanpooling and buspooling do not, in any case, lend themselves well to the quantitative analyses common to many transportation strategies; demand modeling of these and other paratransit modes has never met with much success. This makes such empirical evidence as there is all the more important as a basis for establishing direction and scale.

As with other topics, a number of these investigations date back to the 1970s in particular. The older data must be used with special caution, including energy savings and pollutant emissions reduction estimates based on obsolete vehicle characteristics. Many of the original vanpool programs were formed in the unique 1970s environment of energy shortages and were affected by them. Some well studied forms such as employer based vanpooling have since been in decline, while other forms such as transit system operations are in ascendancy.

Vanpool and buspool usage may be reported in terms of number of persons or employees vanpooling or buspooling, or in terms of person trips, as in the unlinked trip statistics of the NTD for transit provider vanpools. Care must be taken to distinguish between these two types of reporting. In orders of magnitude, each vanpool or buspool member is equivalent to two daily person trips. However, the precise number of equivalent daily trips is substantially less than two, because on any given day, any buspool or vanpool member may be off work, or away from the home worksite, or using another travel mode (typically driving) because of work or home schedule or travel demands. Indeed, another potential data trap is that either one-way or two-way trips may be reported either in terms of average weekday activity or as computed on the basis of total signed-up participants.

Number of vans/vanpools is also reported in different ways, including fleet size, not a measure of active vanpools; vans operated in maximum service; and vans in use on the average weekday, the best measure of active vanpools. For additional guidance on using the examples and generalizations provided in the various chapters of *TCRP Report 95,* reference should be made to Chapter 1, "Introduction." See the section titled "Use of the Handbook."

Traveler Response Summary

Vanpools and buspools provide an attractive and generally effective paratransit mode for home to work commuters not well served by conventional transit. Vanpooling doubled each year in the 1974 to 1980 period, reaching on the order of 15,000 vanpools in the United States. With cheaper gasoline and periodic changes in large-employer trip reduction requirements, vanpooling has—

with peaks and valleys—declined since. There were at least 8,500 vanpools total in operation in the United States as of 1998–99, and perhaps 10,000 more recently, as vanpooling has apparently been benefiting from federal Commuter Choice tax benefits.

The 1990s saw a shift in employer focus from an operational to a supportive role, feeding the move toward third-party vanpooling. From a mix of vanpooling organizations once dominated by employer vanpool programs, roughly half of all vanpools are now third-party operated—mostly by or on behalf of transit providers. The rest are split between employer and owner-operator vanpools. One large nationwide third-party vanpool service provider, contracted with by public agencies, employers and individual vanpools, has over 3,500 vans. Other such privately held providers had 100 vans or less as of 1999. Buspooling is more of a niche transportation mode, much reduced in scale compared to the 1970s.

Vanpool service by transit providers is fast growing. In the mid-1990s, 59 transit systems operated a total of almost 2,700 vanpools. The 2001 vanpool total was over 3,900. There has been a downward trend, however, in average passenger loadings. The five largest U.S. transit provider programs in 2002 had from 204 to 686 vanpools each, serving 2,400 to 7,200 average weekday passenger trips, with average vehicle loadings of 5.2 to 7.0 passengers.

Most vanpool programs do best where one-way trip lengths exceed 20 miles, where work schedules are fixed and regular, where employer size is sufficient to allow matching of 5 to 12 people from the same residential area, where public transit is inadequate, and where some congestion or parking problems exist. Buspools require about three times the density of travel demand, but otherwise the indicators of likely success are comparable. Perhaps 20 to 60 percent of vanpool riders are picked up at home, depending on local circumstances, with the rest accessing the vanpool via a variety of modes from walk to park-and-pool.

The typical vanpooler sacrifices 10 to 12 minutes of travel time compared to driving alone, trading time off against other attributes such as reduced travel cost and stress. Once the extra passenger pickup and discharge time approaches and exceeds line-haul travel time, the van or buspool service is not as attractive and normally fails to draw much of the potential market. Strong employer-operator commitment or public provider/employer partnerships and effective trip reduction legislation can help overcome less than ideal conditions.

Vanpooling accounts for some 0.3 percent of all journey to work travel nationally. For every ten vanpool commuters, there is on the order of one commuter in a buspool. The median share of employees vanpooling was 8 percent in 20 late-1980s case study employer programs, and 2 percent in 5 more-recent Seattle transit provider case studies. At a few very large employment sites, buspools are known to have attracted 5 to 10 percent of the journey to work trips. Of all U.S. transit provider vanpools, 40 percent operate in the Puget Sound region. Supported by a public policy environment that includes legislation to facilitate vanpooling, growth management regulations, a commute trip reduction program, and ferry privileges, vanpools carry 2 percent of all commute trips in the Puget Sound conurbation.

Quantitative information on vanpooler response to incentives is meager. Vanpool mode share increases ranging from 70 percent (5 programs) to a tripling of usage (one large program) have been reported in response to substantial or total fare subsidy. While these particular programs may have been in a highly responsive, formative stage, there is building evidence that vanpoolers may be as much as twice as sensitive to fares as typical local bus transit riders. There is also some evidence that vanpooling is adversely affected by loosening of high-occupancy vehicle (HOV) lane occupancy requirements.

The majority of vanpools and buspools serve office and other salaried and support employees on regular work schedules, but a number of significant operations oriented to craft workers, operators, and laborers exist. Vanpool passengers tend to have socio-economic profiles more like auto commuters than transit riders. As with carpools, the personal relationships involved in a vanpool can affect its success and longevity.

Excepting certain programs serving central business districts (CBDs), slightly over half of new vanpoolers and buspoolers formerly drove an automobile to work. Vanpool program trip length averages mostly fall within the range of 24 to 54 miles one-way, compared to the national average of just over 10 miles for solo auto driver commute trips, and 5 miles for the average unlinked transit trip. These distances make vanpool travel more important in terms of vehicle miles of travel (VMT) reduction than the market share of trips would indicate.

Employer vanpool programs, when surveyed in the late 1980s, reported break-even or positive revenue results in about half of all cases, but only with administrative costs excluded. Nevertheless, most employers judged their vanpool programs to be cost-effective from a broader perspective. Transit provider vanpool programs often make use of external funding sources for capital costs, and then, in several reported instances, achieve cost recovery ratios that approach or even exceed full operating cost recovery. Known buspool cost recovery ratios for transit operators are 60 to 80 percent.

RESPONSE TO VANPOOL AND BUSPOOL PROGRAMS

Employer Sponsored Vanpool Programs

The first vanpools of the 1970's were employer-operated. Even VPSI, the nation's largest third-party vanpool provider, began as an employer-operated vanpool program of the Chrysler Corporation (VPSI, 1999). Employers generally offered this support of vanpools to reduce parking costs, make parking space available for expansion, reduce congestion, respond to energy shortages, or satisfy zoning or air pollution requirements. In addition, corporations noted positive ancillary benefits such as reduced employee tardiness and absenteeism, improved public relations, and lower turnover rates (Wegmann, 1989).

Outstanding Employer Vanpool Programs

What is thought to be the longest established employer sponsored vanpool program was started in 1973 at the 3M Company headquarters in St. Paul, Minnesota. The 425-acre 3M Center is located in a low-density suburban area east of the city. Vanpools were originally introduced to reduce the need for parking spaces and mitigate traffic in the neighborhood. Table 5-1 shows the effectiveness of the 3M program over time to 1995. Peak vanpool usage was circa 1980, with effects of the 1970s energy shortages not yet worn off. At that point, 10.3 percent of all employees commuted by vanpool. Vanpool usage at the site dropped from 135 vans in 1980 to 105 vans in 1985 (Comsis and ITE, 1993). Company managers speculated that high employee turnover, relocations, and the introduction of flextime were to blame (Bhatt and Higgins, 1989). In 1995, of the nearly 13,300 employees, 525 (3.9 percent) used a vanpool to travel to work, and the fleet totaled 68 vans (Minnesota Mining & Manufacturing Co., 1998).

Table 5-1 Effectiveness of the 3M Company Employer Vanpool Program Over Time

Year	1970	1974	1977	1980	1985	1995
Employment	7,723	9,476	10,711	11,740	12,700	13,300
Method of Travel						
Drive Alone	86.4%	72.7%	75.6%	73.1%	76.4%	n/a
Carpool	13.0%	20.1%	14.0%	14.8%	14.1%	n/a
Vanpool	0.0%	6.0%	8.7%	10.3%	7.8%	3.9%
Transit	0.6%	1.2%	1.7%	1.8%	1.7%	n/a
Vehicle Trips per 100 Employees	91.6	81.3	82.0	79.9	82.7	n/a
Average Vehicle Occupancy	1.09	1.23	1.22	1.25	1.21	n/a

Sources: Kuzmyak and Schreffler (1990), Minnesota Mining & Manufacturing Co. (1998).

During the 1970s, two-thirds of the 3M Company vanpool runs were under 20 miles in length and also had ratios of passenger-pickup time to line-haul time in excess of 1.0 (Owens and Sever, 1974 and 1977). According to the available rules of thumb for assessing likely vanpool viability, presented under "Related Information and Impacts"—"Indicators of Market Potential"—"Service Attractiveness Guidelines," these vanpools should not have been attractive to users. Vanpooling at 3M may have been operating in a "supersaturated" mode in the 1970s, in response to both the energy crises of the epoch, and a corporate vanpooling ethic and enthusiasm that ultimately proved hard to sustain in the face of changing circumstances. The reduced 1995 vanpool travel share may represent a more "normal" response, though it is not known if it reflects a decline primarily in shorter-distance vanpooling or simply a general decline. This and other aspects of the 3M program are expanded upon in the case study, "The 3M Company Employer Based Vanpool Program."

Another vanpool program with significant numbers of runs under 20 miles in length, and still operating in that mode as of last report, was that of the Aerospace Corporation in El Segundo, California. Their vanpool program started in 1975 with a full-time coordinator. It grew out of a subscription bus service attempted in 1973–74, and a subsequent carpool matching service that saw 38 percent of the 1974 workforce in carpools during the first 1970s oil crisis. The workforce is heavily professional, and the location is a large "aerospace" employment center just south of Los Angeles International Airport.

Circa 1990, the Aerospace Corporation's vanpool program operated over 60 vans carrying approximately 15 percent of their 4,000 workers plus 2,000 workers of the Space and Missile Program of the U.S. Airforce. Carpooling remained high, at 19 percent. The vans, on average, traveled about 35 miles each way, but 13 of the vans (22 percent) served commutes of between 10 and 20 miles. The program's success is attributed to strong corporate support and sponsorship, employee participation in the program management, and low rider fares; about three-quarters the fare charged at a nearby plant. Aerospace was able to keep fares low by operating the vanpool program itself including insurance and both light and heavy maintenance of the vans that extended their useful life (Torluemke and Roseman, 1989; Comsis and ITE, 1993).

Nationwide Employer Vanpool Program Characteristics

A 1985 nationwide canvass of private employer ridesharing programs yielded information from 160 corporations. The firms responding to the survey came from diverse industries and were dis-

persed among CBD (27 percent), other in-city (26 percent), suburban (37 percent), and rural locales (10 percent). Table 5-2 gives selected characteristics of the 20 large and small vanpool programs reviewed in depth in the study.

Of the 160 firms that responded, 58 were actually operating employer vanpool programs, and another nine provided certain vanpool services to their employees. Before including administrative costs, 50 percent of the vanpool programs were operating at a financial break-even point or better. However, when these costs were allocated against the programs, only a few reported break-even or positive revenue results (Wegmann, 1989).

In the 1990's, many employers shifted their vanpool involvement to a supportive rather than an operational role. There is reportedly a desire on the part of many employers to focus on their core business, leaving such matters as vanpool administration, finances, liability, and insurance to others. Concurrently, involvement of Transportation Management Associations and third-party operators, including transit providers, has grown. The national trend has been toward one form or another of third-party vanpooling (Morris, 1981; Metropool, 1997; Boylan, 1999).

Table 5-2 Characteristics of Twenty 1985 Case Study Employer Vanpool Programs

Employer	Employees	Vans	Vanpool Riders	Vanpool Share	Self Assessment: "Cost Effective?"
Large Programs					
1	12,700	115	990	7.8%	Definitely
2	2,200	20	180	8.1%	Definitely
3	7,000	92	1,120	16.0%	Definitely
4	14,000	54	518	3.7%	Definitely
5	3,000	25	240	8.0%	Definitely
6	3,500	70	525	15.0%	Definitely
7	6,000	54	750	12.5%	Definitely
8	200	8	80	40.0%	Definitely
9	1,300	8	70	5.4%	Marginal
10	2,000	38	400	20.0%	Definitely
11	16,000	37	385	2.4%	No
12	4,800	24	240	5.0%	Definitely
Small Programs					
13	250	4	30	12.0%	No
14	700	2	21	3.0%	Marginal
15	1,000	5	50	5.0%	Definitely
16	3,100	4	62	2.0%	Definitely
17	70	1	9	12.9%	Marginal
18	180	1	8	4.4%	No Response
19	110	2	25	22.7%	Definitely
20	165	1	15	9.1%	Definitely

Note: The self assessment of cost effectiveness applies to employer's overall ridesharing program.

Source: Wegmann (1989).

Third-Party Vanpool Programs

Third-party vanpool programs acquire vans and/or establish vanpool programs for others, either employers, other agencies, or groups of individuals. Through this approach, the third party administers the paperwork associated with the fleet management responsibilities. The sponsoring agency or employer, if any, typically provides financial assistance to offset some portion of administrative expenses or broader operating costs, and to guarantee lease payments for vanpools not yet financially self-sufficient (Comsis and ITE, 1993).

Third-party vanpools have grown, benefiting from the removal of many institutional barriers and the potential cost savings and operating efficiencies that can be realized through centralization of the vanpool operating function. Third-party vanpool programs offer flexibility in "how, where, and at what rate vanpool services are introduced within an urban area" as well as private sector involvement. Multi-employer or small employer vanpools become possible (Heaton et al., 1981). The growth in transit industry vanpools is by far the most pronounced, as will be illustrated further on.

Third-Party Vanpool Demonstration Programs

Four pioneer third-party vanpool programs were created in Knoxville, Tennessee; Norfolk, Virginia; San Francisco, California; and Minneapolis, Minnesota, between 1975 and 1977 under the Urban Mass Transportation Administration's Service and Methods Demonstration program. The four programs had significant differences, which provided a unique opportunity for study. Additional information on the San Francisco—Golden Gate demonstration program is given in the "Golden Gate Vanpool Transportation Demonstration Project" case study. All of the projects were reasonably successful in attracting prospective poolers and placing them in vanpools, as shown in Table 5-3. Vanpoolers in the projects were generally commuters who did not require their car during the day, rarely worked overtime, and traveled relatively long distances. All of the projects continued beyond the demonstration period by using other sources of funding (Heaton et al., 1981).

Third-Party Vanpool Program Evolution

A number of the early third party programs have evolved into new forms. For instance, the former State of Maryland VANGO program, which was leasing almost 140 vans in mid-1980 (Stevens et al., 1980), has devolved into the ridesharing program of the Maryland Transit Administration (MTA). This MTA program provides matching services in cooperation with the Metropolitan Washington Council of Governments (Adams, 1999). It thus provides one example of the number of public agencies restricting their vanpooling role to vanpool formation only, referring their riders to private third party or leasing companies for the equipment.

Table 5-3 Demand Response to Service and Methods Demonstration Vanpool Projects

	Knoxville	Norfolk	Golden Gate Corridor	Minneapolis
Operational program vans at close of demonstration	51	46	86	62
Vanpool occupancy				
Year 1	10	6-8	9.4	8
Year 2	11	8-10	10.2	10.2
Vanpool mode split	2.1%	3.4%	0.5-1.0%	0.3-0.7%
Average round trip distance	61 miles	54 miles	56 miles[a]	54 miles

Note: [a] Figure is for year 2.

Source: Heaton et al. (1981)

Maryland's MTA not withstanding, vanpool operation by transit providers, covered in the next sub-section, has become much more common. Meanwhile, Connecticut's Rideshare Company provides an instructive example of a third party program that has evolved more within its original context. The state of Connecticut has had long-term involvement in providing comprehensive assistance and incentive programs to encourage commuter vanpooling. As of the early 1990's, the State was offering attractive pricing and financing for vanpool purchases through ridesharing organizations that included The Rideshare Company, a not-for-profit corporation (Comsis and ITE, 1993; Higgins and Rabinowitz, 2002).

Business relocation to the suburbs, workforce reductions, and policy changes that reduced incentives for companies to subsidize alternative transportation, all caused a reduction in The Rideshare Company vanpools from a high of 200 in 1993 to 155 in the fall of 1995 (2Plus, 1996b). In October 1995, to respond to these changes, The Rideshare Company began its brand-name commute-to-work service, Easy Street®. At the heart of the branding was the conversion of a fleet of anonymous white vans to prominently and colorfully marked ones with the service's logo and toll-free number. Callers are matched to existing vanpool routes, or if interest is sufficient, new routes are started. The service provides flexibility and a variety of benefits to participants. For example, Easy Street® permits riders to schedule usage on a two or three day a week basis (2Plus, 1996a; The Rideshare Company, 1998).

The new program enjoyed success. Vanpools soon reached 200 once again, and had slightly exceeded that number by November 1996. The number of weekday unlinked trips made via The Rideshare Company vanpools increased by 400 in the same time period, to a total of nearly 1,800. The Easy Street® program was recognized by a number of national awards (2Plus, 1996b and 1997). Additional growth is evident in recent NTD data and the results of a circa-2001 survey, with on the order of 270 vanpools in operation on an average weekday in 2001–2002, serving some 2,400 trips. Riders include welfare-to-work program participants in addition to regular commuters. Objectives include extending the reach of transit service. The vanpools link not only with employment sites, but also with transit services in four states (National Transit Database, 2001 and 2002; Higgins and Rabinowitz, 2002). The program is described further in the case study, "Connecticut's Easy Street® Vanpool Program."

Transit Provider Vanpool Programs

The number of reported vanpools operated by transit service providers has grown steadily from 447 in 1984 to 3,982 in 2001 (Wambalaba, Concas, and Chavarria, 2004). Using what appear to have been slightly different criteria, the American Public Transit Association (now American Public Transportation Association) reported that, as of the mid-1990s, 59 transit agencies were involved in offering vanpool service. The total number of vanpools given in connection with this statistic was 2,668 vans (American Public Transit Association, 1996).

In some cases, the actual administration of the program is done by a contractor. VPSI, Inc., is the largest vanpool provider/operator in the United States and the world, offering services to both employers and public agencies. The firm was incorporated in 1977 as a spin-off from Chrysler's Employee Vanpool Program. VPSI has evolved into a transportation service company that in the 1999 through 2004 period has been providing commuter transportation programs for some 50 to 60 urban areas from 25 to 30 regional customer service centers. These are mostly in the United States, but include modest operations in four cities of the Netherlands. The firm maintains a fleet of 3,500 to 4,000 vans to accommodate roughly 30,000 commuters served daily (equivalent to 60,000 trips) (VPSI, 1999 and 2004; Enoch, 2003). Most U.S. VPSI vans, as of the early 1990s, had between 12 and 15 riders. Drivers had unlimited use of the van after working hours, and paid no fare (Comsis and ITE, 1993). It would appear that the average riders per van may now be between 7 and 9.

The Capital Metropolitan Transportation Authority in Austin, Texas, initially contracted with VPSI to provide equipment, maintenance, and insurance for its vanpool program. Capital Metro marketed the program and it was substantially subsidized by charging service area riders only $10 a month. Riders outside the system paid by the mile or $120 a month. A guaranteed-ride-home program was offered for $5 a year, with up to four rides provided by a taxi operator under contract to Capital Metro. In 1995, over 100 vanpools were operating, including four outside the service area, serving 395,000 annual passenger trips. There were 90 people on a vanpool waiting list, as the system required a minimum of seven guaranteed riders (Rosenbloom, 1998). The program was the sixth largest in the United States offered by a transit provider in 1997, with 134 vanpools. The operation was brought in-house in 1998, with the city of Austin providing a ⅔ subsidy to supplement fares. Average weekday deployment of vanpools stood at 111 in 2001–2002, serving some 1,000 daily and 260,000 annual unlinked trips (National Transit Database, 1997, 2001, and 2002; Higgins and Rabinowitz, 2002).

Community Transit (CT) in Snohomish County north of Seattle, Washington, is one of several large vanpool systems that have always been operated in-house. CT started operating vanpools in 1986. The agency leases vans to qualified commuter groups in the county and markets the vanpool services. In 1994, CT carried 206,450 unlinked passenger trips in 94 vanpools, up 74 percent from 1991, and representing 3.8 percent of its total transit ridership (Rosenbloom, 1998; Higgins and Rabinowitz, 2002). By 1996, vanpool passenger trips had increased to 378,400 annually, served with 159 vans. CT vanpool loadings have tended to be comparatively low, averaging 4.8 per van in 1996 and 5.3 in 2002. Trip lengths were initially quite long. In 1996, the average CT vanpooler had a one-way trip length of about 41.5 miles, undoubtedly reflecting heavy use of vanpools for commuting to King County and Seattle to the south. More recently the average was down to a more typical 26.3 one-way miles. Growth has continued, with CT deploying 243 vans and serving 2,557 average weekday and 652,005 annual unlinked trips in 2002. (National Transit Database, 1996 and 2002). Ridership incentives include lowered fares and HOV lane and ferry access privileges (Higgins and Rabinowitz, 2002).

King County Metro, immediately to the south, also runs its own operation—the largest public vanpool system in the United States. Selected 1985 through 2002 statistics on vanpool and buspool service provided and consumed are given in Table 5-4. The operation originally began in 1979 with 21 vans under the auspices of the city of Seattle. The vehicle loading decrease over the last 10 to 15 years reflects in part local economic and employment shifts, which also have had their effect on vanpool ridership totals. The loading reductions also reflect new operational flexibility afforded in the early 1990s by revisions to Washington State's vanpooling regulations, allowing a 5 instead of 7 passenger vanpool minimum. These factors have led King County Metro to alter the fleet makeup, such that by 2000, mini-vans were being used for roughly 60 percent of all vanpools (Enoch, 2003; Beckwith, 2004).

Table 5-4 Selected King County Metro Vanpool and "Custom Bus" Statistics

Year	Maximum[a] or Average Vehicles in Service	Annual Unlinked Passenger Trips	Weekday Average[b, c]		Average Trip Length	
			Trips per Vehicle	Vehicle Loadings[d]	One Way Miles	Round Trip Miles
1985	127 vans	720,500	22.8	11.4	n/a	n/a
1989	231 vans	1,251,000	21.7	10.9	26.2	52.5
1994	520 vans	2,100,700	16.2	8.1	28.7	57.4
1996	526 vans	1,873,100	14.3	7.2	27.1	54.2
1998	643 vans	1,987,500	12.4	6.2	25.9	51.7
2000	691 vans	2,019,800	12.0	6.0	24.9	49.8
2002	686 vans	1,749,200	10.5	5.2	24.6	49.1
1998	41 buses[e]	434,300[f]	52.5[g]	26.3[g]	n/a	n/a

Notes:
[a] Maximum for 1985-1996, average weekday for 1998-2002 vanpools (average deployments).
[b] Weekday vanpool service averages for 1985-1996 based on an annualization factor of 249.
[c] Weekday averages for 1998-2002 computed directly from NTD average weekday data.
[d] Effectively the average maximum load point volume, not the average over the route.
[e] Total of 82 bus trips on 27 Custom Bus (subscription bus) routes.
[f] Down to 263,300 in 2000 and 186,600 in 2002 (see discussion under ìBusp oolsî).
[g] Based on an annualization factor for buspool service (including school routes) of 201.7.

Sources: National Transit Database (1985, 1989, 1994, 1996, 1998, 2000, and 2002); Beckwith and Burrell (1999); Beckwith (2004); derived estimates by Handbook authors.

The Pace Suburban Bus Service outside Chicago at one point used a hybrid approach, contracting out some of its vanpools (National Transit Database, 1993). Pace vanpools follow Pace-designated routes. Fares are based on a zone system and are calculated for the rider's own trip, not for the van's itinerary. Riders can transfer between vans and buses, using passes. In 1996, nearly 80 percent of the vanpools were routed suburb to suburb. The remainder served the city to suburbs reverse commute market. Suburb to downtown service, where there is high quality conventional transit, is not provided. Competition with fixed route transit service in other areas has not been a problem.

Pace itself deployed 291 vanpools on an average weekday in 1997, making it the second largest U.S. transit provider system (Metropool, 1997; Michael Baker et al., 1997; National Transit Database, 1997). King County Metro and Pace vanpooling incentives are expanded on in the "Underlying Traveler Response Factors" section under "Incentives and User Costs." Additional information on Pace vanpools including their ADaVantage program for serving disabled riders is provided in the case study, "Pace Vanpool and Subscription Bus Programs in Suburban Chicago." Pace 2002 vanpool data is examined below in Table 5-5.

The 5 largest transit provider vanpool systems as of 2002 in terms of weekday vanpool deployments are listed in Table 5-5 along with selected statistics for that year. Traditional vanpooling is a workdays only service, thus the average annualization factor for the 5 systems of only 252.[2] Average weekday vehicle loadings for the 3 largest are barely above 5 passengers, reflecting a change in approach from the Service and Methods Demonstration Project years when average loadings of 8 to 10 or more were commonplace.

Table 5-5 Selected Statistics for the Five Largest U.S. Transit Provider Vanpool Systems in 2002

Transit Provider, Location	Average Weekday No. of Vanpools	Average Weekday Passenger Trips	Annual Unlinked Passenger Trips	Implicit Annualization Factor	Average Weekday Vehicle Loadings	Average One-Way Passenger Miles
King County Metro, Seattle, WA	686	7,199	1,749,200	243	5.2	24.6
Pace, Cook County (Chicago), IL	422	4,678	1,192,900	255	5.5	24.2
CT, Snohomish County, WA	243	2,557	652,000	255	5.3	26.3
Valley Metro, Phoenix, AZ[a]	209	2,945	753,900	256	7.0	27.0
Pierce Transit, Tacoma, WA	204	2,379	594,750	250	5.8	34.2

Notes: Excludes Connecticut's Easy Street® program, which would rank ahead of Community Transit (CT) of Snohomish County, Washington, in numbers of vanpools if included, and the contracted-out program of the San Diego Association of Governments (SANDAG), which would rank ahead of Pierce Transit in Pierce County (Tacoma), Washington.

If ranked by vanpool passenger trips, the Harris County (Houston) METROVan system, contracted out to VPSI, would be included and would rank ahead of CT and Valley Metro.

[a] Vanpool service contracted out to VPSI.

Sources: National Transit Database (2002), derived estimates by Handbook authors.

The typical average one-way passenger trip length for the vanpool systems listed in Table 5-5 is close to 25 miles. Pierce Transit passenger trips average 34 miles one-way (National Transit Database, 2002), however, likely a function of Pierce County's location at the south end of the Puget Sound conurbation. As discussed below, however, some systems not covered in Table 5-5 exhibit remarkably longer average trip lengths.

[2] An annualization factor is the number that is multiplied by average weekday transit passenger trips or revenue to obtain annual trips/revenue.

As noted with respect to Table 5-5, two third-party vanpool operations not run by transit operators fall within the size range of the top five transit provider systems. One of these is the Easy Street® program already described in the context of "Third-Party Vanpool Evolution." The other, the system run for the San Diego Association of Governments (SANDAG), is an example of a system with an exceptionally long average trip length. The SANDAG operation in 2002 had on the average weekday 206 vanpools deployed, 2,566 unlinked passenger trips, average vanpool loadings of 6.2, and an average one-way passenger trip length of 52.6 miles. This has recently been a fast-evolving system, with 309 vans as of early-to-mid 2004 (National Transit Database, 2002; SANDAG, 2004).

Three of these large systems and some 40 percent of U.S. vanpools are in the Puget Sound area, aided by Washington State's vanpool and commute trip reduction legislation, HOV lanes, and priority ferryboat access and pricing. In 1999, vanpools of all types were attracting a 2 percent share of the regional commute trip market (7 percent for commutes over 20 miles). Concurrently, the mass transit share of commute trips was a substantial 13 percent. Of transit provider vanpools, 93 percent serve employers engaged in Commute Trip Reduction programs. The region's ferries carried 11 percent of public system vanpools and roughly 60 percent of the 200 or so private vanpools (WSDOT, 2000; Enoch, 2003).

The Space Coast (Florida) and Hampton Roads (Virginia) systems are examples of smaller vanpool operations with long passenger trip lengths. Space Coast reported having, on the average 2002 weekday, 32 vanpools deployed, 495 unlinked passenger trips, and a 52.3 mile average one-way passenger trip length. The Hampton Roads system reported 39 vanpools, 564 passenger trips, and a 50.6 mile average one-way trip length (National Transit Database, 2002). Average vanpool loadings were 7.7 and 7.2 occupants respectively. These two operations are characterized by serving industrial/military/technology concentrations with widely dispersed employee populations. Capital Metro in Austin, Texas, discussed previously, is an example at the opposite extreme for travel distances. The 2002 average one-way passenger trip length was 21.2 miles, accompanied by an average weekday vanpool loading of 4.5 passengers (National Transit Database, 2002).

Self-reported characterizations of the primary customer base of many of the larger operations and a number of smaller ones surveyed are provided in Table 5-6 along with self-reported information on numbers of vanpools and weekday riders circa 2001. Clearly shown is the modest yet significant expansion of functions performed by transit provider vanpools to serve not only the able working commuter but also special needs clients.

Buspools (Subscription Bus)

Buspool programs organized around and operated by private carriers gained popularity during the 1970s. With time, however, and with transfer of most urban transit operations to public ownership, nearly all of these services were taken over by government entities. The regional transit agencies that found themselves in the business often chose to contract out the buspool services to private companies to retain the lower wages enjoyed by the previous service, but at the same time bring capital subsidies to the program (Cervero, 1997).

In conjunction with these operational shifts, there has been a tendency to convert the more heavily used buspool services into conventional express bus routes offering a normal array of transit fare options and open to any rider showing up at the bus stop. For smaller markets, the challenge

of assembling a bus or mini-bus sized load of long-distance commuters with a common origin and destination, interested in developing a subscription service, has made vanpooling the more attractive option for most applications. Buspooling remains in good use, however, primarily serving the niche market of linking substantial residential concentrations of employees with very large employers, at locations or along corridors not well positioned for service by conventional fixed route transit.

Table 5-6 Transit Provider Vanpool Program Survey Results, Circa 2001

Vanpool Service Provider, Location	Number of Vanpools	No. of Riders per Day	Primary Customer Base: "8 to 5" Commuters	Alt.-Shift Commuters	ADA Commuters	Welfare-to-Work	Non-Commuters
Santa Cruz County RTC, CA	n/a	n/a	●				
Space Coast Area Transit, Brevard Co., FL	100	860*	●	●	●		●
Pace, Chicago, IL	380	3,420	●	●	●	●	●
GCRTA, Cleveland, OH	n/a	440*	●	●		●	
Kibois Area Transit System, OK	n/a	40				●	●
Greenville Transit Authority, SC	n/a	n/a	●	●			
Metro Transit Authority, Nashville, TN	33	450	●	●	●	●	
Capital Metro, Austin, TX	n/a	n/a	●				
METROVan, Houston Metro, TX	111	900	●				
"The T," Fort Worth, TX	286	3,750	●				
Traffix, Hampton Roads, VA	40	670*	●			●	
Ben Franklin Transit, Richland, WA	140	1,200	●	●	●		●
Community Transit, Lynnwood, WA	239	n/a	●	●			
Intercity Transit, Olympia, WA	65	500	●				
Island Transit, Coupeville, WA	30	n/a		●			
King County, Seattle, WA	700+	n/a	●				
Kitsap Transit, Bremerton, WA	92	n/a	●		●	○	
Pierce Transit, Tacoma, WA	261	1,700	●	●	●		
Whatcom Transit, Bellingham, WA	13	130	●				

Notes: n/a = not reported or apparently erroneous. ○ = Goal, not part of primary customer base.

Consistency of these self-reported statistics with the NTD is poor in some instances. Number of vanpools may be average weekday deployment in some cases and van fleet size in other cases. Number of riders per day may be average weekday unlinked one-way trips, one-way trips estimated by multiplying vanpool registrants by 2, or possibly round trips or vanpool registrants unfactored.

Ridership conversions from monthly or annual to daily, indicated by an asterisk (*), have utilized an annualization factor of 250 (after multiplying monthly riders by 12).

Sources: Higgins and Rabinowitz (2002), notes and conversions to daily by the Handbook authors.

Buspool Lessons of the 1960s and 1970s

Significant lessons were learned in the 1960s and 1970s with respect to good, indifferent, and poor environments for operating successful buspool services. The most successful were long-distance routes linking otherwise poorly served outer suburban areas with downtown employment concentrations. Short-haul buspools were less successful. In three federally funded demonstrations, short-haul home-pickup buspools to suburban industrial sites succeeded only where the residential density of targeted employees approached one such employee for every four households. Downtown oriented short-haul buspools had to compete with established radial bus routes and failed completely in all three demonstrations (Pratt, Pedersen, and Mather, 1977). Longer-distance routes to suburban employment sites were not tried during this epoch.

The one short-haul buspool demonstration that did become a modest success was in Peoria, Illinois. All three federal buspool demonstrations were in small cities, the others being Decatur, Illinois, and Flint, Michigan. The Peoria subscription buspools, 17 in all, followed routes 6 to 14 miles long, primarily serving large Caterpillar Tractor Company plants on the edge of the city. They featured home-pickup and special amenities. Unscheduled overtime at the plants made the buspools most popular with the office workers on regular hours. Of employees living in Peoria and working shifts served, 9 percent rode the buspool service and 7 percent used regular transit routes (Pratt, Pedersen, and Mather, 1977). The service outlived the demonstration, and is thought to have lasted until the demise of Peoria's private transit operator.

Among long-distance routes, perhaps the best-known buspool service was that established to link the planned community of Reston, Virginia, with central Washington, DC. The Reston Commuter Bus (RCB) was started in 1968 when no express public bus service and no direct freeway connections were available between Reston and Washington. Residents formed a cooperative and contracted with a private company to provide motorcoach service. The buspool mode share first stabilized at 17 percent of Washington commuters and then restabilized at 23 percent after buses gained exclusive Reston ramp access to the high speed Dulles Access Road.[3] At its height, the service served some 57,000 passengers per month.

The 1980's introduced many changes including the opening of a general use toll expressway parallel to the Access Road, the decentralization of employment in the region, higher fares, and lowered gasoline costs. The RCB services were converted to public transit routes and taken over by the Washington Metropolitan Area Transit Authority. Later, with much of the transit service in the area reorganized as feeders to Metrorail, the services were put under the umbrella of the Fairfax County Connector bus operations. As of the mid-to-late 1990s, regular buses provided commute-hour runs to the District of Columbia for some 2,500 passengers per month in the Reston corridor (Pratt and Copple, 1981; Cervero, 1997).

Buspool Experiences of the 1980s, 1990s, and Beyond

An industry oriented buspool system that has stood the test of time and transition to public agency operation is the Worker/Driver Program of Kitsap Transit, serving the Puget Sound Naval Shipyard in Bremerton, Washington, and one or more smaller worksites. Kitsap Transit itself is a multi-service operator with fixed routes, paratransit, buspooling, vanpooling, ride-matching, and contract passenger ferries serving Kitsap County, across Puget Sound from Seattle. The buspooling started

[3] A 1970 survey indicated that the market penetration to employment areas directly served may have been 2.0 to 2.5 times greater than for the Washington commute as a whole.

during the shipyard expansion and gasoline rationing of World War II. It was formalized as a division of Bremerton's private transit operator in 1967, and absorbed into the new public authority in 1982. The Worker/Driver Program had, at that point, declined from a once extraordinary subscription bus system to 12 poorly utilized vehicles.

The Worker/Driver Program takes its name from the practice of having employees at the destinations served, primarily the Naval Shipyard, drive the 40-ft. GMC buses. The drivers are fully trained and licensed, and are officially part-time employees of Kitsap Transit. Some degree of ride pre-arrangement is required, as the buspools deviate into neighborhoods only when there is someone there desiring service that day. Such arrangements are handled on a bus-by-bus basis. The service is highly personalized; some riders are veterans of 20 years or more, and the buspool is like extended family. Fares as of 2004 are simplified relative to the 1990s, when some of the five different payment options available were distance based. The 1994 fare options are a 40-trip (one-way) punch card for $30.00, a $1.00 one-way cash fare, a $25.00 monthly bus pass, a $10.00 pass for qualified riders, and a Transportation Incentive Program TIP Pass available to Department of Defense employees for free Kitsap Transit riding (Kitsap Transit, 1999 and 2004; Parks, 1999).

Kitsap Transit buspool ridership, 330,737 trips total for 1998, fluctuates with employment at the Naval Shipyard and the other sites served. On-site shipyard employment was, as of early 1999, perhaps half that of 6 years before, when approximately 48 buspools were in operation. In January 1999, only day shifts were being served, with 28 buspools following routes ranging from under 10 to over 40 miles one-way, averaging 15 to 20 miles. For the month, 24,995 passenger trips were carried (Parks, 1999). These statistics suggest an average buspool loading of approximately 24 riders, and a buspool mode share of perhaps 5 to 8 percent of Puget Sound Naval Shipyard civilian employees, the primary users. In August of 2004, the operation encompassed 21 buspools (Kitsap Transit, 2004).

Seattle has had a substantial buspool operation as well. Named the Custom Bus program, and established in 1979, 82 one-way bus trips were being operated on 27 routes as of the late 1990s. Ten of the routes, including all those with more than two one-way bus trips, served Boeing Aircraft and other large employers, including hospitals. The remaining 17 routes and 34 bus trips served educational institutions. As was indicated in Table 5-4, 1998 annual ridership was 434,300 unlinked trips with an average bus loading of 26 riders. King County Metro then required a guarantee of 40 passes per month from the employer/subscriber to operate a Custom Bus. Fares in 1999 ranged from $50 to $90 per month, depending on travel time, and were designed to achieve an 80 percent cost recovery ratio. FlexPasses were accepted (see also "Incentives and User Costs" under "Underlying Traveler Response Factors"), but payment of a premium might be required (Beckwith and Burrell, 1999).

The Custom Bus program declined steadily from the late 1990s until 2003, when 140,700 trips were served on a little more than ¼ as many routes. Services to large employers have been subject to the same economic and employment shifts as Metro's vanpools, with larger proportionate effects, as buspool size relative to vanpools provides less flexibility. The more precipitous decline, however, has been in service to educational institutions. Private schools must pay full cost for the service, and a rate increase caused them to look elsewhere to meet their transportation needs. However, total Custom Bus routes operated are—in the first 3 quarters of 2004—up 50 percent over the previous year, as some schools have found alternative arrangements unsatisfactory (Beckwith, 2004).

Subscription bus service was not found to be the best option for Brevard County, Florida, in a ridesharing demonstration there. The new service made one round-trip per weekday between Sarno Shopping Plaza in Melbourne and several locations on Patrick Air Force Base. A minimum

of 23 riders paying a fare of $1.00 per one-way trip allowed the long-haul bus service to begin. The operating cost averaged $1,932 per month, and fare revenues covered half that. Lacking sufficient supporting funds, the subscription bus service was replaced by two vanpools. At the end of the demonstration, the transit authority also replaced four of its regular peak period bus runs with vanpools. The fixed-route bus runs involved were averaging eight to twelve riders per trip and operating at a substantial loss. The replacement vanpools actually collected revenues above costs (Atherton, 1985).

In Chicago, subscription bus service was made part of the package designed to serve and retain as many transit riders as possible when Sears moved its 5,000 employee Merchandise Group from the Sears Tower in downtown Chicago to suburban Hoffman Estates, 35 miles out. Pace Suburban Bus worked closely with Sears for three years prior to the 1992 move to develop transportation alternatives. Subscription bus service was designed for areas with a significant concentration of Sears employees, but no suitable fixed route service. Ten routes were established using thirteen motorcoaches operated by private contractors. Each route served a park-and-ride lot an hour or more from the worksite. A monthly fare of $75 to $94 was charged.

The mix of fixed route, subscription bus, and vanpool services was successful in retaining a 30 to 35 percent share following the move, compared to 92 percent transit at the Sears Tower site. After 6 months, Sears ridership was divided roughly equally among the three modes. Subscription bus routes carried 986 daily trips after 2 months and 820 after 6 months. Of the 10 subscription bus routes, one was discontinued within the first year following a drop in ridership, but 9 routes and 12 buses were still operating 3 years later (Brazda, Grzesiakowski, and Reynolds, 1993; Community Transportation Association, 1996).

The transit agency serving Talihina, Oklahoma, and the Oklahoma Department of Human Services developed a connecting transit service to poultry processing plants in Fort Smith, Arkansas, as a welfare-to-work project. As of 1996, the 60-mile shuttle was responsible for employment of over 100 residents of Talihina, where the unemployment rate was 15 percent. Workers using the service were trained as drivers, producing characteristics of a vanpool or buspool operation (Surface Transportation Policy Project, 1996). A circa 2001 response to a vanpool survey reported a daily ridership of 40 (Higgins and Rabinowitz, 2002).

The Triangle Transit Authority (TTA), from 1993 through early 1999, used an innovative form of buspools as a way of developing new service areas within North Carolina's Research Triangle region. The service used large vans and minibuses, and reserved half of the seats for subscription passengers and half for per-trip passengers. Thus passengers were provided the option of either paying a fare of $2.00 each way or subscribing for $50.00 per month. By obtaining advance commitments for about half the seats, the routes were not as dependent on walk-up riders as a regular bus route. This approach was viewed as being less costly than beginning conventional service outright. In 1998, the 11 operating buspools had an average monthly ridership of 1,929 representing an average occupancy of 29 percent (Triangle Transit Authority, 1998a and b). The service was terminated abruptly when the Federal Transit Administration (FTA) ruled that since they operated on fixed routes, the buses involved had to be ADA accessible, which they were not. As many of the routes as could be were converted to vanpools (Litton, 2004).

A new, privately operated buspool service was initiated in 2000 by a San Francisco area entrepreneur. At the end of the year, eight buspools were being operated with 15 to 20 people per 25-seat mini-bus. Three routes served San Francisco from the urban fringes and five routes served Silicon Valley locations. Monthly fares were $89. HOV lane privileges and Commuter Check rider fare subsidies for some riders helped attract patrons. The operation as of 2004 is down to two routes,

however, using 15-passenger vehicles classified as vanpools. The operator is seeking California tax relief legislation to make private operation of commuter services more financially attractive (Urban Transportation Monitor, 2000; Buspool.org, 2001; Peoples, 2004).

UNDERLYING TRAVELER RESPONSE FACTORS

The transportation service attributes offered to the commuter by vanpools and buspools lie in general between the attributes of carpools and conventional transit. Of concern to the potential vanpool and buspool participants are travel time, cost, convenience, and other tangibles and intangibles. For vanpooling and buspooling, travel time includes access time, wait time, pickup time or trip circuitry, and line haul time.

Pickup Time, Line Haul Time, and Trip Distance

Vanpool and buspool riders generally experience longer travel times than they would if traveling via single occupancy automobile, though this may not always be the case in congested corridors or crossings with major HOV facilities or ferry access privileges. The generally longer times result from either vanpooling/buspooling on a circuitous route to pick up or drop off other riders, or having to travel to a pick-up location. Additional discussion of the influence of pickup time is provided under "Related Information and Impacts"—"Indicators of Market Potential"—"Service Attractiveness Guidelines."

The average former auto commuter among Golden Gate vanpoolers and the average Maryland vanpooler (typically a prior auto user) endured 11 to 12 minute one-way travel time increases over their former commute. This is essentially the same as the 10 to 11 minute increases on average reported by 3M and Michigan State Government employer-sponsored vanpool programs, and the 10 minute average extra travel time of Southern California COM-BUS subscription buspools as compared to comparable auto commutes. Riders trade off travel time for the other travel attributes (Dorosin, Fitzgerald, and Richard, 1979; McCall, 1977; Owens and Sever, 1974 and 1977; Stevens et al., 1980; U.S. Department of Energy, 1979).

These additional time penalties are less significant in the context of a longer trip. Indeed, the market for vanpooling is primarily commuters with longer-than-average commute distances, normally over 20 miles each way. Analysis of data in an early vanpool demonstration in Minneapolis revealed that among vanpoolers, the trip lengths of former transit users and solo drivers are considerably shorter than those of former carpoolers. Because the cost advantage of vanpooling over automobile travel increases with distance, eventually overtaking even the savings of multi-occupant carpooling, this finding suggests rational economic behavior on the part of vanpoolers in their mode switching behavior (Heaton et al., 1981).

Former transit users most often save time vanpooling. Golden Gate vanpoolers, for example, saved an average of 9 minutes over using transit (Dorosin, Fitzgerald, and Richard, 1979). When an HOV facility is available to lessen or even reverse the normal vanpooling time disadvantage, vanpooling becomes more attractive relative to solo driving. VPSI estimated that vanpools on the Shirley Highway HOV lanes in Washington, DC, area outnumber VPSI vanpools on the other radial freeways by a ratio of three to one (Comsis and ITE, 1993). The occupancy requirement on the Shirley HOV lanes is three or more persons (3+), higher than most. The 3+ occupancy requirement is possibly an additional inducement to vanpooling, as discussed under "Preferences, Privileges, and Intangibles."

Access Considerations

Vanpools and buspools may offer door-to-door convenience, or travel between centralized collection and distribution points, or combinations and variations thereof. There is an obvious trade-off between accepting circuitous, time-consuming route deviations to achieve or approximate home pickup, and requiring passengers to get themselves to a more efficient or even centralized pickup point.

The early small city subscription bus demonstrations, of which only the Peoria operation continued past the demonstration period, relied almost exclusively on home pickup. Riders cited the convenience of door-to-door service as the overriding reason for use of these short-haul buspools (Pratt, Pedersen, and Mather, 1977). Some early employer vanpool programs had a similar focus, but fairly early on, programs began reporting more diverse access modes, as illustrated in Table 5-7.

Table 5-7 Means of Access to Vanpool and Buspool Programs of the Late 1970s

Program Type	Maryland Vanpools		Knoxville Brokered	Golden Gate Demo[a]	Michigan Employees	COM-BUS Southern CA
Pickup Point	Third Party & Owner-Op'r.	Access	Third Party Vanpools	Third Party Vanpools	Employer Van Program	Buspool
Home	19%	Home	36%	44%	62%	5%
Intersection	11	Walk	10	17	5	—
Parking Lot	57	Auto	54	39	33	70
Other	13	Other	—	—	1	25[b]

Notes: [a] First nine months of Demonstration Project; during bad weather.
[b] Central pickup points (access unspecified).

Sources: Dorosin, Fitzgerald, and Richard (1979); McCall (1977); Stevens et al. (1980); Pratt and Copple (1981).

In the Pace Vanpool program of suburban Chicago, where free passes allow no-cost transfers to suburban buses, participants use a variety of modes to get to their vanpool. The primary Pace Vanpool access modes and percentages are shown in Table 5-8 (Pace Suburban Bus Service, 1993). Although no rigorous analysis has been done on it, home pickup may be somewhat more prevalent in smaller cities and regions.

Table 5-8 Modes Used to Get to Pace Chicago Region Vanpool Pick-up Points

Mode	Percentage
Drive	38%
Carpool	17
Walk	21
Home Pick-Up	19
Transit	5

Source: Pace Suburban Bus Service (1993).

Work Scheduling Implications

Vanpool and buspool users normally must adhere to a fixed commuting schedule. The worker who has to stay overtime is thus challenged. Even if work schedule aberrations are anticipated in advance, the only travel choice typically available is to forsake the vanpool or buspool mode for the occasion. This is probably a major reason, along with work absences, why the "attendance factor" of these programs is typically 80 to 90 percent. Golden Gate vanpoolers rode 4 out of 5 days on the average. Seventy percent of 3M vanpool riders rode 5 days a week, 25 percent 4 days a week, and 5 percent 3 days or less a week (Dorosin, Fitzgerald, and Richard, 1979; Owens and Sever, 1974 and 1977).

This irregular usage poses a dilemma in that the vanpool's carrying potential is not maximized and therefore its per passenger costs are not minimized. Some programs have developed methods to cope with irregular vanpool usage. One way is to over-subscribe; allowing lower monthly rates and assuming one or more persons will be away each day. Another way is to use trip-based pricing in conjunction with a low monthly base fee. Still another approach is to plan directly for part-time use—Connecticut's Easy Street® allows 2 or 3 day a week subscriptions for part time workers (Alan M. Voorhees and Associates, 1974; The Rideshare Company, 1998; Suhrbier and Wagner, 1979).

The requirement that vanpoolers pay for days that they miss as well as days that they ride has been cited as a detriment to vanpooling, especially during vacation periods. This is one reason Connecticut's Easy Street® program allows a rebate for passengers taking two consecutive weeks off (The Rideshare Company, 1998). For longer absences, most programs allow riders to leave the program with 30-days notice.

There are support programs that may help to encourage vanpool use. Flextime is generally but not universally thought to be supportive of vanpooling and high occupancy vehicle use by allowing employees to better coordinate their schedules for ridesharing. A survey of commuter transportation programs found that, circa 1990, ridesharers were offered flextime programs by their employer in 27 to 45 percent of all cases depending on type of service provider (see Table 5-9 for additional details) (Spence, 1990). An example of the contrary view about flextime comes from The 3M Company, where managers speculated that high employee turnover, relocations, and the introduction of flextime were to blame for vanpool use declines (Bhatt and Higgins, 1989).

To make riders more comfortable about leaving the car at home, many vanpool programs incorporate a "guaranteed ride home" service. Such programs are addressed in Chapter 19, "Employer and Institutional TDM Strategies." The service provides a ride to home or other destination in cases of emergency or unanticipated delay leaving work. The guaranteed ride may be provided by use of company or agency cars or fleet vehicles, short term auto rentals, or taxi services. Most programs limit the number of times per year each person may utilize the service, but maximums are rarely reached. Instead, the programs serve as a low cost mechanism for encouraging use of alternative transportation (K.T. Analytics, 1992).

In a similar manner, the "straggler bus" of the original Reston Commuter Bus operation, run after the regular evening subscription service, encouraged use of the system by people that needed the assurance they would not be stranded at their workplace by a late meeting or other delay. Although actual ridership on this 7:00 PM bus varied between 15 and 20 passengers, its addition in 1970 attracted more than 80 new riders to the system as a whole (Furniss, 1977).

Incentives and User Costs

Overall Use of Incentives

The success of vanpool programs is heavily influenced by the degree of employer support, even in the case of third-party programs. A Pace Suburban Bus Service survey in 1993 found the employers of most Pace VIP vanpool participants provided at least one incentive. Of survey respondents, 82 percent indicated that their employer provided preferred spaces for vanpools and carpools, 62 percent reported flexible working hours that permitted them to synchronize work schedules with fellow participants, 59 percent had employers who provided a way to advertise for additional riders, 49 percent were given information on public incentives by their employer, and 30 percent received subsidies for vanpool or transit from their employer (Pace Suburban Bus Service, 1993). Table 5-9 illustrates the prevalence of various ridesharing incentives, circa 1990, among companies and other organizations known to be involved in ridesharing program activities.

Table 5-9 Ridesharing Incentives Available to Program Participants Served

Type of Organization **Type of Incentive**	**Non-Profits** (TMAs; other ridesharing or commute management organizations)	**Private Companies** (any entity offering commute programs to their employees)	**Public Agencies** (all levels of government; regional bodies; transit agencies)
Free rides for driver	44%	57%	44%
Driver has weekend use of van	46	49	44
Flextime	33	45	27
Free parking	36	72	27
Guaranteed ride home	41	58	13
Subsidized bus/transit fares	31	48	17
Subsidized vanpool fares	36	48	19

Note: See the text which precedes Table 5-12, and the Table 5-12 note, for more information on the conduct of this survey.

Source: Spence (1990).

The percentages shown in Table 5-9 were derived from a nationwide survey of a wide variety of commuter transportation organizations. The percentages do not reflect the behavior of companies and organizations without ridesharing programs; they were excluded from the sample (Spence, 1990). No nationwide quantification of the effect on vanpooling of incentives was encountered, but findings of research on financial incentive effects for Puget Sound commuters are presented below in the "Financial Incentives in Greater Seattle" subsection. Prodded by Commute Trip Reduction regulations and assisted by associated legislation, 71 percent of Puget Sound area vanpoolers in a rideshare pricing research sample were receiving such incentives in 1997 (Wambalaba, Concas, and Chavarria, 2004). A 1999 market study found that 93 percent of Puget Sound's transit provider vanpools serve "major employers involved in Commute Trip Reduction (CTR) programs" (WSDOT, 2000).

Financial Incentives at TVA Headquarters

Relatively little quantitative information is available on effects of incentives on vanpooling. One classic case involving financial incentives is offered by the Travel Demand Management program of the downtown Knoxville headquarters of the Tennessee Valley Authority. In that 1970s case, a comprehensive TDM program was initiated without financial incentives other than avoidance of the existing pay parking. Then, in a separate and distinct action, financial incentives were provided. Table 5-10 presents the before, after without incentives, and after with incentives results (Wegmann, Chatterjee, and Stokey, 1979).

Table 5-10 Results of TVA Knoxville Headquarters Ridesharing/TDM Program and the Provision of Financial Incentives

	Before TDM Nov. 1973	TDM, No Monetary Incentives- December 1974		TDM + Monetary Incentives January 1977	
Employee Travel Mode	Employee Mode Share	Employee Mode Share	Change Versus Before TDM	Employee Mode Share	Change Versus No Incentives
Drive Alone	65.0%	42.0%	-35.4%	18.0%	-57.1%
Carpool	30.0	40.0	+33.3	41.0	+2.5
Regular Bus	3.5	3.0	-14.3	3.0	0.0
Express Bus	0.0	11.0	n/a	28.0	+154.6
Vanpool	0.0	2.3	n/a	7.0	+204.4
Walk, Bike, etc.	1.5	1.7	+13.3	3.0	+76.5
No. Employees	2,950	3,000	+1.7%	3,400	+13.3%
Parking Need	2,200	1,640	-25.4	1,070	-34.8

Note: Gasoline shortage occurred between November 1973 and December 1974, but not between December 1974 and January 1977.

Source: Wegmann, Chatterjee, and Stokey (1979).

The scale of the financial incentives TVA offered can probably be inferred from the one-third discount provided on commuter bus tickets. Carpools received preferred and inexpensive parking, and vanpools were subsidized for every TVA rider. The response to monetary incentives and associated additional express buses and vanpools had 2 years to stabilize before the January 1977 data collection date, as compared to 1 year before December 1974 for the TDM program without monetary incentives. However, this was more or less counterbalanced by the occurrence of the first 1970s fuel crisis and gasoline shortage during the initial phase. As Table 5-10 illustrates, the incremental effect of the monetary incentives was greater for all modes except carpooling than the initial TDM program effect, including introduction of direct express bus service and the vanpool mode. The largest effect percentagewise was on the vanpooling share (Wegmann, Chatterjee, and Stokey, 1979).

Financial Incentives in Greater Seattle

Seattle Metro tested vanpool subsidies as part of a 1987–89 demonstration of directed marketing aimed at persuading suburban office park commuters to use alternatives to driving alone. Among

other tactics, Metro developed an Early Start Program to encourage and speed vanpool start-up, subsidizing empty seats while a full complement of passengers was being sought. This strategy was applied at two major employment centers, coupled with a one-month free subsidy to new vanpoolers at one location, and a two-months-free subsidy to vanpoolers toward the end of the project at the other.

By the end of the two-year demonstration, the number of known vanpools at these sites had increased from 6 to 24. Although the vanpool component was considered a success, third year project area surveys found that, overall, there had been no net change between 1987 and 1989 in the share of commuters in high occupancy vehicles. Reversion back to single-occupant commuting was shown to be the predominant post-demonstration response. It was concluded that a program of positive services and incentives could not make up for limited employer and employee interest in seeking commute alternatives (Comsis, 1991).

Seattle region employer involvement was stimulated in the early 1990s by the coming together of a number of forces, including growing congestion affecting all parties, passage of Washington State's Commute Trip Reduction and Growth Management legislation, associated "Concurrency Requirements" mandating adequate public facilities for new development and thus further encouraging demand management, and regional policies favoring alternative transportation (Samdahl, 1999; WSDOT, 2000; Kavage and Samdahl, 2004). The impetus provided strengthens the now ongoing employer subsidy program for transit fares, vanpools, and other non-traditional commuter services administered by King County Metro for the Seattle region. The results provide some additional information on vanpooler response to monetary incentives.

Metro now offers a family of payment instruments and commuter incentive programs for use in partnership with employers and other major generators, primarily educational institutions. As of the late 1990s, these included a Traditional Pass Subsidy Program, the Commuter Bonus Program, and FlexPass. Vanpoolers can apply the face value of their subsidized traditional pass against their vanpool fare. The Commuter Bonus Program provides vouchers that can likewise be applied to vanpool fares among several other options. The FlexPass Program is an umbrella program providing an annual transit pass, vouchers, and other benefits. The FlexPass provides a predetermined vanpool fare discount (Michael Baker et al., 1997).

The FlexPass Program and transit rider response to it are described in Chapter 12, "Transit Pricing and Fares," under "Response by Type of Strategy"—"Changes in Fare Categories"—"Unlimited Travel Pass Partnerships." There in Table 12-16, seven selected King County Metro employer FlexPass programs are examined in terms of their offerings and the before and after mode shares associated with their implementation, including the reduction in single occupant driving. The vanpool subsidies at the seven companies ranged from $40 per month to full subsidy. The overall increase in vanpool usage for the five companies reporting vanpool shares was approximately 70 percent (King County Metro, 1998).

Not included in this average is the case of Microsoft, in Redmond, Washington, where a full-subsidy FlexPass program was initiated in 1996 for 16,000 employees and contractors (up to over 21,000 in October 1998). Results included formation of 35 new vanpool groups as of 1998, where before there had been none known of (King County DOT, 1998).

National Center for Transportation Research (NCTR) investigators have attempted to quantify for Puget Sound commuters the effect on vanpool mode choice of financial incentives. Their research used employer surveys and employee travel data generated by Washington State's Commute Trip Reduction program requirements. Over 200,000 employee travel choice observations from 1997

were analyzed along with a lesser number from 1999. Among the 1997 observations, 1.98 percent of employees were vanpooling, and of these, 71 percent received vanpool subsidies. Regression and logit models were developed. The formulations included both a vanpool cost variable and a yes/no variable indicating whether there was a rider subsidy available, with similar variables for other travel modes, and a demographic variable addressing work status.

A vanpool subsidy odds ratio of 1.089 was estimated from the 1997 data set, meaning that user subsidies were estimated to increase the likelihood of choosing the vanpool mode by 8.9 percent. The comparable odds ratio estimated from the smaller 1999 data set was 2.79, implying an increase of 179 percent in the likelihood of vanpooling with rider subsidy. The researchers concluded, based on statistical tests, that the magnitude of subsidy impact could not be reliably estimated. However, they found the results to be sufficient evidence of a positive impact (Wambalaba, Concas, and Chavarria, 2004).

Sensitivity to Fare Changes

Evidence concerning the related matter of sensitivity of vanpool and buspool ridership to fares is from the late 1960s and 1970s on one hand, and from the recent NCTR research on the other. Available investigations present a varied picture, one in which some reports and research results indicate little or no sensitivity to fares, but other reports and results strongly suggest a high vanpool fare elasticity, even into the elastic range in some instances. Overall, it seems reasonable to conclude that while vanpool fare elasticities may vary widely, their average is in the inelastic range but significantly larger than—indeed roughly double—the –0.4 average for local bus transit fare changes.[4]

In the late 1970s, a 20 percent fare increase for Commuter Computer vanpoolers in Southern California led to a 14 percent drop-off in vanpooling among those not receiving a subsidy. This equates to a fare elasticity of –0.83. Among the vanpoolers directly subsidized by ARCO, a major employer, the drop-off was only 3 percent. The ARCO vanpooler subsidy was set equal to their estimate of parking subsidy savings: $22.00 per employer per month at the time (Suhrbier and Wagner, 1979).

In Peoria, although a survey of buspool riders indicated that convenience, timing, speed and reliability were more important than price, a subsequent 21 percent fare increase, accompanied by a reduction in passenger amenities, resulted in a 21 percent decrease in ridership. In contrast, there was no evidence that incremental fare increases to cover increased costs had identifiable impact on ridership in any of the long-haul commuter buspool operations of the era (Pratt and Copple, 1981).

The NCTR research already described obtained fare elasticities for vanpool ridership of –0.61 from the 1997 Puget Sound employer/employee dataset, –1.34 from the smaller 1999 dataset, and approximately –1.14 from a separate nested logit model fare elasticity analysis. The data set was structured

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[4] A fare elasticity of –0.4 (the average for bus transit fare changes) indicates a 0.4 percent decrease (increase) in ridership in response to each 1 percent fare increase (decrease), calculated in infinitesimally small increments. The negative sign indicates that the effect operates in the opposite direction from the cause. An elastic value is –1.0 or beyond, and indicates a demand response that is more than proportionate to the change in the impetus. (See "Concept of Elasticity" in Chapter 1, "Introduction"; Appendix A, "Elasticity Discussion and Formulae"; and also "Response by Type of Strategy"—"Changes in General Fare Level" in Chapter 12, "Transit Pricing and Fares.")

such that these findings pertained to change in daily cost of vanpooling before application of any user subsidy. The point elasticity computation method was employed (Wambalaba, Concas, and Chavarria, 2004). Taken together, the Puget Sound results suggest a vanpool fare elasticity more or less on the cusp of elastic response, where a percentage decrease in fares results in a roughly equal percentage increase in ridership. The 1970s Peoria buspool case is an example of such a response, except that example is clouded by the simultaneous reduction in special rider amenities.

NCTR researchers also calculated mid-point elasticities for vanpooling in other regions, utilizing ridership and fare data furnished by transit providers. Both short-term and so-called "long-term" elasticities were computed for two separate fare increases by the VanGo operation in the greater Denver-Boulder area of Colorado, making adjustments for exogenous employment factors. In this region, there were no mandatory trip reduction regulations in the applicable 2000–02 time period. Roughly ¼ to ⅓ of riders received some form of subsidy. Computed short-term elasticities ranged from –0.3 to –1.7, averaging –0.8. The "long-term" elasticities for both fare increases were each close to –0.6 (Wambalaba, Concas, and Chavarria, 2004). The "long-term" elasticities appear to be for time spans that would, in typical transit fare elasticity evaluations, be considered "mid-term" at most.

The vanpool operation of the transit agency VOTRAN in Volusia County, Florida, sustained an average growth rate of some 74 percent during the FY 1998/1999 through FY 2002/2003 period. There was a monthly fare change from $28 to $30 in 2000. Looking only at the ridership of three vans that were in operation both before and after the change, representing 21 percent of the fleet at the time, a fare elasticity of –1.7 was computed. Elasticity computations were also made for the LYNX operation in the Orlando area. Here the results ranged from +4.7 to –2.0 (Wambalaba, Concas, and Chavarria, 2004). In both of these cases, small samples, upward growth trends, and other exogenous factors make the fare elasticity results of questionable value except as a demonstration of the variability possible.

The NCTR researchers make the point that vanpoolers face the problem that if a fare increase causes a vanpool member to drop out, the cost no longer covered by that rider may have to be distributed among the remaining riders, creating a "double whammy" effect. They note that unsubsidized vanpool fares are generally fairly large, such that a change is quite noticeable, and also that vanpool riders tend not to be captive riders without other options (Wambalaba, Concas, and Chavarria, 2004). These factors would all explain relatively high fare sensitivities. Looking at the available findings, and giving extra weight to the recent and less problematical Puget Sound area and Denver-Boulder VanGo results, average vanpool fare elasticities seem to mostly fall in the zone of –0.65 to –0.95, but with individual vanpool and buspool results ranging from no discernable impact to elastic response.

Preferences, Privileges, and Intangibles

When Pace VIP vanpoolers were asked what they liked most about the vanpool program, they gave convenience, cost savings, and avoiding driving as the top responses (15 percent each). Other survey respondents cited "less stress" and social aspects of the vanpool as being most important. Liked least was the constraint of a fixed schedule, the van itself, and the fare schedule (21 percent, 15 percent, and 11 percent of respondents, respectively) (Pace Suburban Bus Service, 1993).

Vanpool response is affected by the personalities of the driver and the riders. It has been stated that for a vanpool to become permanent, it must establish its own social identity and pattern of

personal relationships. Twelve percent of Pace survey respondents reported the social aspects of the vanpool to be what they most liked about the mode. The driver is a key to the success of a long-lived vanpool, with commitment, affability, leadership, and driving skills being cited as prerequisite characteristics. In the Pace vanpool survey, 92 percent of respondents indicated satisfaction with driver performance (Suhrbier and Wagner, 1979; Pace Suburban Bus Service, 1993).

All vanpools have the privilege of using any HOV facility open to carpools, plus the few open only to buses and vanpools. This is true, for all practical purposes, whatever the carpool occupancy requirements of the HOV facility. Nevertheless, this privilege may mean more when the HOV facility occupancy requirement is high enough to make carpool formation more bothersome than the minimum difficulty. Circumstantial evidence of this effect is provided by the sharp drop in vanpooling recorded when the occupancy requirement on I-66 in the Virginia suburbs of Washington was dropped from three or more occupants (3+) to two or more (2+), and when the occupancy requirement on the Katy Freeway in Houston was progressively lowered from buses and vanpools only to 2+ carpools. The circumstances are described and the outcomes are tabulated in Chapter 2, "HOV Facilities" under "Traveler Response by Type of HOV Application"—"Response to Changes in Vehicle Occupancy Requirements"—"I-66, Northern Virginia" and "Katy (I-10W) HOV Lane, Houston."

On I-66 in Virginia, average vehicle occupancy (AVO) on the facility was only moderately affected by the occupancy requirement change from 3+ to 2+, declining 11 percent in the AM peak period. However, the corresponding number of vanpools dropped by 25 percent, from 102 to 77 (Virginia Department of Transportation, 1996). The peak one hour drop in I-66 vanpools was 42 percent, a statistic that is perhaps suspect, as all of the 25-van peak period vanpool decline is shown as applying to the peak one hour traffic count.

The situation on the Katy (I-10W) Freeway HOV lane in Houston is more complex, as vanpooling in Houston was already in precipitous decline during the entire 1980s time period of interest. Houston vanpooling fell victim to the 1980s collapse of energy prices, recession in the local energy industry, and abandonment of vanpooling programs by affected employers.

The Katy HOV lane AM peak one hour vanpool count started at 66 when the facility opened in 1984 as a bus and vanpool lane only, increasing to 68 vanpools 6 months later. (Specially authorized 4+ carpools were allowed on at that time, but only 3 peak-hour carpools took advantage.) From then through 1986, as occupancy requirements were progressively loosened, vanpool volumes dropped by 44 percent, to 38 vans in the AM peak hour. This decline was 23 percentage points more than the corresponding reduction in Houston vanpooling, which was down 21 percent (estimated) during the same period.

The 23 percentage point differential between the Katy HOV lane percentage decline in vanpooling, and the less precipitous decline for Houston as a whole, held again in 1987. At this point, the Katy HOV lane AM peak hour vanpool count was 21 vans. Then in 1988, after the carpool occupancy requirement was *raised* from 2+ to 3+ in response to congestion, AM peak hour vanpool volumes increased to 24 vans after 6 months and 28 vans after one year, a 33 percent recovery. This recovery, although it brought Katy Freeway vanpool trends back in line with Houston trends (and possibly more), failed to stem long-term decline in Katy Freeway HOV lane use by vanpools. The peak hour vanpool vehicle count was back down to 19 vans after another 6 months, where it more or less stabilized for some time, as illustrated by the Chapter 2 tabulations (Christiansen and Morris, 1990, with unpublished worksheets; Texas Energy, 1978–88; Stockton et al., 1997).

RELATED INFORMATION AND IMPACTS

Extent of Vanpooling and Buspooling

Numbers of Vanpools

The first vanpool program is credited to the 3M Company, implemented in 1973 at their 3M Center outside St. Paul (Comsis and ITE, 1993). During the remainder of the 1970s and into the early 1980s, vanpooling grew dramatically. The number of vanpools in organized U.S. and Canadian programs doubled each year in the 1974 to 1980 period, reaching 8,100 in 1980. In early 1981, the U.S. Department of Energy estimated that there were about 12,183 such vanpools at 853 sites in the United States, under sponsorship of 697 employers, third parties, and other formal organizations (Pratt and Copple, 1981). In addition, as of 1979 it was thought that there might be 3,000 to 5,000 owner-operator vanpools (Pratsch and Starling, 1979). Taking the lower estimate for owner-operator vanpools, there may have been, circa 1980, some 15,000 vanpools in the United States.

A major impetus for the vanpool growth leading up to the early 1980s was the oil crises of 1974 and 1979, with associated gasoline shortages and longer term gasoline price increases (Pratt and Copple, 1981). With lower energy costs in the 1980s, vanpooling decreased. The most precipitous decline may have been in Houston, for energy-industry-related reasons described in the previous section. Houston vanpooling slipped from a peak of 1,885 vanpools in October 1981 to 453 in August 1988, a 76 percent drop, while in the rest of Texas, the vanpool census remained close to 580 vans (Texas Energy, 1978–88). A 1984 estimate placed the U.S. total at 10,000 vanpools with 100,000 participants. This estimate was generally accepted for the next 10 years. In 1991, the Nationwide Personal Transportation Survey found about 0.3 percent of all work trips nationally being made in a shared ride vehicle with 5 or more occupants (Comsis and ITE, 1993; van der Knaap, 1996).

Transportation Systems Management in general, and thus vanpooling specifically, received a boost following the passage of the Clean Air Act (CAA) of 1990 and its subsequent implementation (Comsis and ITE, 1993; van der Knaap, 1996). However, the mandatory aspects of the Employer Commute Options (ECO) element of the CAA, otherwise known as the Employer Trip Reduction program, were relaxed at the end of 1995. This relaxation was thought to have had an adverse impact on vanpooling nationwide, even though alternative voluntary programs (VEMPs) have a role in mobile source emissions reduction. The Vanpool Council of the Association for Commuter Transportation (ACT) estimated there were about 8,500 vanpools operating as of early 1999 (Boylan, 1999).

A more recent but less comprehensive review has concluded that the numbers are now again increasing (circa 2001–2002), and puts the total in the United States at 10,000 vanpools once more. This review attributes resurgence to Commuter Choice tax benefits now available in the United States (Enoch, 2003). Tax free benefits for vanpool costs were established at $60 per month by the Comprehensive Energy Policy Act of 1992. These benefits, like the similar transit pass benefits, were raised from $65 to $100 tax free per month for 2002 (with provisions for escalation) under the Transportation Equity Act for the 21st Century of 1998 (Federal Transit Administration, 2004).

Meanwhile, a 9-fold growth of the transit provider component of vanpooling between 1984 and 2001, measured in fleet size, is documented in the next section. This growth brings transit system vanpooling up to a total approaching 4,000 vans.

As if to underscore the difficulty of getting a good handle on total numbers of vanpools, especially owner-operator units, a 1995 study done in support of tax revenue analysis for the Commuter Choice tax benefit legislation arrived at a much larger estimate of vanpooling than any of those

reported above. Starting with the 1990 Census, this study estimated there were 309,886 employees vanpooling in 1995, a 0.3 percent mode share. That figure was translated into a vanpool parking demand nationwide of over 44,000 parked vanpools (KPMG Peat Marwick, 1995). This result is equivalent to a vanpooling estimate 3 to 5 times the size of any other published estimate encountered for any year between 1980 and 2002.

Vanpool Operating Organizations

Major shifts have taken place over time in the types and mix of vanpool operating organizations. In the mid 1970s, employer programs dominated and the only other type was owner-operator vanpools (Pratt and Copple, 1981). Third-party vanpooling independent of one-on-one employer involvement began to emerge in the 1976–78 period with the resolution of significant institutional barriers (Heaton et al., 1981; Pratsch and Starling, 1979). By the mid-1990s, the estimated mix of program types was 25 percent employer sponsored vans, 65 percent third party vanpools, and 10 percent owner-operator vans (van der Knaap, 1996).

The 1999 ACT estimate is composed of about 2,000 vanpools (24 percent) operated by individual employers, 4,000 (47 percent) operated through "municipal" organizations (including transit providers), and 2,500 owner-operator vanpools (29 percent). Note the definitional differences. Within all of these three categories, but particularly within the "municipal" category, many vans are now supplied and maintained through for-profit vanpool service organizations. At the time, the largest such provider was VPSI with some 3,500 to 3,700 vans. Enterprise was next with only 100 vans, and there were several with still smaller fleets (Boylan, 1999).

As noted, transit providers are included within the "municipal" category of the ACT vanpooling estimates. Examination of National Transit Database (NTD) totals for U.S. public transit agency vanpool operations indicates steady vanpool growth in this category on two counts. First of all, the size of individual operations has continued to grow overall, even though individual systems may have setbacks related to local economic conditions. Secondly, new vanpool system starts that more than counterbalance system closures have been expanding the number of operators. The combined effect is a transit provider vanpool growth from 447 vehicles in maximum service in 1984 to 3,932 vehicles in 2001, an expansion by almost 9 times in 18 years. Much of the growth has been fairly recent, as illustrated in Table 5-11 (Wambalaba, Concas, and Chavarria, 2004). The one caveat that must be emphasized is that, at least in some of the largest operations, average transit provider vanpool loadings have been decreasing (see Table 5-4, for example). Thus it is doubtful that there has been a 9-fold increase in transit system vanpool passenger trips.

Table 5-11 Growth in U.S. Transit Provider Vanpools Operated in Maximum Service

Year	Vanpools	Year	Vanpools	Year	Vanpools
1984	447	1990	612	1996	1,919
1985	488	1991	930	1997	2,545
1986	524	1992	1,045	1998	3,329
1987	581	1993	1,227	1999	3,580
1988	661	1994	1,503	2000	3,692
1989	486	1995	1,533	2001	3,932

Source: Wambalaba, Concas, and Chavarria (2004).

More in-depth transit provider vanpool statistics have been extracted for 1994. In that year, 55 out of 5,973 U.S. public transit agencies (0.9 percent) operated vanpools. The 2,361 vanpools involved (apparently a fleet size statistic) represented 2.0 percent of the total transit vehicle fleet. The 6 million trips that these vanpools carried were 0.07 percent of all transit trips, but produced 204 million passenger miles, 0.5 percent of the total, at an operating cost of $17 million, 0.09 percent of all transit operating expenses. The average one-way vanpool passenger trip length was 32.4 miles, compared to the average unlinked transit trip length of 4.9 miles (Gross and Feldman, 1996).

Relative Buspool Market Share

Buspooling surfaced as a recognized urban transportation mode in the late 1960s, at least half a decade before the invention of formal vanpool programs. For many markets, buspools have been superseded by vanpools with their lower unit cost and ability to serve smaller trip concentrations. Various buspool or subscription bus applications remain viable, however, as described under "Response to Vanpool and Buspool Programs"—"Buspools (Subscription Bus)." In 1990, a nationwide survey of commuter transportation organizations indicated that there was roughly one buspool commuter for every 10 vanpool commuters.

More precisely, the average buspool versus vanpool split of subscription commuting was 8.3 percent buspools and 91.7 percent vanpools for programs of public agencies including transit providers, 12.7 percent buspools and 87.3 percent vanpools for employer programs, and 2.9 percent buspools and 97.1 percent vanpools for Transportation Management Associations (TMAs) and similar nonprofit organizations (Spence, 1990). Although the survey in question was not primarily focused on determining mode shares, and thus not structured statistically toward that end, the information is some of the most detailed available for the distribution among ridesharing modes. It is reproduced in Table 5-12. Mode shares for the vast body of uninvolved companies and other uninvolved organizations are by definition not included.

Table 5-12 Average 1990 Ridesharing Mode Shares of Commuter Program Populations Served

Type of Organization	Buspool Share	Vanpool Share	Carpool Share
Non-Profits (TMAs; other ridesharing or commute management organizations)	0.02%	0.67%	13.77%
Private Companies (any entity offering commute programs to their employees)	0.7	4.8	6.4
Public Agencies (governments at all levels; regional bodies; transit agencies)	0.1	1.1	3.8

Note: Of survey respondents, 43 percent were in California, 13 percent in the remainder of the West, 22 percent in the Midwest, and 22 percent in the East. Many types of organizations being involved, the population served ranged from eighty (80) to seven million (7,000,000).

Source: Spence (1990).

Demographic Characteristics of Riders

Golden Gate, Maryland, Chicago, and Seattle vanpooler characteristics and attitudes that can be directly compared are included in Table 5-13. These data suggest that a high percentage of the van-

poolers in major metropolitan areas hold professional, technical, or management jobs. Vanpoolers holding either professional/management or support/sales jobs constitute 86 to 96 percent of these four samples.

The Golden Gate and Maryland vanpooler income data, and comparisons with overall service area demography, indicate a predominantly middle to upper-middle income market for vanpooling. The market is characterized by employees with stable employment and fairly regular hours traveling long distances (Dorosin, Fitzgerald, and Richard, 1979; Stevens et al., 1980). In suburban Chicago, Pace vanpool participants tend to have somewhat higher household incomes than other Pace transit riders, and to be largely indistinguishable from the general population (Michael Baker et al., 1997; Pace Suburban Bus Service, 1993).

Vanpooler characteristics surveyed in Minneapolis suggest income levels similar to Golden Gate and Maryland, but with fewer workers in the managerial and professional categories (47 percent as compared to 71 to 73 percent). Minneapolis demographic characteristics were found to be indistinguishable from those of auto commuters at the employment sites served. Of Golden Gate Corridor vanpoolers, 93 percent rarely worked overtime and 95 percent rarely needed their car for work; the corresponding percentages for Minneapolis were 86 percent on both counts. In Norfolk, 80 percent of vanpoolers reported regular working hours. Knoxville vanpoolers had lower incomes, only 20 percent were in managerial and professional categories, and 7 percent reported no automobile available (Heaton et al., 1981).

Table 5-13 Demographic Characteristics of Vanpool Riders in Major Metropolitan Areas

Characteristic	Golden Gate	Maryland	Seattle	Chicago
Average Age	40 years	41 years	42 years	44 years
Sex	63% male	57% male	55% male	46% male
Marital Status	78% married	72% married	n/a	n/a
Average Income ($ 1985)	$37,000	$45,000 (family)	$37,000	
Household Income ($ 1993)				$50 - $75,000
Occupation				
Professional, Technical	55%	58%	53%	32%
Manager, Administrator	16%	15%	14%	42%
Clerical, Sales	18%	19%	19%	22%[a]
Crafts, Operators, Laborers	8%	2%	10%	1%
Service	1%	0%	3%	1%[a]
Other	2%	6%	2%	1%
Overall Satisfaction (good/adequate or better)	99%	91%	n/a	94%

Note: [a] Sales included under "Service."

Sources: Dorosin, Fitzgerald, and Richard (1979); Stevens et al. (1980); Conway Associates (1986); Pace Suburban Bus Service (1993).

As the limited Knoxville data barely hints at, the vanpooler characteristics data of Table 5-13 cannot possibly be fully representative on all counts. The prevalence of vanpooling and buspooling in connection with large shipyards suggests that there must be another largely undocumented potential vanpooling and buspooling market spectrum.

In 1980, on the order of 200 owner-operator vanpools were carrying 15 percent of all 12,750 AM peak hour person trips entering the core area of Newport News, Virginia, dominated by the Newport News Shipyard and Drydock Company. Another 10 percent were carried in some 30 privately operated buspools (Pratt and Copple, 1981). Nearly half of the 25,000 military and civilian employees of the shipyard in Portsmouth, Virginia, were reported to be commuting via buses, vans, or carpools around 1990 (Keesling, 1991). In 1998, some 5 to 8 percent of civilian employees at the Bremerton, Washington, Naval Shipyard were commuting via buspools using a program in place since World War II (see "Response to Vanpool and Buspool Programs"—"Buspools (Subscription Bus)"). Other Bremerton shipyard workers are served by Kitsap Transit vanpools. Although a number of the van and buspool riders at the Newport News, Portsmouth, and Bremerton shipyards may be administrative personnel, a substantial percentage must be blue collar riders, given both the gross numbers involved and anecdotal evidence as well. Finally, there is the Talihina, Oklahoma to Ft. Smith, Arkansas shuttle, also reported under "Buspools (Subscription Bus)," operated for welfare-to-work poultry processing workers.

Data from the late 1970s third-party vanpooling demonstrations indicate that drivers tended to be slightly older, better educated, and from higher income households than passengers, with nearly all of them being married males (Heaton et al., 1981). In 1980, Massachusetts found that 74 percent of their regular and backup drivers were male (Morris, 1981). It is not known whether this aspect of the driver profile has changed over time or not.

Sources of New Ridership and Vanpooler Turnover

In examining sources of new vanpool (or buspool) ridership, it is potentially useful to differentiate between new or relatively new vanpool programs and ongoing programs. All but the most recent available surveys of vanpooler prior travel modes have focused on new or relatively new programs. For ongoing vanpools, new vanpoolers are needed only to replace driver and rider turnover. The only available information on turnover itself pertains to rates of turnover, presented toward the end of this subsection.

Prior Mode of Travel

When vanpools serve central area employment in corridors with heavy transit service, a substantial proportion of the vanpoolers may be drawn away from transit use. For example, both Montgomery Ward Chicago vans and Golden Gate Vanpool Demonstration Project vans serving the downtown San Francisco commute attracted over half their riders from conventional bus or rail services. This is shown in Table 5-14. The Golden Gate van-versus-bus competition was a deliberate attempt to head off further expansion of the deficit financed bus service without sacrificing highway lane productivity (Dorosin, Fitzgerald, and Richard, 1979; Johnson and Sen, 1977).

Table 5-14 also illustrates what is presumably the effect of external events. The shift in the latter stages of the Golden Gate Demonstration toward more vanpoolers who previously drove alone probably reflected not only a greater focus on suburban employment destinations, but also the impact of the 1979 gasoline shortage and price-at-the-pump increases (Dorosin, 1982).

Table 5-14 Former Commute Mode of 1970s Chicago and San Francisco Vanpoolers

	Chicago	San Francisco Golden Gate Demonstration		
Former Mode	Wards	First 9 Months (Downtown)	First 9 Months (Suburban)	Last 10 Months (All Markets)
Drove car alone	15%	10%	25%	33%
Carpool	29	23	74	33
Drop off/other	2	—	—	—
Regular transit	53	62	1	34
Buspool	—	5	—	—

Source: Johnson and Sen (1977); Dorosin, Fitzgerald, and Richard (1979); Dorosin (1982).

Most vanpool and buspool operations tap a predominantly new travel market as compared to more traditional mass transit. It is a market shared to a degree by carpooling, however. The late 1970s demonstration projects illustrate typical results, summarized in Table 5-15, with respect to ridership sources.

Table 5-15 Former Commute Mode of Late 1970s Demonstration Project Vanpoolers in Four Areas

Former Mode	Knoxville	Norfolk	Golden Gate[a]	Minneapolis
Drive Alone	36%	52%	15-33%	27%
Carpool	54	33	35-33	65
Transit	10	3	50-34	8
Private Hauler	0	12	0	0

Notes: [a] First 9 months - Last 10 months.

Source: Heaton et al. (1981), Dorosin (1982).

More recent findings are similar to those displayed in Table 5-15. The "Caravan" third-party vanpool program in Massachusetts launched 34 vanpools in 1980. Of its participants, 46 percent previously drove alone, 44 percent carpooled, and 10 percent took the bus (Morris, 1981). A 1987 survey in the Hampton Roads, Virginia, area found the prior mode of vanpool participants to be roughly one-third solo driving, one-third carpool, 13 percent transit riders, and somewhat less than a quarter "another vanpool." This may be one survey that reflects mainly turnover-replacement vanpooler characteristics (Keesling, 1991). Table 5-16 presents additional prior mode data that unquestionably reflects predominantly turnover-replacement vanpooler prior modes. This information was obtained in a circa-2000 cross-sectional survey of the vanpools of King County Metro, serving the central county of Greater Seattle, and presently and for many years the nation's largest vanpool operator.

Table 5-16 King County Metro Vanpooler Prior Commute Modes, Systemwide Sample

Prior Modes	Samples	Percent	Prior Modes	Samples	Percent
No Commute	24	1.9%	Bike	2	0.2%
Drive Alone	642	51.2	Walk	3	0.2
Carpool	263	21.0	Bus	192	15.3
Vanpool	127	10.1	Total	1,253	100%

Note: The existence of bike and walk prior modes suggests that some travelers surveyed may have been involved in a different (shorter) commute prior to vanpooling.

Source: Cambridge Systematics and Urban Analytics (2003).

The survey samples summarized in Table 5-16 were used to develop a behavioral model to estimate the former mode of vanpoolers, intended for application in conjunction with an experience-based vanpool usage calculation. The model shows high drive-alone operating cost to be an indicator of above-average likelihood to have switched from another high occupancy mode, while good employment accessibility via transit indicates above-average likelihood to have switched from public transit specifically. Higher household auto ownership is, as expected, associated with higher incidence of the drive-alone prior mode (Cambridge Systematics and Urban Analytics, 2003).

Based on the findings from new vanpool programs and the two available examples from ongoing programs, the one major compositional difference in the prior modes of new versus ongoing programs is that ongoing programs do have vanpooling as a significant prior mode. This presence of vanpooling as a former mode appears to be roughly counterbalanced by fewer prior carpoolers. In any case, prior solo drivers constitute roughly a quarter to slightly over a half of the vanpoolers and buspoolers in examples of commuting to non-CBD workplaces. Total prior auto drivers, counting in carpool drivers (but discounting alternate drivers), are in the 45 to over 65 percent range (Heaton et al., 1981; Morris, 1981; Keesling, 1991; Pratt and Copple, 1981; Cambridge Systematics and Urban Analytics, 2003).

Vanpooler Turnover

The Hampton Roads survey indicates a moderate degree of stability among ridesharing arrangements. Of those surveyed, two-thirds had been in current arrangements for 1 year or more while one quarter were enrolled for 6 months or less (Keesling, 1991). In the late 1970s third-party vanpooling demonstrations, passenger drop-out rates averaged well under one rider per month per van in Norfolk and Minneapolis, and less than 5 percent of all registered vanpoolers in the Golden Gate Corridor demonstration.

Nine months into the Golden Gate demonstration, 32 drivers had been used to operate 30 vans. The average driver turnover rate in Knoxville during the last 6 months of the demonstration was 2.6 drivers per month, representing 7 percent of the operating vanpools. Principal reasons for leaving a vanpool, as reported in the Minneapolis and Golden Gate surveys, appeared to be higher than anticipated vanpool fares, inability of low income passengers to pay a monthly fare, insufficient flexibility and convenience, and changes in commuting needs (Heaton et al., 1981).

The Spring of 1993 survey of Pace vanpoolers in suburban Chicago revealed that 4 percent had been Pace vanpool members for less than 3 months, 24 percent for 3 to 6 months, 66 percent for

6 months to one year, and 6 percent for over a year (Pace Suburban Bus Service, 1993). These results reflect in large measure the major influx of new vanpools, roughly a doubling of the fleet, when Sears moved to the suburbs about 6 months previous.

Even in a more stable situation, with vanpooling in operation for one to two decades and more, rider and vanpool turnover may be high. Puget Sound area operators identified an annual turnover in both ridership and vanpools of 40 to 50 percent. Most of this turnover is ascribed to job-related reasons (WSDOT, 2000), and probably results not only from job changes and residential relocations, but also reassignments within multi-location firms.

An important aspect of attracting vanpool participants is arranging matches. An alternative to computer matching is provided by the Commuter's Register. The Register is published every month for distribution to 70,000 to 100,000 commuters in Connecticut, New York, New Jersey, and Massachusetts. It has over 1,500 listings for ridesharing, as well as transit route and schedule information. Monthly telemarketer monitoring indicates a rideshare success rate of 25 to 35 percent. In a June 1990 survey, publishers found that of people finding a high occupancy solution for their commute, 36 percent began ridesharing, 8 percent increased the size of their pool, and 50 percent began taking the bus (Urban Transportation Monitor, July 20, 1990).

Indicators of Market Potential

Vanpools and buspools are almost exclusively oriented to serving work trips. Vanpools are normally most successful where one-way trip lengths exceed 20 miles, work schedules are fixed and regular, employer size is sufficient to allow matching of 5 to 12 people from the same residential area, public transit service is inadequate, and other conditions exist such as congestion or a shortage of parking. Nevertheless, strong employer commitment in cases of either employer-sponsored programs or partnerships of employers and third-party operators can help overcome conditions that are otherwise not ideal.

Vanpooler Trip Lengths

The average person trip lengths for vanpools tend to be much longer than for carpools or transit. Vanpool pickup and dropoff time becomes less onerous in the context of a longer overall trip, and cost savings increase, adding to the attraction of vanpools for long trips.

Practically all vanpool program one-way trip length *averages* fall within a range of 24 to 54 miles, with the lower end of the range being more common. Drawing upon data presented elsewhere in this chapter, it can be shown that this range covers the averages for the El Segundo, California, Aerospace Corporation employer vanpool program (35 miles); the third-party demonstrations in Knoxville, Minneapolis, Norfolk, and the Golden Gate Corridor (27 to 30 miles, see Table 5-3); and third party programs in Connecticut (36 miles) and Massachusetts (33 miles). (The Aerospace Corporation and Connecticut values are van rather than person mileage, and thus somewhat overstated.) The 7 largest transit provider and other public agency vanpool programs as of 2002 also fall within the 24 to 54 mile range (see Table 5-5 and the discussion immediately following). These large programs are, in fact, what has been used here to define the range (National Transit Database, 2002).

These vanpool person trip length figures also bracket the results of a 1990 nationwide survey of commuter transportation organizations, in which average vanpool one-way trip lengths were reported as 32 to 35 miles (Spence, 1990). The 3M employer vanpool program is the most notable

exception: in the 1970s their person trip lengths averaged approximately 17 miles one-way (Owens and Sever, 1974 and 1977). The 24 to 54 mile vanpool person trip length range stands in contrast to the national solo-driver average one-way commute trip length of 10.5 miles reported in the 1990 National Personal Transportation Survey, and the transit rider unlinked trip average of about 5 miles.

Service Attractiveness Guidelines

The ratio of maximum passenger pickup and delivery time to line-haul travel time was proposed in the early days of vanpooling as a useful rule of thumb measure with which to judge the attractiveness of individual vanpools and buspools. This "Utility Ratio" or "service ratio" describes the travel time quality of the vanpool trip in terms of the ratio of residential pickup time to line-haul time. Although users accept long vanpool travel times, there is a limit to the time spent picking up and dropping off passengers, perhaps relative to driving time with a full load or perhaps in the absolute, that will be tolerated. The Utility Ratio measure assumes the limit is relative. This concept is examined further within the case study, "The 3M Company Employer Based Vanpool Program."

Pace vanpoolers complained about the time required to pick up passengers in a 1993 survey (Pace Suburban Bus Service, 1993). In the original 3M pilot vanpooling program, vanpools with a ratio of residential pickup time to line-haul time of up to 1.0 proved successful, while problems were encountered with forming vanpools in areas where the ratio would be greater than 1.0 (Owens and Sever, 1974 and 1977). Other evidence, provided by Maryland vanpooling and buspooling experience, suggests the Utility Ratio is often lower than 1.0. The total time spent picking up and dropping off passengers was 14.0 minutes for the average Montgomery County vanpooler compared to 40.1 minutes enroute time, an average Utility Ratio of 0.35. The corresponding figures for other Maryland vanpoolers were 22.6 minutes pickup or dropoff and 37.4 enroute, for an average Utility Ratio of 0.60 (Stevens et al., 1980). Although the Utility Ratios for individual vanpools assuredly vary significantly around these mean values, it is easy to imagine that most lie well below 1.0.

There is some evidence to support the alternative proposition that the tolerance limit for time spent picking up and dropping off passengers is an absolute, rather than relative, limit. In the Minneapolis third party vanpooling demonstration project analysis, it was found that the absolute circuity time increment was roughly constant regardless of commute distance. It has been noted that this finding was consistent with empirical evidence from Australia on carpool spatial structure. In Minneapolis, the average vanpool time increment over the drive-alone time was found to be about 12 minutes for vanpool passengers and 22 minutes for van drivers (Heaton et al., 1981). A much simpler measure has also been offered: the suggestion that the economics and time analyses only begin to look favorable for vanpooling when one-way trip lengths approach 20 miles (Comsis and ITE, 1993).

Theoretical Market Potential

The 1993 Federal Highway Administration report *Implementing Effective Travel Demand Management Measures* estimated the potential market for vanpooling by looking at the distribution of U.S. worker population by size of employer and one-way trip distance. (The distribution is reproduced in Table 5-17). The analysis relaxed the 20-mile threshold, and assumed that the potential vanpool market would include trips of 11 or more miles for the largest employers, 16 or more miles for medium-large employers, and 21 or more miles for medium-small employers. The market potential thus calculated was 11 percent of all U.S. workers.

Table 5-17 Cumulative Distributions of U.S. Work Trips by Employer Size, Trip Length, and Both Parameters Combined

Employer Size	Trip Distance (in Miles) / Cumulative Distribution	30+	21+	16+	11+	6+	All
		3.4%	8.4%	14.9%	25.0%	46.3%	100.0%
500+	25.0%	0.8%	2.1%	3.7%	6.3%	11.6%	25.0%
100+	50.0%	1.7%	4.2%	7.5%	12.5%	23.2%	50.0%
50+	61.6%	2.1%	5.2%	9.2%	15.4%	28.5%	61.6%
All	100.0%	3.4%	8.4%	14.9%	25.0%	46.3%	100.0%

Source: Comsis and ITE (1993).

Next, a success rate of 50 percent of the resulting market was assumed. With this, a vanpooling goal of 5 percent of the U.S. worker population was obtained (Comsis and ITE, 1993). Restricting the analysis to include only those workers with trips of more than 20 miles, but with the same assumed success rate, yields an alternative overall vanpooling goal of 2 to 3 percent of U.S. (or region-wide) work trips.

It is instructive to compare actual vanpooling experience in the Greater Seattle area of Puget Sound with these theoretical market potential estimates of 5 percent, or alternatively 2 to 3 percent, of work trips. The observed Greater Seattle vanpool mode share had already reached 2 percent of the overall commuter market as of 1999 (WSDOT, 2000; Enoch, 2003). This market share has been achieved in the context of geographic and institutional factors capable of being replicated in large measure but not completely in other areas. The geographic feature that cannot be replicated is a large body of water immediately west of Seattle and Everett that is directly crossed only by ferries, which in turn offer priority vanpool access with substantial time savings including certainty of getting on board in peak loading hours. The Washington State Ferries also waive vanpool vehicle and driver fares for registered vanpools. As previously noted, ferries in 1999 were carrying 11 percent of public system vanpools and roughly 60 percent of the approximately 200 private vanpools (WSDOT, 2000).

The institutional factors of the Puget Sound area, largely amenable to replication, include an extensive HOV lane system and—most importantly—a series of legislative acts that cause many large employers to proactively support alternative transportation for their employees, require adequate public facilities for new developments (leading to further travel demand reduction efforts), and provide trip reduction support and assistance (WSDOT, 2000; Enoch, 2003; Samdahl, 1999; Kavage and Samdahl, 2004). The importance of this state legislation in encouraging vanpooling is underscored by the previously mentioned statistic identifying employers involved with Commute Trip Reduction as being served by 93 percent of area vanpools (WSDOT, 2000), implying relatively little vanpooling to non-involved employers.

The Washington State Department of Transportation conducted a study of the market potential for vanpooling in the Greater Seattle area that concluded a 7 percent market share could reasonably be attained. This estimate encompasses all those projected (on the basis of a survey) to rely on the automobile for the trip to work, commute at least 10 miles each way, and have an interest in van-

pooling. To achieve this market share would require major penetration of worksites not presently involved with Commute Trip Reduction, to the point where a majority of vanpools would be focusing on such employers (WSDOT, 2000).

Employer Participation

The one major consideration not addressed by these theoretical market potential analyses is the propensity for *employers* to get (or not get) involved in vanpooling programs even when urged, either as employer-sponsors or in partnership with third party operators. Under present conditions, a relatively small proportion of U.S. employers overall are under any type of mandatory trip reduction requirement.

Although voluntary rates of employer participation have never been researched for vanpool programs per se, the proportion of larger and smaller firms offering ridesharing assistance in the early 1980s was examined in Atlanta, Cincinnati, Houston, Portland, and Seattle as part of the National Ridesharing Demonstration Program. The average rate of employer participation in ridesharing was found to be 36.8 percent for firms with 100 or more employees and 4.0 percent for smaller firms (Booth and Waksman, 1985). Applying these percentages to the national goal calculations presented at the start of the previous subsection results in horizon estimates for nation- or region-wide vanpooling somewhat less than 2 percent of work trips for the 5 percent goal, and 1 percent for the alternative 2 to 3 percent goal.[5] A return to nationwide mandatory trip reduction would move these horizon estimates closer to the national goal calculations. It bears repeating that the present national utilization of vanpooling is estimated at some 0.3 percent of all work purpose travel.

Impacts on VMT, Energy, and Environment

Vanpooling is the least energy intensive of four-or-more-wheeled urban transportation modes, which is to say that vanpooling is estimated to consume the least propulsion energy per passenger mile. The reduction in number of vehicle trips and VMT that results from commuters switching to vanpooling, taking into account prior travel modes and all possible energy requirements, leads to substantially reduced fuel consumption. There has not been comparable evaluation of buspooling, but buspools probably have an energy intensiveness similar to or somewhat better than conventional bus service, depending on the extent to which the bus vehicles are or are not parked at the trip origins and destinations (Pratt and Copple, 1981).

A 1980–81 analysis of the then-new third-party vanpool program in Massachusetts found the daily round-trip VMT per participant had dropped on average from 43.1 to 10.5 miles, a reduction of 76 percent. These estimates were the result of taking into account the mix of previous modes of travel and the access mode to the vanpool; the average vanpooler round trip was actually 66 miles. The 76 percent decrease in VMT was somewhat more than the estimated percentage decreases in fuel consumption and emissions, because the van and short-distance auto-access trips had higher per-mile fuel use rates than long automobile line-haul trips. Each Massachusetts vanpool saved an average of 26.2 gallons of gasoline daily or about 6,548 gallons per year. For

[5] Employer participation calculations such as these are applied in the "Projected Effectiveness of Individual TDM Strategies" section of the "Implementing Effective Travel Demand Management Measures" report (Comsis and ITE, 1993), and are examined further in Chapter 19, "Employer and Institutional TDM Strategies," of this *TCRP Report 95,* "Traveler Response to Transportation System Changes" Handbook.

each vanpool group, the fuel reduction was 66 percent with a per commuter reduction of 1.9 gallons per day.

The same study also calculated hydrocarbon emissions reductions from the Massachusetts vanpools using information on VMT reduction and vehicle cold starts. Each vanpool was estimated to reduce the non-methane hydrocarbon (NMHC) emissions by 2.62 pounds each day of operation. On an annual basis, this equated to an emissions reduction of 0.33 tons (55 percent). For the average vanpool group, the 4.79 pounds per day released by the vanpoolers in their previous modes dropped to 2.17 pounds per day for the vanpool group (Morris, 1981). Both the energy and emissions savings would be different and presumably less today, with nearly two decades of automotive fuel economy and pollution control improvements. Nevertheless, these early 1980's computations serve as a model for taking into account prior mode and access mode influences that are all too often inappropriately ignored.

The Pace VIP vanpool program serves as a component of the Chicago region's air quality improvement program. The 1996 daily impacts estimated for the 252 vanpools then in operation are listed in Table 5-18. The calculations are adjusted for mode of access. They do not rely on vanpooler reports of prior mode, because of the large number of person trips involved that have relocated to the suburbs from Chicago's central area. Instead, the estimation relies on rider survey reporting of current alternative modes. The estimated volatile organic compounds (VOC) reduction of 0.0666 tons per day constitutes 2.5 percent of the 2 to 3 tons budgeted for Transportation Control Measures (TCMs) in the 15 Percent Rate of Progress SIP for 1996. The TCM-generated emissions reductions are a small but still vital portion of the region's overall emissions reduction budget (Michael Baker et al., 1997).

Table 5-18 Estimated Air Quality Benefits of 1996 Pace VIP Vanpool Program

Measure of Effectiveness	Effectiveness (Daily Impacts)
Number of Vanpools	252 vanpools
Number of Vanpool Commuters	2,423 commuters
Daily Vanpool Person Trips	4,846 person trips
Vehicle Trip Reduction	2,529 vehicle trips
Vehicle Miles of Travel (VMT) Reduction	119,956 vehicle miles
VOC Emissions Reduction	0.0666 tons
NOx Emissions Reduction	0.156 tons
CO Emissions Reduction	0.639 tons

Note: VOC reduction adjusted for cold starts for 38 percent of participants and model improvements.

Source: Michael Baker et al. (1997).

The cost of obtaining the emissions reductions credited to Pace VIP vanpooling is essentially limited to the purchase price of the vanpool vehicles, given that operating costs are almost entirely supported through fare revenue. With 252 vehicles having a standard useful life of 4 years and a replacement cost of $27,000 each, the cost of reducing 0.0666 tons of VOC emissions is estimated to be $7,000 per day, or $51 per pound of VOC emissions (Michael Baker et al., 1997). If the cost were to be distributed over other benefits, such as congestion mitigation, parking needs reduction and mobility, the emissions reduction component would obviously be much reduced.

Revenue/Cost Considerations

Vanpooling has established itself as a comparatively cost-effective commuter service option. Although wide variation is possible in vanpool expenses, including program administration costs in particular, the use of a volunteer driver helps to hold costs down. Most employer-sponsored vanpool programs have been priced so as to recover vehicle and operating costs, but typically provide a private subsidy covering costs of program administration and support. Some third-party programs seek to cover all costs, but most have elected to use public subsidies for certain program administration, overhead and promotional costs, or alternatively, for capital costs. For transit providers operating vanpool systems, the vanpools typically enjoy a high fare recovery ratio, which contributes to the overall transit agency performance (Suhrbier and Wagner, 1979; Michael Baker et al., 1997). Owner-operator vans are normally supported by user charges alone, although the owner may choose to absorb certain costs to keep the vanpool viable if the vehicle has other, personal value.

The FTA's Capital Cost of Contracting program helped to fund the vanpool program of the San Diego Association of Governments (SANDAG). Each of the 130 vanpools operating in mid-1997 received a $300 per month subsidy from SANDAG. Participants in the FTA's subsidy program are required to report monthly ridership, travel time, and mileage data of the subsidized vanpools for the National Transit Database (MetroPool, 1997).

Federal funds constituted 80 percent of the 1997 Pace (suburban Chicago) $28.6 million VIP vanpool capital budget. Congestion Mitigation and Air Quality (CMAQ) funds were the major component, along with Section 3 discretionary and Section 9 apportionment funds, and Surface Transportation Program and other flexible funds. The balance of the capital program was made up with Regional Transit Authority discretionary funds and Illinois DOT funds. Operating costs of the core Pace VIP vanpool program are virtually all covered by fares: the cost recovery ratio was 92.42 percent in 1995 and 105.27 percent (estimated) in 1996. The overall vanpool cost recovery ratio is lowered somewhat by the inclusion of ADvAntage vanpools, which serve the physically and mentally disabled having regular employment or workshops to attend. The ADvAntage vanpools posted a 69 percent cost recovery ratio for 1995–96, still a considerable savings, given Americans with Disabilities Act (ADA) requirements, over the cost of serving these trips with regular ADA paratransit. The overall Pace cost recovery ratio for 1995–96 was 36 percent (Michael Baker et al., 1997).

King County Metro annual vanpool program operating costs were $2.6 million in 2000. These costs were covered by vanpool fares, grants, and income from the self insurance reserve and sale of vans over 5 years old. These same sources also covered 45 percent of the $1.5 million annual administration costs. The other 55 percent was covered by public subsidy (Enoch, 2003).

Most vanpool programs either charge a flat per person fee or a distance or zone based fare. Some programs may have additional fees for added services such as guaranteed ride home programs. Typically monthly fares as of 1998–99 were in the $70–$120 range. Specific examples are provided in the "Response to Vanpool and Buspool Programs" section and in the case studies. Third-party providers keep fares low through economies of scale with large fleets and the benefit of federal capital subsidies. Employer sponsored programs keep fares low by absorbing administrative, insurance, and sometimes maintenance costs.

Vanpools have administrative time costs associated with their formation and the replacement of lost riders. Employee transportation coordinators can play an important role in minimizing these costs. Third-party providers often help with the marketing and administration of programs, including the recruitment of drivers and riders (Comsis and ITE, 1993).

Vanpool subsidies, particularly within employer-sponsored programs or partnerships of employers and third-party operators, should be taken in context with benefits. A number of expanding companies report savings in parking space requirements and reduction of localized traffic congestion among other benefits. In a self-assessment covering 160 corporations, a majority of employers rated their vanpool programs as definitely cost effective, even when objective analyses showed that most employers did not achieve positive or even break-even revenue returns. Sixty percent of the firms paid less than $10,000 per year to support ridesharing programs, including administration (Wegmann, 1989).

In the circa 1980 third-party vanpool demonstrations, it was found that among other cost savings for vanpoolers themselves was the ability to sell a household vehicle or defer purchase of a new one. In Norfolk, 5 percent of vanpool passengers and 21 percent of drivers sold a vehicle, with 28 and 29 percent, respectively, claiming that they had deferred purchase of a new vehicle. Percentages for Knoxville and the Golden Gate Corridor were lower but still substantial (Heaton et al., 1981; Dorosin, Fitzgerald, and Richard, 1979).

ADDITIONAL RESOURCES

The Comsis Corporation and Institute of Transportation Engineers report, *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience,* prepared for the Federal Highway Administration and the Federal Transit Administration, provides a comprehensive review of vanpooling as a strategy, its market and cost effectiveness, and parametric estimates of travel and traffic impact potential. Published as report DOT-T-94-02, the document includes case studies of both employer based and third-party vanpooling (Comsis and ITE, 1993).

Vanpooling—A Handbook to Help You Set Up A Program At Your Company is available on the FTA website at http://www.fta.dot.gov/fta/library/planning/VANPOOL/vanpool.html. This manual, prepared by Commuter Transportation Services, Inc., provides program design and implementation procedures targeted toward employee transportation coordinators who are in charge of vanpooling efforts and choose to lease vanpool vehicles (Commuter Transportation Services, 1993).

The Texas Transportation Institute report, *Transit-Operated Vanpools in the United States: Selected Case Studies* provides encapsulated case-by-case and summary survey findings with emphasis on the institutional and funding aspects of transit provider vanpool operations (Higgins and Rabinowitz, 2002). The on-line *TDM Encyclopedia* at www.vtpi.org examines vanpooling in the context of ridesharing/TDM overall with references and periodic updates (Victoria Transport Policy Institute, 2004). Chapter 19, "Employer and Institutional TDM Strategies," of this *TCRP Report 95,* "Traveler Response to Transportation System Changes" Handbook will also cover vanpooling and buspooling in the overall TDM program context.

CASE STUDIES

The 3M Company Employer Based Vanpool Program

Situation. The 3M Company, St. Paul, Minnesota, in 1973 began an experimental vanpooling program for employees not conveniently served by transit. The 3M Center involved consisted of 20 buildings housing approximately 10,000 administrative and laboratory employees, located on

a 400 acre site at the eastern edge of St. Paul. The center had facilities to park 8,000 vehicles. A 1970 Home-Work Travel Survey showed only 43 persons using transit, and a 1.24 average auto occupancy.

Actions. Standard 12-passenger vans were purchased by the 3M Company and provided to vanpools formed on the basis of a special pilot program questionnaire. Drivers were 3M employees willing to pick up and drive at least 8 other employees to and from work. Vehicle maintenance and preferential parking for the vans were provided by the 3M Company. Drivers' responsibilities included picking up and delivering passengers on a set schedule, arranging for service and maintenance of the van, keeping at least 8 paying passengers in the vanpool, and providing for standby drivers. In exchange for their responsibilities, the drivers were not required to pay the approximately $20 to $30 monthly fare charged other passengers, were given personal use of the van during non-work hours for a reasonable mileage rate, and could keep the fares for any passengers over the minimum of eight.

Analysis. The 3M Company undertook and made available detailed evaluations of the 3M vanpool and overall ridesharing program in the initial years. In April 1974 and August 1976, survey questionnaires were given to all participants in the Commute-A-Van program. Responses were obtained from 437 and 566 users respectively. The full array of employee mode shares for the journey to work was tracked through 1985.

Results. The 3M vanpooling endeavor began as a 6 van pilot project in April, 1973. As a result of the success of the original experiment, the number of vans was gradually increased to a total of 86 carrying over 800 riders as of January 1977, the date of the second status report. When surveyed in 1974 each van was carrying an average of 11.36 persons for an average monthly fare of $23.72 and an average round trip distance of 49 miles. The operating ratio (total operating costs divided by operating income less amortization) was 0.88. The 86 vanpools recorded in 1977 reduced the demand for parking by 735 spaces and saved well over 2,250,000 vehicle miles of travel and 190,000 gallons of gasoline per year.

Responses were virtually identical for both the 1974 and 1976 surveys of vanpool users. Of those who responded, 49 percent previously drove to work alone, 7 percent drove with a passenger, 23 percent were in a rotating carpool, 16 percent were a carpool rider, 4 percent were dropped off at work, and 1 percent rode transit. Eighty percent of the respondents found the vanpool more convenient than their former means of getting to work and 97 percent intended to continue using the vanpool on a permanent basis. The average travel time for vanpoolers before using the van was 28 minutes compared with 38 minutes afterwards. One quarter traveled over 20 minutes longer after joining the vanpool.

Vanpool program benefits were numerous and well distributed. Participating commuters saved money, reduced the tensions associated with commuting, and freed a car for use by other family members. Non-users benefited from the reduction in congestion and parking demand in and around the 3M Company. The Company itself was able to expand without adding more roadway and parking capacity.

More . . . For use in vanpool planning a Utility Ratio was derived, defined as the passenger-pickup time divided by the line-haul time. It was anticipated that the larger the ratio, the more difficult it would be to form and operate a vanpool. Some problems were encountered in forming vanpools where the Utility Ratio was greater than 1.0, but ultimately many operating vans fell into this category. In 1974, when 52 vans were operating, the average Utility Ratio was 1.18 and the Utility Ratio breakdowns were as recorded in Table 5-19.

Table 5-19 3M Vanpool Utility Ratio Breakdowns for 1974

Utility Ratio	Average Pick-up Time	Average Line Haul Distance	Number of Vans	Percentage of Vans
0.35-0.75	15.9 minutes	21.5 miles	10	19%
0.76-0.99	26.6	22.2	7	13
1.00-1.20	25.8	16.4	14	27
1.21-1.60	29.0	14.8	11	21
1.61-2.40	33.4	13.2	10	19

Table 5-1 in the main "Response to Vanpool and Buspool Programs" section documents the effectiveness of the 3M program over time. Peak vanpool usage was circa 1980, with effects of 1970s energy shortages not yet worn off, when 10.3 percent of all employees commuted by vanpool. Vanpool usage at the site dropped from 135 vans in 1980 to 105 vans in 1985. Company managers speculated that high employee turnover, relocations, and the introduction of flextime were to blame for the decline. In 1995, of the nearly 13,300 employees, 525 or 3.9 percent used 68 vanpools to travel to work.

There is another possible interpretation, although lacking recent data on pick-up and line-haul time and mileage breakdowns, it involves considerable speculation. Two rules of thumb applied as indicators of likely vanpool attractiveness are that the passenger-pickup time to line-haul time ratio should be less than 1.0, or that the line-haul distance should be at least 20 miles. Either of these criteria suggests that only a third of the 1970s 3M vanpool users, as broken down in Table 5-19, were vanpooling under inherently attractive circumstances. One-third of the peak 1980 vanpool share of 10.3 percent is 3.4 percent, very close to the 3.9 percent achieved in 1995. This may be purely coincidental, or it may validate the rules of thumb, suggesting that 3M vanpooling was operating in a "supersaturated" mode in the 1970s, perhaps by virtue of the energy crises combined with a corporate vanpooling ethic and enthusiasm that may ultimately have proved hard to sustain.

Sources. Owens, R. D., and Sever., H. L., *The 3M Commute-A-Van Program: Status Report.* Reprinted by the Federal Highway Administration, U.S. Department of Transportation, Washington, DC (May, 1974). Also *Status Report II.* 3M (January, 1977). • Kuzmyak, J. R., and Schreffler, E. N., "Evaluation of Travel Demand Management (TDM) Measures to Relieve Congestion." Prepared by Comsis Corporation and Harold Katz and Associates for the Federal Highway Administration, Washington, DC (February, 1990). • Comsis Corporation and the Institute of Transportation Engineers, "Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience." Prepared for the Federal Highway Administration and Federal Transit Administration, Washington, DC (September, 1993). • Minnesota Mining & Manufacturing Co., "3M Center Fact Sheet: Year-end 1995." Maplewood, MN, http://www.mmm.com/profile/looking/center.html (Webpage accessed July 9, 1998). • Bhatt, K., and Higgins, T., *An Assessment of Travel Demand Management Approaches at Suburban Activity Centers: Final Report.* Prepared by K. T. Analytics for the Transportation Systems Center, Cambridge, MA (July, 1989). • Certain interpretations added by Handbook authors.

Golden Gate Vanpool Transportation Demonstration Project

Situation. The Golden Gate Vanpool Transportation Demonstration Project grantee, the Golden Gate Bridge, Highway and Transportation District, was and is a multi-modal transportation agency that operates fixed route buses and passenger ferries, sponsors club buses, and controls the Golden Gate toll bridge. The project area is the congested corridor north of San Francisco, with an exclusive, toll-free HOV lane leading via the toll bridge toward the San Francisco employment center. The project was designed to test the feasibility of a public sector transportation agency promotion of vanpool group formation, and of "seeding" owner-operator vanpool groups via transition from initial third-party operation, after a 6 month introductory period. An overarching objective was to decrease vehicle demand on the bridge without requiring further expansion of the District's deficit financed transit service. The demonstration ran for 33 months, October 1977 through June 1980. Results of the latter part of the project were impacted by the 1979 gasoline shortage and price increases, which had a positive effect on the demand for ridesharing.

Analysis. Conclusions were based on preexisting data bases (more complete for corridor travel than for intra-suburbs travel), bridge vehicle and occupancy counts, vanpool application form data, initial (at time of joining) and supplementary vanpooler surveys, and on-board trip logs. The initial 9 months were analyzed and reported in detail, with further conclusions developed at the end of the project.

Actions/Results. A variety of methods were used in a promotional campaign launched at the beginning of the project to attract vanpooling applications. Toll booth handouts proved the most cost-effective at $11 per application generated, followed by bus handouts ($13), employer contacts ($17), and downtown street demonstrations ($17). The least cost-effective strategies were shopping center demonstrations ($100), fair booths (no applications), and the following approaches which cost over $200 per application (in increasing order of expense): take-one holders in public places, newspaper advertising, free rides, community meetings, and kiosks (3 kiosks for one application). Not measured were the effect of news releases and synergistic effects. Of the 1,350 applicants for vanpool membership in the first 9 months, 287 (21 percent) became active vanpoolers. The corresponding 33 month totals were 3,926 applicants with 804 (20 percent) becoming active vanpoolers. Half of all applicants submitted their applications following a telephone contact with staff, rather than in response to a specific marketing activity. Fifteen percent of all vanpoolers in project vanpools never went through the formalities of application submission, and another 20 percent did not submit applications because they were in project-assisted vans not furnished by the project. Many came through employer coordinators, driver efforts, and word of mouth.

Driver incentives were a free commute and limited personal use of the van for 17.5 cents per mile (price as of 3/1/80). Thirty vanpools were formed in the first 9 months, with an average occupancy of 9.6 persons. Five of these were terminated because of inability to achieve full ridership (3 vans), inability to replace riders transferred to another work site, and end of a school year (State College destination). Luxury vans with airline type seats were initially in greater demand than bench seat vans, despite a 60 mile round trip monthly fare of $44 versus $36, but this preference dissipated later in the project. Initial demand split into two markets, the San Francisco commute (20 vans less 2 terminations) and intra-suburbs (10 vans less 3 terminations). In May 1978, of 40,400 inbound Golden Gate Bridge commuters between 6 and 10 AM, 59.4 percent used 1 or 2 occupant autos, 26.6 percent used public transit, 35 percent were in 3+ carpools, and 0.5 percent used project vanpools. Project vanpoolers constituted 0.1 percent of the intra-suburbs market. A socio-economic profile of May 1978 vanpoolers, with comparison to bus and ferry commuters, is given in Table 5-20.

Table 5-20 Socio-Economic Characteristics of Golden Gate Vanpoolers, Bus Riders, and Ferry Passengers

Socio-Economic Parameters (1978 Dollars)	Marin County - San Francisco Bus Riders	Larkspur Ferry Passengers	Golden Gate Vanpoolers
Income under $15,000	30% (sic)	24%	14%
$ 15,000 - $24,999	31 (sic)	24	40
$25,500 or over	29 (sic)	52	45
Male/Female	63/37	73/27	63/37
No auto	0	2	0
1 auto	47	41	33
2 or more autos	53	57	67

Source: Dorosin, Fitzgerald, and Richard (1979), as presented in Pratt and Copple (1981).

By the end of the 33 months, 148 project and project-assisted vanpools had been formed. Their apportionment among markets served was more evenly distributed than for the initial vanpools, with 53 percent serving San Francisco employers, 40 percent traveling suburbs to suburbs, and 7 percent serving reverse commuting out from San Francisco. Reasons for the shift to suburbs-to-suburbs orientation included a change in marketing emphasis, greater public awareness, and a 53 percent increase in the cost of gasoline, which made vanpooling cost effective for shorter distances. Of vanpools formed, 25 percent terminated prior to the end of the project. Vanpools successfully transitioned to other third-party or owner-operator status totaled 34 percent at the end of the project; 24 percent were still operating as project vanpools, and 17 percent were project-assisted vanpools that had never been formal project vanpools. At the conclusion of the demonstration, the 111 operating vanpools were carrying 1,232 commuters (804 from applications, 428 accepted without formal application). Although nearly half of the early vanpoolers previously used public transit, Golden Gate transit bus ridership increased throughout the vanpool project. No direct transit service was available for the markets covered by 44 percent of the vanpools. Prior modes of vanpoolers at both the beginning and the end of the project were given in Table 5-15 of the "Related Information and Impacts" section.

The average round trip for the San Francisco commute was initially 79 miles for bench seat vans and 93 miles for luxury vans. The corresponding intra-suburbs averages were 70–73 miles. The average round-trip distance steadily decreased as the program matured, gasoline prices increased, and the market shifted. In the initial 9 months, prior to the 1979 oil crisis, vanpooling was found to be always less expensive than one or two occupant auto commuting, less expensive than bus or three occupant carpool commuting for round trips of over 30 miles or so, and occasionally less expensive than five occupant carpool commuting. These cost comparisons take into account that the average vanpooler was found to ride only 4 out of 5 days, thus increasing the effective vanpool user cost. Travel time averaged only a minute longer than for prior modes, but former transit riders saved an average of 9 minutes while former auto commuters added nearly 11 minutes. Thirteen percent of all vanpoolers sacrificed 20 minutes or more. Riders themselves ranked vanpooling faster than bus or club bus, slower than driving alone, and equivalent to a carpool. At the end of 9 months, survey results suggested that 8 percent of all vanpoolers had deferred replacing an auto, 7 percent had avoided buying an auto, 1 percent had sold a vehicle, and 4 percent planned to.

More . . . Little progress was made during the initial months on the demonstration effort to transition individual vanpool groups from the project's vanpool incubation period, intended to be only 6 months, to owner-operator status. By the end of the project, however, 51 vanpools, 42 percent of all vanpools formed, had been transitioned into either owner-operator (or leased) vanpools, vanpools of the Bay Area RIDES third-party operation, or employer sponsored vanpools. It would appear that the transition was greatly facilitated by the 1979 oil crisis. In any case, the demonstration project as a whole was found worthy, and was transitioned into a permanent Ridesharing Division within the Bridge District.

Sources. Dorosin, E., Fitzgerald, P., and Richard, B., *Golden Gate Vanpool Demonstration Project.* Prepared by Crain & Associates, Inc. for the Urban Mass Transportation Administration, Washington, DC (July, 1979). • Dorosin, E., *Golden Gate Vanpool Transportation Project: Final Report.* Prepared by Crain & Associates, Inc. for the Urban Mass Transportation Administration, Washington, DC (September, 1982).

Connecticut's Easy Street® Vanpool Program

Situation. The Connecticut Department of Transportation and the non-profit rideshare brokerage The Rideshare Company, serving greater Hartford and Eastern Connecticut, operate the vanpool program Easy Street®. The state subsidizes the commuter service, which is available for trips beginning or ending in Connecticut. Easy Street® is a new mode of operation for The Rideshare Company, developed in response to ridership losses in the mid-1990s. Business relocation to the suburbs, workforce reductions, and policy changes that led companies away from subsidizing alternative transportation all combined to cause a reduction in Rideshare Company vanpools from a high of 200 in 1993 to 155 in the fall of 1995.

Actions. The Easy Street® repackaging of The Rideshare Company's vanpool operations was implemented in October 1995. Instead of anonymous white, Easy Street® vans each have a green, yellow, and purple decal brand design on a white background, along with the toll free number to attract potential riders. An automated voice mail system offers detailed information. Easy Street® provides a free commute to the driver along with 40 free personal miles monthly. Easy Street® takes care of maintenance, gasoline charges, and 24 hour roadside assistance with no out-of-pocket expense to the driver. Fares are structured to cover costs. The service includes a guaranteed ride home program.

Easy Street® offers predictable prices by setting the fares across the board, based on round trip mileage. Calculated in 5 mile increments, the fares range from $70 to $100, with vacation rebates. Part time and daily fares are also offered. TransitChek vouchers, purchased and to varying degrees subsidized by employers, can be used to help pay the fare. The state of Connecticut pays for about a third of an employer's TransitChek voucher's cost and also subsidizes empty seats in new vanpools. The minimum group to start or continue a van is eight passengers and a driver. A sliding scale for 4 to 6 months determines a gradually decreasing subsidy.

Analysis. The Easy Street® vanpool program has not been analyzed in depth. Instead, the available information has been culled from brochures, newsletters, briefs, and the Internet, as indicated under "Sources." The reported mileage and air quality reduction benefits were apparently estimated assuming that all vanpool passengers would otherwise be driving alone, and thus may well be overstated.

Results. Phone calls inquiring about vanpool service increased from 74 in October 1995 to 143 in January 1996. After The Rideshare Company's count of 155 vans in the fall of 1995, Easy Street®

vans in service increased to 163 in January 1996, 183 in March, and 203 in November. November 1996 riders totaled 1,787, up by nearly 400 riders from Easy Street's® inception. The vanpool fleet was reported to have been driven 3.5 million miles in calendar year 1996. Easy Street® was recognized as one of the U.S. EPA's "Transportation Partners: 1997 Way to Go! Award Winners" for reduction of vehicle traffic while preserving or enhancing transportation choices and quality of life in the community. The vehicle traffic kept off of Connecticut highways was estimated at 28 million single occupant miles. The corresponding air quality emissions savings were reported as 10,670 tons of Carbon Dioxide, 55 tons of Carbon Monoxide, 3 tons of nitrogen oxides, and 4 tons of hydrocarbons.

More . . . The ridership increases are attributed in large measure to the improved visibility that the self-promoting branded vans provide. Even the decals themselves received national praise—Easy Street® won the annual Commercial Fleet Graphics Contest sponsored by the Commercial Carrier Journal and the National Private Truck Council. Note that 2001–2002 statistics and service information on Easy Street® operations are provided within the "Response to Vanpool and Buspool Programs" section under "Third-Party Vanpool Programs"—"Third-Party Vanpool Program Evolution."

Sources. The Rideshare Company, "Easy Street® Is The Convenient New Van Service Available In Your Area." 2Plus, Cary, NC, http://www.easystreet.org (Webpages accessed July 8, 1998). • Metropool, Inc., "Vanpooling Proves Test of Time." *Commuter Connections. Vol. 7, No. 4.* http://www.metropool.com (Web document dated 1997). • 2Plus, "Easy Street® commuter service grows, attracts new riders." *Commuters' Register, Connecticut Edition, Vol. 2, No. 3.* Cary, NC (March, 1996a). • 2Plus, "Easy Street® system wins national award." *Commuters' Register, Connecticut Edition, Vol. 2, No. 10.* Cary, NC (October, 1996b). • 2Plus, "Branding boosts ridership to new high." *Commuters' Register, Connecticut Edition, Vol. 3, No. 5.* Cary, NC (May, 1997). • Renew America, "EPA's Transportation Partners: 1997 Way To Go! Award Winners." Washington, DC, http://www.crest.org/environment/renew_america/wtgo97.html (Webpages accessed July 16, 1998).

Pace Vanpool and Subscription Bus Programs in Suburban Chicago

Situation. Pace, the Chicago Regional Transportation Authority's suburban bus division, provides service to an area of six counties and 264 municipalities that is nearly the size of Connecticut. The population and employment have grown to substantially exceed those of Chicago. This 3,446 square mile suburban area had a 1990 population of 4,454,300 and employment of 2,163,600, including 40 percent of the Chicago region's office space. Approximately 48 percent of Pace fixed route bus riders are making suburb to suburb trips. However, of the more than 55 million square feet of office space built in the suburbs since 1975, the majority is poorly accessible to transit patrons. One of the biggest challenges faced by Pace was serving the 5,000 employee Sears Merchandise Group during and following its 35-mile relocation in November 1992 from the Sears Tower in downtown Chicago to Hoffman Estates on the fringe of suburbia.

Actions. To serve small groups of commuters in the diverse and changing suburban market, Pace in 1991 established what it calls its vanpool incentive program (VIP). The VIP service provides passenger vans to groups of 5 to 15 people. Vanpools may be initiated through an employer or independently. Pace plans the route, provides the van and insurance, pays for fuel and maintenance, sets the fare, bills riders individually, and offers a Guaranteed Ride Home. Vanpool drivers ride free and get up to 300 personal use miles per month. The monthly fare is calculated rider by rider, based on mileage increments, ranging, in January 1998, from $47 for a 14-passenger vanpool rider with 20 round trip miles or less, to $126 for a 4-passenger vanpool rider traveling 131 to 140 miles

($55 for a 14-passenger vanpool rider). A Commuter Club Card may be requested, which is effectively a Pace fixed route bus pass. For a surcharge, a Pace/CTA Universal Monthly Pass may be obtained. These passes facilitate use of connecting buses, and also rail rapid transit in the case of the universal pass. Employers may subsidize vanpools through Pace's Transit Check program.

Around 1994, the vanpool program was expanded to add ADvAntage vans intended to provide a transit alternative to individuals with disabilities who commute regularly to either worksites or rehabilitative workshops. The ADvAntage vans are available to human services organizations, workshops, and agencies providing such work-related transportation services. The van driver must be an employee of the human service entity or a relative of a rider. The monthly fee as of 1999 for an entire van was $325 for minivans, or for any available van type if more than half the trips served are made by ADA certified clients; otherwise the fee was $650 per month.

The Pace Suburban Bus Service worked closely with Sears for 3 years prior to their 1992 move on employee surveys and the development of transportation alternatives. A mix of fixed route services, subscription bus services, and vanpools was designed. The fixed routes connected with the pre-existing transit network, with service levels ranging from 2 to 9 trips in both the morning and evening peak periods. Subscription bus service was designed for areas with a significant concentration of Sears employees, but no suitable fixed route service. A minimum of 30 passengers was required for a buspool. Ten routes were established using thirteen motorcoaches operated by private contractors. Each route served a park-and-ride lot an hour or more from the worksite, and charged a monthly fare of $75 to $94 (later standardized at $80). Smaller groups of employees were offered the option of vanpools, with preferential parking at the employment site. Initially 44 vanpools were formed.

Analysis. Pace vanpool and buspool fleet and usage statistics have been culled from reports, papers, fact sheets, and the Internet, as indicated under "Sources." Information on Pace VIP program participants, their travel and opinions, and support provided by their employers, was obtained in a Spring 1993 survey. This self-administered survey was sent to 671 riders and drivers. A 48 percent return was obtained, 87 percent from riders and back-up drivers, and 13 percent from primary drivers.

Results. Officially reported Pace VIP vans in maximum service for 1994 through 1997 were 162, 205, 231, and 291, respectively. Some 80 to 90 percent were serving the suburbs-to-suburbs market in 1994–96, with the remainder serving the city-to-suburbs reverse commute. Vanpooler unlinked trips grew from 558,100 in 1994 to 969,900 in 1996. The corresponding weekday vanpool loadings grew from 6.9 to 8.6 passengers, including driver, per vanpool. Trip length, relatively stable over the 1994 through 1996 period, averaged 38.6 miles one way or 77.1 miles round trip. Although the vanpool program is structured to achieve an 80 percent cost recovery ratio minimum, it has in practice typically achieved over 100 percent, exclusive of ADvAntage vans. (Additional cost recovery detail is provided in the "Revenue/Cost Considerations" section under "Related Information and Impacts.") Compared to a 17 percent recovery ratio minimum performance standard for fixed routes, and 35 percent for the system as a whole, Pace subscription bus services are required to maintain a 60 percent recovery ratio. ADvAntage vans totaled approximately 20 circa 1994, and 55 in 1996.

The mix of fixed route, subscription bus, and vanpool service provided to the relocated Sears Merchandise Group employees was initially successful in retaining a 30 to 35 percent transit and paratransit share, compared to 92 percent at the Sears Tower site. The fixed plus subscription route recovery ratio was 36.6 percent for 1992, not counting a short-term subsidy provided by Sears, which raised it to 55 percent. In January 1993, Sears transit and paratransit use was roughly equally

divided among the three primary modes: Fixed route services carried 870 daily passenger trips, subscription bus carried 986 daily trips, and vanpools carried somewhat less than 800 daily trips. About 53 percent of all Pace vanpools in the spring of 1993 were Sears vanpools. Of the 10 Sears subscription bus routes, 1 was discontinued within the first year following a drop in ridership, but 9 routes and 12 buses were still operating as of 1996. The transit share for Sears employees in 1996 was 25 percent, with 2 fixed routes, the buspools, and 45 vanpools providing the Sears service.

More . . . Pace vanpool user demographic characteristics and overall satisfaction levels are provided as part of Table 5-13 of the "Related Information and Impacts" section. Modes used to get to vanpool pickup points are quantified in Table 5-8 of the "Underlying Traveler Response Factors" section. Pace operating statistics updated to 2002 are provided and reviewed in Table 5-5 and associated discussion, located in the "Response to Vanpool and Buspool Programs" section under "Third-Party Vanpool Programs"—"Transit Provider Vanpool Programs."

Sources. Hooper, K., "Innovative Suburb-to-Suburb Transit Practices." *TCRP Synthesis 14.* Transportation Research Board, Washington, DC (1995). • Brazda, R., Grzesiakowski, T., and Reynolds, W., "Sears' headquarters move to outer suburbia: How transit reacted." Symposium Papers for the Operational and Service Planning Symposium. Sponsored by the Federal Transit Administration (December 8–10, 1993). • VIPpace Vanpool Services, "VIP ADvAntage Service Fact Sheet." Arlington Heights, IL (February, 1999). • Pace Suburban Bus Service, "Pace Vanpool Participant Survey: Technical Report." Arlington Heights, IL (1993). • Michael Baker Corporation, Crain & Associates, LKC Consulting Services, and Howard/Stein-Hudson, "The Potential of Public Transit as a Transportation Control Measure: Case Studies and Innovations, Draft Document." Annapolis, MD (October, 1997). • Community Transportation Association, "Proceedings from the People, Jobs & Transportation Conference" (October, 1996). • National Transit Database, "NTD Data" (*formerly* Federal Transit Administration, "National Transit Database Annual Report, Data Tables"). Federal Transit Administration, Department of Transportation, Washington, DC, http://www.ntdprogram.com/NTD/ntdhome.nsf/Docs/NTDData?OpenDocument (1994–1997). • Derived estimates by Handbook authors.

REFERENCES

2Plus, "Branding boosts ridership to new high." *Commuters' Register, Connecticut Edition, Vol. 3, No. 5.* Cary, NC, http://www.commutersregister.com/ct/articles/9705/rslocal.htm (May, 1997).

2Plus, "Easy Street® commuter service grows, attracts new riders." *Commuters' Register, Connecticut Edition, Vol. 2, No. 3.* Cary, NC, http://www.commutersregister.com/ct/articles/9603/rsfpeasy.htm (March, 1996a).

2Plus, "Easy Street® system wins national award." *Commuters' Register, Connecticut Edition, Vol. 2, No. 10.* Cary, NC, http://www.commutersregister.com/ct/articles/9610/local3.htm (October, 1996b).

Adams, D., Mass Transit Administration, Maryland. Telephone interview (February 12, 1999).

Alan M. Voorhees and Associates, Inc., "Transportation Pooling." NTIS PB 236-157. McLean, VA (January, 1974).

American Public Transit Association, "APTA Transit Fact Book 1996." American Public Transit Association, Washington, DC (1996).

Atherton, T. J., *Commuter's Choice: Ridesharing Demonstration in Brevard County, FL.* Prepared by Cambridge Systematics, Inc. for the Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, DC (October, 1985).

Beckwith, J., King County Metro. Seattle, WA. Telephone interview (November 4, 2004).

Beckwith, J., and Burrell, J., King County Metro. Seattle, WA. E-mail to the Handbook authors (March 3, 8, and 19, 1999).

Bhatt, K., and Higgins, T., *An Assessment of Travel Demand Management Approaches at Suburban Activity Centers: Final Report.* Prepared by K. T. Analytics for the Transportation Systems Center, Cambridge, MA (July, 1989).

Booth, R., and Waksman, R., *National Ridesharing Demonstration Program: Comparative Evaluation Report.* Urban Mass Transportation Administration, Washington, DC (August, 1985).

Boylan, M., Association for Commuter Transportation Vanpool Council. Telephone interviews (January 27 and March 22, 1999).

Brazda, R., Grzesiakowski, T., and Reynolds., W., "Sears' headquarters move to outer suburbia: How transit reacted." Symposium Papers for the Operational and Service Planning Symposium. Sponsored by the Federal Transit Administration (December 8–10, 1993).

Buspool.org, "Routes & Schedules." http://www.buspool.org/routes_shced.html, Aptos, CA (Webpage copyrighted 2001).

Cambridge Systematics, Inc., and Urban Analytics, Inc., "PSRC Travel Model Improvements." Prepared for the Puget Sound Regional Council, Seattle, WA (March, 2003).

Cervero, R., *Paratransit In America: Redefining Mass Transportation.* Praeger Publishers, Westport, CT (1997).

Christiansen, D. L., and Morris, D. E., *The Status and Effectiveness of the Houston Transitway System, 1989.* Texas Transportation Institute, College Station, TX (1990).

Community Transportation Association, "Proceedings from the People, Jobs & Transportation Conference" (October, 1996).

Commuter Transportation Services, Inc., "Vanpooling—A Handbook to Help You Set Up A Program At Your Company." Prepared for the Federal Transit Administration, U.S. Department of Transportation, Washington, DC, http://www.fta.dot.gov/fta/library/planning/VANPOOL/vanpool.html (Web document dated January, 1993).

Comsis Corporation and the Institute of Transportation Engineers, "Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience." Prepared for the Federal Highway Administration and Federal Transit Administration, Washington, DC (September, 1993).

Comsis Corporation, "A Case Study of the Experience of the Seattle Metro in Fostering Suburban Mobility." Prepared for the Urban Mass Transportation Administration, Washington, DC (1991).

Conway Associates, "Metro Vanpool Market Analysis." Prepared for Municipality of Metropolitan Seattle, WA (1986).

Dorosin, E., Fitzgerald, P., and Richard, B., *Golden Gate Vanpool Demonstration Project.* Prepared by Crain & Associates, Inc. for the Urban Mass Transportation Administration, Washington, DC (July, 1979).

Dorosin, E., *Golden Gate Vanpool Transportation Project: Final Report.* Prepared by Crain & Associates, Inc. for the Urban Mass Transportation Administration, Washington, DC (September, 1982).

Enoch, M., "Pooling together: why the vanpool works in the US and the Netherlands." *Traffic Engineering and Control,* Vol. 44, No. 1 (January, 2003).

Federal Transit Administration, "Commuter Choice Program." Washington, DC, http://www.fta.gov/2171_6021_ENG_HTML.htm (Webpages accessed November 11, 2004).

Furniss, R. E., *Evolution and Operations of the Reston Virginia Commuter Bus Service.* Sponsored by the Urban Mass Transportation Administration. CACI, Inc., Los Angeles, CA (August, 1977).

Gross, M., and Feldman, R. N., *National Transportation Statistics 1997.* Prepared by Volpe National Transportation Systems Center for the Bureau of Transportation Statistics, Washington, DC (December, 1996).

Heaton, C., Abkowitz, M., Damm, D., and Jacobson, J., "Impacts and Effectiveness of Third-Party Vanpooling: Synthesis and Comparison of Findings from Four Demonstration Projects." *Transportation Research Record 823* (1981).

Higgins, L. L., and Rabinowitz, R. I., *Transit-Operated Vanpools in the United States: Selected Case Studies.* Prepared by the Texas Transportation Institute for the Southwest Region University Transportation Center, College Station, TX (December, 2002).

Hooper, K., "Innovative Suburb-to-Suburb Transit Practices." *TCRP Synthesis 14.* Transportation Research Board, Washington, DC (1995).

Johnson, C., and Sen, A. K., *Ride Sharing and Park and Ride: An Assessment of Past Experience and Planning Methods for the Future. Volume II. The Van Pool Planning Manual.* University of Illinois, School of Urban Sciences, Chicago, Illinois. Prepared for the Office of University Research, U.S. Department of Transportation, Washington, DC (November, 1977).

Kavage, S., and Samdahl, D., Washington State Department of Transportation and Mirai Associates, respectively. Email to the Handbook authors (November 16, 2004).

Keesling, G., "Employer-Based Rideshare Programs: The South Hampton Roads (VA) Experience." *Journal of Transportation Research Forum. Vol. 31, No. 2* (1991).

King County Department of Transportation, Transit Division, Service Development Section, "Six-Year Transit Development Plan 1996–2001: Status of Service Implementation and Preliminary Results." Seattle, WA (October, 1998).

King County Metro, Seattle, WA, "Sampling of Employer Offerings and Shifts in Mode Share—Metro FlexPass Customers." Tabulation [1998].

Kitsap Transit, "Welcome to Kitsap Transit." Kitsap Transit On-Line, Bremerton, WA, http://www.kitsaptransit.org (Website accessed March 4, 1999).

Kitsap Transit, "Worker/Driver Program" (WorkerDriverBusProgram.html), "Worker/Driver Bus Fares" (WorkerDriverBusFares.html), and "Transportation Incentive Program TIP" (Federal TransportationIncentiveProgram.html). *Welcome to Kitsap Transit,* Bremerton, WA, http://www.kitsaptransit.org/ (Website accessed October 22, 2004).

KPMG Peat Marwick LLP, "Commuter Choice Initiative—Weighted Survey Results, Employer Provided Transportation Benefits" (August 4, 1995).

K. T. Analytics, Inc., "TDM Status Report: Guaranteed Ride Home." Prepared for the Federal Transit Administration, Washington, DC, http://www.fta.dot.gov/library/planning/tdmstatus/tdm.htm (Web document dated August, 1992).

Kuzmyak, J. R., and Schreffler, E. N., *Evaluation of Travel Demand Management (TDM) Measures to Relieve Congestion.* Prepared by Comsis Corporation and Harold Katz and Associates for the Federal Highway Administration, Washington, DC (February, 1990).

Litton, J., Triangle Transit Authority, Research Triangle Park, NC. Telephone interview (October 26, 2004).

McCall, C. H., Jr., *Com-Bus: A Southern California Subscription Bus Service.* CACI, Inc., Los Angeles, CA (May, 1977).

Metropool, Inc., "Vanpooling Proves Test of Time." *Commuter Connections. Vol. 7, No. 4.* http://www.metropool.com (Web document dated 1997).

Michael Baker Corporation, Crain & Associates, LKC Consulting Services, and Howard/Stein-Hudson, "The Potential of Public Transit as a Transportation Control Measure: Case Studies and Innovations, Draft Document." Annapolis, MD (October, 1997).

Minnesota Mining & Manufacturing Co., "3M Center Fact Sheet: Year-end 1995." Maplewood, MN, http://www.mmm.com/profile/looking/center.html (Webpage accessed July 9, 1998).

Morris, H. J., "Analysis of Transportation Impacts of Massachusetts' Third-Party Vanpool Program." *Transportation Research Record 823* (1981).

National Transit Database, "NTD Data" (*formerly* Urban Mass Transit Administration, "National Urban Mass Transportation Statistics—Section 15 Annual Report" *and more recently* Federal Transit Administration, "National Transit Database Annual Report, Data Tables"). Federal Transit Administration, U.S. Department of Transportation, Washington, DC, http://www.ntdprogram.com/NTD/ntdhome.nsf/Docs/NTDData?OpenDocument (Data year as indicated in citation).

Owens, R. D., and Sever, H. L., *The 3M Commute-A-Van Program: Status Report.* Reprinted by the Federal Highway Administration, U.S. Department of Transportation, Washington, DC (May, 1974). Also *Status Report II.* 3M (January, 1977).

Pace Suburban Bus Service, "Pace Vanpool Participant Survey: Technical Report." Arlington Heights, IL (1993).

Parks, J., Kitsap Transit, Worker/Driver Program. Telephone interview (March 4, 1999).

Peoples, B., Executive Commute, Inc. Aptos, CA. Telephone interview (October 22, 2004).

Pratsch, L., and Starling, R., *Vanpooling-An Update.* U.S. Department of Energy, Washington, DC (September, 1979).

Pratt, R. H., and Copple, J. N., *Traveler Response to Transportation System Changes.* Second Edition. Federal Highway Administration, Washington, DC (July, 1981).

Pratt, R. H., Pedersen, N. J., and Mather, J. J., *Traveler Response to Transportation System Changes—A Handbook for Transportation Planners* [first edition]. Federal Highway Administration, U.S. Department of Transportation, Washington, DC (February, 1977).

Renew America, "EPA's Transportation Partners: 1997 Way To Go! Award Winners." Washington, DC, http://www.crest.org/environment/renew_america/wtgo97.html (Webpages accessed July 16, 1998).

Rideshare Company, The, "Easy Street® Is The Convenient New Van Service Available In Your Area." 2Plus, Cary, NC, http://www.easystreet.org (Webpages accessed July 8, 1998).

Rosenbloom, S., "Transit Markets of the Future: The Challenge of Change." *TCRP Report 28*. Transportation Research Board, Washington, DC (1998).

Samdahl, D., Mirai Associates. Telephone interview (March 25, 1999).

SANDAG :: NEWS :: San Diego's Regional Planning Agency, "News—Full Story." San Diego, CA, http://www.sandag.org/index.asp?newsid=219&fuseaction=news.detail (posted April 5, 2004).

Spence, S., *National Commuter Transportation Survey—People and Programs.* Prepared by the Association for Commuter Transportation for the Office of Traffic Operations, Federal Highway Administration, Washington, DC (July, 1990).

Stevens, K. B., Soronson, M. K., Clark, J. J., and Rainone, L. R., "Characteristics of Vanpools and Vanpoolers in Maryland." *ITE Compendium of Technical Papers.* Institute of Transportation Engineers, Arlington, VA (1980).

Stockton, B., Daniels, G., Hall, K., and Christiansen, D., *An Evaluation of High-Occupancy Vehicle Lanes in Texas, 1996.* Texas Transportation Institute, College Station, TX (1997).

Suhrbier, J. H., and Wagner, F. A., *Vanpool Research: State-of-the-Art Review.* Prepared for the Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, DC (April, 1979).

Surface Transportation Policy Project, "From Welfare to Work." *Progress,* Vol. 6, No. 3 (April, 1996).

Texas Energy and Natural Resources Advisory Council, "The Texas Vanpool Census." Various issues (1978–88).

Torluemke, D. A., and Roseman, D., "Vanpools: Pricing and Market Penetration." *Transportation Research Record 1212* (1989).

Triangle Transit Authority, "Board of Trustees Agenda Package, June 24, 1998 Board Meeting." Durham, NC (1998a).

Triangle Transit Authority, "Triangle Transit Authority Ridesharing." Triangle Transit Authority On-Line, Durham, NC, http://www.state.nc.us/TTA/Ttac.htm (Webpages accessed July 8, 1998b).

Urban Transportation Monitor, " 'Buspool' Operates Successfully in San Francisco." Vol. 14, No. 21 (November 10, 2000).

Urban Transportation Monitor, "Ridesharing Newspaper Achieves Considerable Success." Vol. 4, No. 14 (July 20, 1990).

U.S. Department of Energy, "New Approaches to Successful Vanpooling: Five Case Studies." Office of Transportation Programs, Washington, DC (May, 1979).

van der Knaap, R., *Vanpooling in Nederland een Alternatieve Verplaatsingswijze in Het Woon-Werkverkeer Met Toekomst.* Organizational Coaching, Rijen, Netherlands (1996).

Victoria Transport Policy Institute, "Ridesharing—Car and Van Pooling." *TDM Encyclopedia.* Victoria, BC, Canada, http://vtpi.org/tdm/tdm34.htm (Webpages updated June 4, 2004).

VIPpace Vanpool Services, "VIP ADvAntage Service Fact Sheet." Arlington Heights, IL (February, 1999).

Virginia Department of Transportation, "I-66 HOV-2 Demonstration Project Final Report." Richmond, VA (1996).

VPSI, Inc., "Corporate History" (home.submenu.asp?MMID=4&SMID=41&OID=261), and "News/Press Releases" (home.submenu.asp?MMID=4&SMID=47&OID=261). *Join a Vanpool—About VPSI, Inc.,* Troy, MI, http://www.vpsiinc.com/ (accessed October 20, 2004).

VPSI, Inc., "Vanpools—Making it Easy to Get to Work" (a1amain.asp), "The VPSI Story" (d2.htm) and "Vanpool Services" (b1.htm). *VPSI Commuter Vanpools,* Troy, MI, http://www.vpsiinc.com/ (Webpages accessed November 8, 1999).

Wambalaba, F., Concas, S., and Chavarria, M., *Price Elasticity of Rideshare: Commuter Fringe Benefits for Vanpools.* National Center for Transit Research (NCTR), Center for Urban Transportation Research (CUTR), University of South Florida, Tampa, FL (June, 2004).

Wegmann, F. J., "Cost-Effectiveness of Private Employer Ridesharing Programs." *Transportation Research Record 1212* (1989).

Wegmann, F. J., Chatterjee, A., and Stokey, S. R., "Evaluation of an Employer-Based Commuter Ride-Sharing Program." *Transportation Research Board Special Report No. 184.* Transportation Research Board, Washington, DC (1979).

WSDOT, "Puget Sound Regional Vanpool Market Study." Draft Executive Summary. Prepared for the Washington State Department of Transportation by 2Plus Inc., Ilium Inc., and CUTR. Olympia, WA (October, 2000).

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Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation