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Vanpool Research: State-of-the-Art Review

Final Report
April 1979

Service and Methods Demonstration Program

U.S. DEPARTMENT OF TRANSPORTATION
Urban Mass Transportation Administration and
Research and Special Programs Administration
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16. Abstract

A considerable amount of vanpool-related activity is presently ongoing, with a divergence of opinion existing over the potential of future growth of employer-based, third-party and owner-operator vanpool programs. This report 1) identifies existing vanpool research activities of Federal, state, and local governments, private organizations, and universities; 2) assesses the current state of knowledge, based on this research, of vanpool operating characteristics, institutional issues, and ridership; 3) determines areas where additional vanpool research may be particularly beneficial; and 4) provides guidance in developing future vanpool-related demonstration projects.

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PREFACE

Preparation of this report has been funded by the U.S. Department of Transportation, Urban Mass Transportation Administration (UMTA) Service and Methods Demonstration (SMD) Program. Under contract to the U.S. Department of Transportation, Transportation Systems Center (TSC), Cambridge Systematics, Inc. performed this review of vanpool-related research in support of the TSC evaluations of the four SMD-supported vanpool demonstration projects.

The report was written by John H. Suhrbier of Cambridge Systematics, Inc., with important contributions from Frederick A. Wagner of Wagner-McGee Associates in McLean, Virginia. The authors wish to thank the Cambridge Systematics staff who provided assistance in performing the research review, especially Carol Walb and Robin Kaelber. Carla Heaton of the Transportation Systems Center served as the project monitor and provided valuable guidance and input throughout the project.

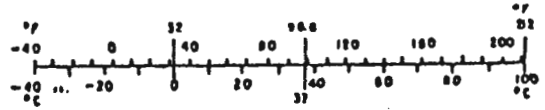
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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EXECUTIVE SUMMARY

Vanpooling - A Success or a Curiosity?

A wide dichotomy of viewpoints currently exists regarding the growth of employer-based, third-party and owner-operator vanpool programs. On the positive side, statements such as the following are made:

> Vanpooling is a highly cost-effective, innovative mode of commuter travel which is growing rapidly in acceptance and use. The number of vanpools which are part of formal employer-based or government sponsored programs has approximately doubled each year since 1973 and now stands at about 2,000 vans carrying about 20,000 commuters. The surface has barely been scratched, and the potential for sustained growth of vanpooling is large.

In contrast, however, a somewhat more cautious view is also expressed:

> If all the true costs of vanpool formation and operation are considered, including absorbed costs of administration, marketing and arranging vans, the cost-effectiveness of vanpooling is poorer than supposed. Presently, vanpooling is viewed as a curiosity, practiced mainly in organizations in which special situations dictate a compelling motivation to make vanpooling work. Propagation of vanpooling to broader segments of the population has limited potential. Perceived risks and institutional impediments to vanpool formation are generally stronger than perceived needs and benefits.

The existence of this range of opinion indicates that the vanpool market may not be as well understood or as broad as implied by some of the available promotional material. Conversely, the demonstrated success of vanpool operations also implies that vanpooling may be more than a relatively isolated curiosity.

A considerable amount of vanpool-related activity is presently on-going and it is the purpose of this report:

- to identify existing vanpool research activities of Federal, state, and local governments, private organizations, and universities;
- to assess the current state of knowledge, based on this research, of vanpool operating characteristics, institutional issues, and ridership;

in order to

- determine areas where additional vanpool research may be needed and
- provide guidance in developing future vanpool-related demonstration projects.

Specifically, an objective is to assist the Urban Mass Transportation Administration's Service and Methods Demonstration Program in the identification of those areas where existing knowledge is adequate, inadequate, or in conflict.

Vanpooling, like the private automobile and the carpool upon which it is patterned, has emerged as a remarkably flexible form of transportation. For every generalization, exceptions can be cited. Some view vanpooling as a new mode; others perceive it as a special form of transit; still others see vanpooling as just a large carpool. To identify research needs that can be operationally addressed, information has been examined in the following areas:

1. marketing programs and effectiveness;
2. legal, regulatory and other institutional issues;
3. insurance and safety;
4. program administrative structure and operations;
5. program costs, revenues and pricing policy;
6. vanpool operating characteristics -- service area, type and number of vans, trip length, etc.;

7. ridership and travel demand impacts -- number of users and modal share data, previous mode, user characteristics, etc.;

8. program benefits, impacts and evaluation;

9. impacts to employer sponsors.

Research Needs

Numerous vanpool-related reports and papers have been published during the past six years. Most of this work, however, cannot be described as rigorous research per se. Rather, the majority of the available writings can be characterized as being in one of the following categories:

- a description of the operating characteristics and ridership of a particular vanpool system,
- an identification of insurance and regulatory barriers to vanpool formation,
- guidelines for the formation of employer-sponsored vanpool programs, or
- promotional material describing the benefits of vanpooling.

This material, though, has served a very valuable role in communicating important issues to those persons with an interest in implementing vanpool programs. Many of these people have assimilated this information, combined it with their own practical experience, and developed a reasonably accurate perception of the state-of-the-art of existing vanpool research. Unfortunately, this type of personal synthesis of operational experience has not been well documented.

The assessment of vanpooling that emerges from both a review of available material and discussions with those active in the field is mixed. On the one hand, there are numerous exciting and innovative successes.

In contrast, however, vanpooling has not grown at anywhere near the rate expected by even the more moderate of the vanpool advocates. There are examples of employer pilot programs that have either disbanded or been reduced in size; vanpooling is either non-existent or very limited in at least 30 of the 50 states. Ambitious promotional programs have resulted in only a small number of new vanpools formed. The result is an increasing feeling that much remains unknown about the vanpool market - the driver, rider, and provider. If previous and somewhat simplistic statements had been correct, then vanpooling would be considerably larger than it now is.

An examination of available vanpool information indicates a lack of reliable and objective evaluation data on the relative costs and effectiveness of different vanpooling arrangements. Vanpooling, even more than carpooling, has tended to be promoted by a relatively small number of highly visible advocates. Data presented to policy and decision makers occasionally have been sufficiently one-sided so as to result in a backlash reaction. Most evaluation data cited are based on a few highly successful examples rather than a more comprehensive sample of currently ongoing activities.

Some, if not much, of the current frustration is undoubtedly the result of unrealistically high expectations, failure to understand basic principles of travel behavior, and a lack of appreciation for the complexities and dynamics of introducing fundamental change into a heterogeneous society. A person's decision of what mode to use in commuting between home and work is made in the same mid-term time frame as the decision of how many and what types of automobiles to own. This implies

that the success of vanpool programs should be evaluated over a three- to five-year horizon; expecting dramatic changes to occur within a few weeks or months simply is unrealistic.

It is with the idea of patience and long-term growth in mind that the following vanpool research needs are suggested:

1. Systematic Evaluation of Existing Programs

There is a need for a systematic, comprehensive and in-depth evaluation of a random sample of existing vanpool operations, including a consistent and up-to-date comparison of employer, individual and third-party programs.

2. Analysis of Social and Psychological Aspects of Vanpooling

Individual reactions to vanpooling cannot be explained exclusively in terms of level-of-service, economic, and locational variables. Psychosocial aspects involving number of riders, acquaintanceship, sex, race, age/life cycle, peer group/social pressure, and degree of privacy/personal independence need to be investigated.

3. Analysis of Program Costs

A more exhaustive accounting of direct and indirect costs associated with initiating and operating a vanpool program is needed. There is a natural fear of the unknown, and a current perception on the part of some people is that the indirect costs associated with vanpooling may be quite large.

4. Improvement of Market Analysis Techniques

To maximize the effectiveness of those individuals responsible for vanpool programs, there is a need for a more rigorous and quantitative set of market analysis techniques so that limited staff efforts can be directed

toward those markets having the highest possible potential payoff.

5. Resolution of Regulatory, Insurance, and Taxation Uncertainties

While these barriers have become increasingly well understood and general solutions have been hypothesized, uncertainties still exist. There is a need for a coordinated action program oriented toward obtaining agreement on the specifics of solutions and implementing necessary changes.

6. Improve Integration with Other Transportation Programs

Vanpooling frequently is organized in relative isolation, independent of other transportation activities. There is a need to reduce this fragmentation; achieving an integration with ongoing carpooling, transit, preferential treatment, parking management, work hour scheduling, and other transportation systems management actions.

7. Contingency Planning

Contingency options frequently are viewed only in terms of fuel rationing and allocation, or restrictions on use of the private auto. Studies have shown, however, that the effectiveness of disincentives can be increased by a factor of three to five where alternative travel modes are readily available. While transit is most often cited as this available alternative, there is a need to develop mechanisms by which vanpools also can serve as a contingency travel mode.

Vanpool Initiatives - Next Steps

Vanpool initiatives by governmental agencies, as well as by private employers, have the potential to contribute to an increased understanding of vanpool operations. While the identified research needs suggest specific actions that can be taken in designing either new or expanded vanpool programs, demonstrations

in the following areas (beyond the removal of potential regulatory, taxation, and insurance barriers) would be especially useful.

- Local and State Government

1. The choice of appropriate lead agency for administering a metropolitan area vanpool program, including the specific roles to be played by employers, van providers, drivers and independent non-profit third-parties.

2. The use of marketing programs that address the psychological and social aspects of vanpooling, rather than relying primarily on potential economic benefits.

3. The use of more personalized and more responsive vanpool formation and matching procedures than exist at present.

4. The development of new methods of pricing, with attention given to the employer sponsor, the rider, the driver, and the van provider/administrator.

5. Integration of vanpooling into a broader set of ridesharing and transit incentives oriented to employers, individuals, and owner/operators.

6. Integration with transit services, including the use of vanpooling to replace high deficit transit operations and to provide introductory service into low density areas.

- Federal Government

1. Synthesize and disseminate technical information on the organization and operation of existing "typical" vanpool programs.

2. Provide increased quick-response technical assistance, on request, to state and urban area programs, with perhaps some attention devoted to

a small number of large employers or transit operating agencies.

3. Demonstrate the government's commitment to vanpooling by initiating a nationwide vanpool program for Federal employees.

4. Undertake comprehensive transportation systems management demonstrations including coordinated areawide, sub-regional, employer and possibly individual actions. Emphasis should be on the integrated design of incentives and disincentives affecting all modes and aspects of travel, including transit and parking, as well as other means of ridesharing.

5. Recently published Transportation Air Quality Planning Guidelines provide an administrative basis for integrating certain DOT- and EPA-sponsored programs at the state and local level. The opportunity exists now to use DOT resources to help make this major consolidation of programs a success. Additional money can be used as an incentive to support pilot or especially promising local initiatives that are an integral part of a combined energy conservation, air quality, transportation program.

VANPOOL RESEARCH
STATE-OF-THE-ART REVIEW

I. VANPOOLING - A SUCCESS OR A CURIOSITY?

In discussing vanpooling with a wide variety of public officials, operators, employers, and users, a remarkable dichotomy of viewpoints emerges.

Positive View	Negative View
Vanpooling is a highly cost-effective, innovative mode of commuter travel which is growing rapidly in acceptance and use. The number of vanpools which are part of formal employer-based or government sponsored programs has approximately doubled each year since 1973, and now stands at about 2,000 vans carrying about 20,000 commuters. The surface has barely been scratched, and the potential for sustained growth of vanpooling is large.	If all the true costs of vanpool formation and operation are considered, including absorbed costs of administration, marketing and arranging vans, the cost-effectiveness of vanpooling is poorer than supposed. Presently, vanpooling is viewed as a curiosity, practiced mainly in organizations in which special situations dictate a compelling motivation to make vanpooling work. Propagation of vanpooling to broader segments of the population has limited potential. Perceived risks and institutional impediments to vanpool formation are generally stronger than perceived needs and benefits.
Because vanpooling is primarily applicable to very long commuting trips, the potential for VMT reduction and associated savings in commuting cost and energy consumption per person induced to join a vanpool is proportionately larger than other travel reduction strategies.	Because vanpooling is primarily applicable to very long commuting trips, the market potential for vanpool formation is substantive only in a relatively small number of large metropolitan areas and a few other unique urban areas where work trip lengths are, for one reason or another, unusually long.
The institutional impediments to vanpooling are being rapidly overcome. Many states have acted to exempt vanpooling from common carrier regulation. The Department of Labor has ruled that in a broad variety of forms of vanpooling (including employer owned and leased vans and	A host of legal, regulation, and insurance impediments to vanpool formation still exist which discourage individual commuters, employers and third party providers from engaging in vanpooling. There is great uncertainty about the applicability of workmen's compensation or tradi-

company-arranged, third party provided vans) an employer/employee relationship is deemed not to exist between the van drivers and the employer or the third party, and the wages and hours provisions of the Fair Labor Standards Act do not apply. The Insurance Service Office has developed favorable national guidelines for premium ratings for commuter vans.	tional liability insurance coverage in any given vanpool situation. This is an issue which has to be resolved state by state. In general, there is considerable concern about the adequacy of liability protection for high occupancy vanpools, and the possible range of technicalities which might exclude or diminish protection under certain situations. Whether a vanpool will be defined as a "for-hire" is also uncertain, and in the event of the former classification, burdensome insurance premium rates may be applied. It is unknown under what conditions IRS will construe a vanpool as a trade or business, subject to income taxes and eligible to claim expense deductions. This uncertainty may significantly constrain the growth of owner-operated vanpools. In some states which have nominally exempted vanpools from common carrier regulation, the language of the exemptions is so narrow that many forms of vanpool arrangements are now more clearly non-exempt than before, and their formation thus will be deterred. In such cases, the exemption ruling itself may have effects which, in balance, are more negative than positive.

The existence of this range of opinion indicates that the vanpool market may not be as well understood or as broad as implied by some of the available promotional material. Conversely, the demonstrated success of vanpool operations also implies that vanpooling may be more than a relatively isolated curiosity.

To develop a better understanding of vanpooling than now exists, the Urban Mass Transportation Administration presently is sponsoring, as

part of the Service and Methods Demonstration (SMD) Program, projects in San Francisco, California; Knoxville, Tennessee; Norfolk, Virginia; and Minneapolis, Minnesota, involving the provision of vanpooling as an alternative ridesharing mode for the trip between home and work (1). While each of these projects has a number of unique characteristics, collectively they differ from most recent vanpooling efforts in three important respects:

- vanpooling is provided by a transit agency or other transportation authority rather than by employers, and in two cases is part of a broader transportation brokerage service;
- the projects serve multiple employers rather than individual sites;
- vans are provided on a third-party lease or purchase arrangement.

Consistent with the objectives of the SMD program, each of these four demonstrations is being independently evaluated by the Transportation Systems Center (2,3,4,5). A considerable amount of other vanpooling-related activity, however, is proceeding independently and it is the purpose of this report:

- to identify existing vanpool research activities of federal, state, and local governments, private organizations, and universities;
- to assess the current state of knowledge, based on this research, of vanpool operating characteristics, institutional issues, and ridership;

in order to

- determine areas where additional vanpool research may be needed, and
- provide guidance in developing and evaluating future vanpool-related demonstration projects.

Specifically, an objective is the identification of those areas where existing knowledge is adequate, inadequate, or in conflict. The emphasis,

therefore, is not to summarize existing findings and reports per se, or even to concisely describe the characteristics of the numerous on-going vanpool programs, but rather to characterize available evaluation and research findings as to their comprehensiveness, validity and consistency.

Information has been examined on all important aspects of vanpooling, including the following:

1. marketing programs and effectiveness;
2. legal, regulatory and other institutional issues;
3. insurance and safety;
4. program administrative structure and operations - funding, matching procedures, relation to other ridesharing incentives, etc.;
5. program costs, revenues and pricing policy;
6. vanpool operating characteristics - service area, type and number of vans, trip length, trip circuity, level of service relative to other modes, reliability, etc.;
7. ridership and travel demand impacts - number of users and modal share data, previous mode, user characteristics, effects on auto ownership, length of participation, user attitudes, numbers of applicants and matches, etc.;
8. program benefits, impacts and evaluation - fuel, pollutants, costs, parking, estimates of effectiveness and productivity, etc.;
9. impacts to employer sponsors - employer motivations, employee morale and performance, public relations, costs avoided, etc.

In obtaining this information, activities of the following types of organizations have been reviewed:

1. Federal agencies and Congressional offices that have been active in vanpooling;
2. operators of vanpool programs at the state and urban area level that may have conducted relevant research oriented evaluations;

3. consultants, service organizations, operators or user groups, and research agencies that have been active in vanpooling;

4. universities having graduate transportation programs in which vanpool-related research could be performed.

Emphasis has been placed on those individuals and organizations having a high probability of having performed research that is specifically oriented to vanpooling (in contrast to carpooling); comprehensive surveys of all states, urban areas or universities were not attempted. In a similar vein, direct contact has not been made with individual employers, persons or organizations who are providing vanpool services; rather, this base of knowledge has been tapped indirectly by working with the kinds of representatives identified above.

II. EXISTING VANPOOL RESEARCH ACTIVITIES

Numerous vanpool-related activities have been undertaken during the past six years, with many reports and papers being published. Most of this work, however, cannot be described as rigorous research per se.[1] Rather, the majority of the available writings can be characterized as being in one of the following categories:

- a description of the operating characteristics and ridership of a particular vanpool system,
- an identification of insurance and regulatory barriers to vanpool formation,
- guidelines for the formation of employer-sponsored vanpool programs, or
- promotional material describing the benefits of vanpooling.

This material, though, has served a very valuable role in communicating important issues to those persons with an interest in implementing vanpool programs. Many of these people have assimilated this information, combined it with their own practical experience, and developed a reasonably accurate perception of the state-of-the-art of existing vanpool research. Unfortunately, this type of personal synthesis of operational experience has not been well documented.

The purpose of this section is to summarize the kinds of vanpool work that has been performed by different types of organizations, including an indication of the unique contributions that are being made by the four UMTA SMD demonstration projects involving vanpooling. Following this discussion, eight specific aspects of vanpooling are examined, identifying

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[1] A number of documents related to vanpool research, in addition to those cited, are identified in the references.

areas where there is general agreement among research findings and areas where research needs still exist.

A. Federal Initiatives

Various agencies and offices within the Federal government have actively and effectively promoted the vanpool concept during recent years. Though lacking both formal coordination and any comprehensive, systematic evaluation, these activities have nonetheless served as the primary impetus for the initiation of employer-sponsored and third-party vanpool programs.

Provisions of 1977 legislation formally designated the Department of Transportation as the official home of executive branch vanpooling activities and this is resulting in new initiatives being taken by the Department (6). Nonetheless, a number of Federal agencies and offices maintain an active involvement in vanpooling as part of their ongoing programs.[1]

1. Federal Highway Administration

The Federal Highway Administration (FHWA) was the first Federal agency to become actively involved in ridesharing during the 1973-74 energy shortage and has undertaken a variety of vanpool-related activities since that period.

Starting with an emphasis on computerized carpool matching, their activities have grown to include promotion, technical assistance and the sponsorship of some 87 carpool demonstration programs. Vanpooling has

[1] Federally sponsored university research relating to vanpooling is identified as part of Section D and also as part of a separate appendix.

received increased recent attention with at least 20 vanpool demonstration projects either initiated or pending during 1977 and 1978, Table 1. Some of these programs, such as in Baltimore and Honolulu, are non-profit third-party leasing arrangements similar in some respects to the current UMTA vanpool demonstrations; others, such as in Massachusetts, are intended to assist sponsors in financing the acquisition of vanpool vehicles. An important FHWA contribution has been publication of a Ridesharing Newsletter that is widely distributed to those persons having operating responsibilities for ridesharing programs (7).

A responsibility of each FHWA demonstration project is an evaluation of the program results. In contrast to the UMTA evaluations which are performed by an independent agency and consultant, the FHWA evaluations are the responsibility of the group conducting the demonstration. With respect to vanpooling, evaluation data are not yet available. Many of the programs are still in the early stages of implementation, and some have encountered serious start-up problems. Available carpool evaluation data are analyzed in the 1978 FHWA publication, "Evaluation of Carpool Demonstration Projects - Phase I Report" (8). The report represents the most complete and up-to-date compendium of the results of FHWA funded areawide and employer-based carpooling efforts, and provides both operating statistics and a variety of cost-effectiveness indicators. For example, for 22 projects having submitted adequate evaluation data, the estimated annual cost per new carpooler was $47 and the estimated cost per VMT reduced was 2.4 cents. For six projects measuring more comprehensive impacts, the corresponding figures were $28 and 1.6 cents.

TABLE 1

Vanpool Projects Using Federal-Aid Highway Funds[1]

State	Urban Area	Amount[2]	Vans[3]
Connecticut	Hartford	$170,212	20
Hawaii	Honolulu	139,900	11
Idaho	Boise	12,000	5
Kentucky	Louisville		6
Maryland	Baltimore	30,000	14
Massachusetts	Statewide	50,000	30
Maine	Augusta		6
New Mexico	Santa Fe	100,000	10
North Dakota	Bismarck	20,000	2
Oregon	Portland	350,000	
Pennsylvania	Philadelphia	27,000	15
Rhode Island	Statewide	75,000	
Wisconsin	Statewide	85,525	
Colorado	Denver	132,000	
Missouri	St. Louis	72,500	6
New Jersey	Three Counties	600,000	270
California	Statewide	2,000,000	
Washington	Seattle	690,000	

1 Project either approved or pending approval as of Fall, 1977.
2 Federal-Aid funding level.
3 Including both operating and planned.

As the FHWA report points out, however (8),

"Significant deficiencies were uncovered in the evaluation methodology employed by the project implementing agencies. Frequently occuring faults which affected the validity of results included:

- Sample sizes too small.
- Bias due to low rates of survey responses.
- Samples drawn from too narrow a subset of the population.
- Extrapolation of sample results to the wrong population (i.e., a larger population than the one from which the survey sample was drawn).
- Failure to control for external causes of travel behavior changes.
- Inability to discriminate between "old" carpoolers and "new" carpoolers caused by project efforts.
- Failure to consider normal carpool turnover phenomena.
- Failure to account for carpool dropouts.
- Lack of information on or failure to account for prior travel modes of new carpoolers.
- Failure to consider extra travel mileage due to trip circuity in carpool collection and distribution.
- Failure to consider changes in non-work travel behavior which may accompany expansion of commuter carpooling."

An example of these problems is Denver, Colorado, where surveys have shown that only about one-half of the employers participating in a state, legally-required ridesharing program are utilizing the FHWA-funded matching services, and many of the participating firms are known to be less aggressive in their promotional efforts than are organizations that have adopted their own more personalized matching procedures (9). Yet, the individual FHWA evaluations generally are based only on that subset officially contained in the computerized file; surveys of non-users of the matching services have been performed in only six of the FHWA-funded projects.

Many of these problems result from the relatively low budgets devoted to the evaluation task and the fact that the evaluations were performed as a secondary responsibility of people having primarily a promotional assignment. While these same deficiencies will not automatically apply to the vanpool evaluations, it is likely that many of the same problems will arise unless changes are made in FHWA's procedures under which the evaluation data are obtained.

Another currently funded FHWA research project that is potentially related to vanpooling concerns "Employer Perceptions of Employee Carpooling" (10). The work involves a series of panel discussions with employers o various-sized firms to obtain information with respect to the following ridesharing issues:

- employer reactions to employees sharing rides
- possible employer benefits from promoting carpools
- potential employer-provided incentives
- role of local governments in enhancing employer provision of ridesharing incentives
- constraints to employers providing increased incentives

While the project was conceived as basically being carpool-oriented, the findings also should provide assistance in developing new employer-based vanpool programs. For example, preliminary results demonstrate that larger employers already have a well developed knowledge of ridesharing options; the problem is that they do not feel there are meaningful benefits to be obtained. Many admit that even though benefits have been reported to governmental agencies, actual accomplishments have been minimal. Incentives beyond the provision of matching services and possibly

the communication of the availability of third-party vanpool programs often is resisted by management.

FHWA's technical assistance role, in combination with their sponsorship of ridesharing research, has given them a unique perspective in identifying vanpool research needs. Items mentioned by FHWA staff include in-depth vanpool and carpool behavioral analyses, an investigation of institutional arrangements and operational procedures that would facilitate the initiation of vanpools by employers and individuals, development of procedures to facilitate more personalized matching, guidelines for the identification of high potential vanpool markets, ascertaining the appropriate role of mass media vs. more focused advertising, and issues relating to ridesharing stability such as the frequent lack of a designated leader in a small group carpool. While FHWA has performed extensive travel behavior studies, this research to date has been limited to carpooling and not extended to include vanpooling.

2. Department of Energy

A second major Federal participant in vanpooling has been the Department of Energy (DOE), formerly the Federal Energy Administration (FEA). Though vanpool activities nominally are now centralized within DOT, vanpooling and ridesharing constitutes one of five required components in DOE's funding determination for State Energy Conservation Programs (11) and DOE continues to maintain an active interest in vanpooling. While DOE perhaps is best recognized for their promotional and workshop activities, they also have been actively involved in a number of institutional issues including insurance, regulation and funding.

In addition to the State Energy Conservation Program vanpool contributions, three recent DOE initiatives are as follows:

- A May, 1978, update by Gray, Pratsch and Starling of the January, 1976, Forstater and Twomey EPA Vanpooling inventory report(12,13). The report documents 2000 employer-sponsored vans at more than 160 sites and includes summary descriptions of the programs operating at several companies. Experience in several geographic areas, along with the experience of employers, demonstrates the high value of peer group pressure and this kind of summary document serves an extremely important function.[1]

- An assessment of vanpooling institutional barriers by Davis and Burkhalter discussing insurance, labor and tax issues at the Federal, state and local levels; and presenting extensive background material and recommended solutions (14).

- Support of a cooperative 10-van third-party program in Denver, Colorado, involving Rockwell International, DOE, and Denver's Regional Transportation District (15). Having 3,200 employees and located where conventional public transportation would be extremely inefficient, the vanpool program is seen as a way of providing an alternative to the drive-alone auto as a means of commuting. Though the program has been attacked by the local unit of the Amalgamated Transit Union, the 10 vans are operational and the program is considered to be highly successful.

Two additional areas of high interest to DOE are:

- Owner-operator vanpools. There is a feeling that this type of vanpooling exceeds employer-supported vanpooling and that independently owned vans constitute the largest growth area. The interest is both in developing an estimate of the existing number of owner-operated vanpools and in providing incentives to further increase this particular form of vanpooling.

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[1] A second summary of vanpool operational information is provided in the Transit Compendium notebook series published by N.D. Lea & Associates, Inc. (16). Its major advantages are that it is more quantitative and systematic than the EPA/DOE summaries and that it is privately produced and maintained. The major disadvantages are that at present it contains information on only about a dozen vanpool programs and that it is read primarily by individuals active in the transit profession. Vanpooling data are provided as part of the paratransit section and include address, location, service area description, system description, development history, system and operating characteristics, fare structure, vehicle fleet, relation to other modes, impacts, staff, administrative/institutional issues, costs and revenues.

- Attitudinal aspects of vanpooling and carpooling, with the need being to translate attitudinal research findings into pragmatic, operational marketing techniques.

DOE's aggressive involvement in vanpooling is based, in part, on a series of transportation energy conservation policy analyses during 1974 and 1975 in which vanpooling emerged as one of the options having a high potential for contributing to energy conservation (17,18,19). As a result, two major demonstration/workshop programs were initiated.

The first was conducted by Grey Advertising, Inc., with independent evaluations performed by both Grey and SRI International (20,21,22). Working in five cities, alternative employer vanpool marketing approaches were evaluated including one-on-one contact, direct mailing, mass media, and workshops. In addition, interviews were conducted with a range of companies both offering and not offering vanpool programs. Though there has been a tendency on the part of people to be critical of the Grey work, their December, 1977, report represents a clear statement of employer attitudes toward vanpooling. The Grey demonstration, however, was too short, six months, to detect significant changes in vanpooling and did not contain provisions for employer follow-up. It is now recognized that most employers cannot be expected to respond with an operational vanpool program in such a relatively brief time frame. Nonetheless, numerous useful findings emerged from the Grey and SRI efforts, including the following observations.

- The most effective marketing strategy was the group workshop followed by one-on-one contact. Pure one-on-one marketing was the least effective.
- Vanpooling is not suitable for all employers.

- Vanpools cannot be sold only on the basis of energy conservation.
- Political and public attitudes, including strong institutional support, are key influential factors for vanpooling.
- A number of companies are initiating flex time policies, which are perceived as being incompatible with vanpooling.
- There is a need for third-party van operators.
- The current FHWA vanpooling abort provisions are not serving as an effective vanpool incentive.

The second major FEA program was a series of regional vanpool workshops conducted during 1977 by Skidmore, Owings & Merrill (SOM) and by Alan M. Voorhees & Associates, Inc. (AMV). One widely distributed product of these workshops was the red vanpool "Workshop Kit" containing a series of materials useful to an employer in initiating a vanpool program (23). Of the numerous vanpool guideline-type documents that have been produced, this is, in our opinion, the most professional and objective. Though the AMV/SOM contract has not been formally evaluated, the following Spring, 1978, discussion by Chuck Steinman of SOM represents his cumulative experience from the FEA vanpool workshops as well as from implementing employer-based vanpool and carpool programs in Massachusetts.

> "One of the most important insights that has emerged from this experience is the significant differences between carpool and vanpool programs, with vanpool programs frequently seeming to have better success rates than carpool programs. This is partly because of the need to have some form of institutionalized organization and promotional function between the program level and the individual rider or driver. Because vanpool programs involve a higher degree of coordination, responsibility for which usually falls upon the driver, the driver plays the organizing and selling or "mediating" role between the overall program and the individual commuter. In most carpool programs, there is much less of a personalized mediating function. It thus appears that any institutional strategy must recognize the need for a personalized organizing entity to mediate between the broad program objectives and the day-to-day needs and desires

of potential poolers. This function can be performed by a variety of entities: employer-based coordinators, drivers, third party vehicle providers, or neighborhood or town-based home-site coordinators operating out of town government or civic associations.

"In addition to the problems of reaching commuters themselves, there also are problems in convincing employers to organize carpool programs, although vanpool programs often have proven easier to sell. The reasons for this are complex, but they highlight some of the reasons why many people feel vanpool programs have been more popular and successful than carpool programs, and point the way toward the improvement of carpool programs as well. The most important advantage in vanpool programs is that they are more tangible since they involve the acquisition of specific vehicles for a particular purpose. This high visibility creates specific benefits to the employer who gains public relations advantages and parking savings. This high visibility also helps vanpooling to be self-promoting and, therefore, further accelerates success. The employer can easily monitor the progress and success of vanpools, while it is much harder to ascertain how many people are carpooling, how often, and in what size groups. Carpooling is a more private phenomenon which, from the point of view of both employee and employer, exists at a psychological distance from company management.

"There is also a difference between the way carpool and vanpool programs are managed and the types of people who manage them. Vanpool program directors typically are more "hardware" oriented, coming from backgrounds in transportation, fleet management, and administrative services. They are people who need to and are used to producing tangible results which are more visible and therefore tend to build upon their own successes. By contrast, carpool program directors are usually drawn from personnel functions, are more "people-oriented", and are used to being satisfied with work which provides largely intangible benefits to the employer. It is quite possible that behavioral and attitudinal research will show that different types of people prefer carpools and vanpools and thus that different types of programs, tailored to the needs of each type of pooler, with different kinds of administrators and monitoring systems, should be devised."

3. Environmental Protection Agency

The vanpooling related activities of the Environmental Protection Agency (EPA) are oriented toward air quality State Implementation Plans and the changes created by the Clean Air Act Amendments of 1977. These

amendments require state and local governments, in areas where national ambient air quality standards are being violated to develop revised State Implementation Plans (SIP's) which will provide for attainment of the standards by 1982. In areas with especially severe photochemical oxidant or carbon monoxide problems, provision can be made to extend the attainment deadline to 1987 on the condition that "reasonable further progress" can be demonstrated in the interim period. In many urban areas, strategies will be required to reduce emissions from transportation-related sources; vanpooling represents one such possible measure.

The development of vanpool and other air quality transportation measures requires urban areas to systematically analyze and evaluate alternative strategies in accordance with recently issued joint EPA-DOT Air Quality Transportation Planning Guidelines (24). The intent of these guidelines is to ensure both the integration of the respective EPA and DOT air quality transportation planning processes and a balancing of air quality, economic, energy, environmental and mobility concerns. In support of these guidelines, EPA is publishing a series of state-of-the-art papers relating to specific transportation measures as well as to analysis methodologies. The January, 1976, EPA report, "Vanpooling: A Summary and Description of Existing Vanpool Programs", has been widely utilized by those with an interest in vanpooling (13), and EPA participated in the recent updating of this inventory (12). In addition, two March, 1978, EPA publications relate directly to vanpooling:

- "Transit Improvement, Preferential Lane, and Carpool Programs: An Annotated Bibliography of Demonstration and Analytical Experience" (25)
- "Air Quality Impacts of Transit Improvements, Preferential Lane, and Carpool/Vanpool Programs" (26)

Both reports are intended to assist metropolitan planning organizations in understanding and planning vanpool (and other) programs. The second report, in particular, evaluates a series of hypothetical scenarios based on existing data.

Various regional offices of EPA also have published vanpool information. Examples are the Region III paper by Miesse describing a vanpool demand model (27) and the 1978 Region VIII report, "Vanpooling: An Overview" (28). (The latter report is in some respects similar in intent to a University of Illinois, Chicago Circle, study (66) summarized in the Appendix but less comprehensive in its scope and depth.)

4. Urban Mass Transportation Administration

The Urban Mass Transportation Administration's (UMTA) interest in vanpooling is related to its broader paratransit program which involves a variety of shared-ride taxi, jitney, subscription bus, and demand-responsive transit concepts. Much of UMTA's early paratransit research was performed by the Urban Institute, with two 1976 reports dealing specifically with vanpooling. These are an assessment of commuter van programs examining the full breadth of vanpool issues relevant to the programs as of that date, and a set of guidelines for the organization of vanpool programs (29,30). Done by Gerald Miller and Melinda Green, the studies reflect the view that vanpooling does not represent a unique mode, but rather part of a continuum of transit modes. The guidelines report is interesting because it stresses the performance of a feasibility assessment prior to organization and promotion of the program, and because alternative mechanisms are described for calculating costs and fares.

UMTA's current involvement in vanpooling is based on sponsorship of demonstration projects as part of its Service and Methods Demonstration (SMD) Program. Four demonstrations -- being conducted in Knoxville, Norfolk, Minneapolis, and San Francisco -- provide a unique opportunity to significantly add to existing vanpool knowledge. While the programs have numerous differences, they, nonetheless, have important commonalities when compared to other ongoing vanpool activities (1):

- The programs are administered by a transit agency or other transportation authority rather than by employers or individuals, and in two cases involve a broader transportation brokerage service.
- They are intended to serve multiple employers rather than individual sites.
- The vans are provided on a third-party lease or purchase arrangement.
- Each is being independently evaluated.

Given the weaknesses in existing vanpool evaluation data, the independently funded and managed evaluations being performed by the Department of Transportation's Transportation Systems Center (TSC) should provide, by far, more comprehensive analyses of vanpool programs than now exist. While no evaluation can achieve the ideal, still the four evaluations should avoid many of the deficiencies in existing data. Further, the TSC effort provides an opportunity of consistently comparing the range of vanpool programs now existing, something which is very difficult to do at present.

The UMTA demonstrations are significantly expanding knowledge about effective institutional arrangements for vanpool programs. Almost all programs are now employer-based, with some estimates existing of extensive owner-operated vans. Many people have recommended various forms of

third-party arrangements; the UMTA demonstrations provide an opportunity to test these concepts in a variety of urban settings.

The Tidewater Transportation District Commission in Norfolk, Virginia, has purchased 50 vans to serve US Navy civilian and military employees at five bases (4). The program is organized so as to strengthen the operation of existing privately-owned employee vans and buses that are used by their owners to transport co-workers to their employment sites. Application, selection and matching of riders and drivers is performed with the assistance of the involved Navy commands, though drivers are encouraged to obtain their own riders as well. Fares also are determined by the individual drivers, but with a suggested fare structure provided by the Commission. The minimum vanpool size is eight, with six passengers being sufficient to begin service.

The Knoxville demonstration was started in January, 1976, and ran until December, 1978(3). Operated by the City of Knoxville with the assistance of the University of Tennessee's Transportation Center, the program was conceived as part of a broader brokerage operation involving carpooling and transit improvements as well as vanpooling. The program involved 51 purchased vans and was areawide in coverage; maintenance of the vans was provided by the Knoxville transit agency after the warranty period was completed. The program was based on the concept of van seeding in which vans were initially leased to a driver with the intent that the driver would eventually either purchase the program's van or an independent new van. Depreciation funds, however, were designed to permit continuance of a brokerage operation. As of August, 1978, 40 of the 51

original vans had been sold to drivers, and a Knoxville Area Vanpool Association (KAVA) had been established both to assist these owner-operators and to obtain group discounts on various types of purchases. Program operations, known as the Knoxville Commuter Pool, were based at the University of Tennessee until July, 1977, when they were transferred to the City of Knoxville's Department of Public Transportation. As of the end of the formal demonstration, operations were being returned to the university.

Much emphasis has been given in the Knoxville demonstration to "institution building," particularly the development of a Section 13(c) transit labor union agreement and the provision of adequate insurance coverage. Still, a variety of interesting operating statistics have been developed. For example, more than 50 percent of vanpool users are previous carpoolers, and more than 40 percent use a private auto to get to a vanpool "park-n-ride" collection point (31). KCP also found it difficult to determine which trial vans would become successful and which would fail. Because of this termination effect, approximately 16 during 1976, more vanpools had to be established than had been considered in initial planning.

The Metropolitan Transit Commission (MTC) demonstration in Minneapolis, Minnesota, is similar to the Knoxville program in that vanpooling is one part of a broader carpooling and transit improvement program(5). Service was provided initially to three large suburban multi-employer sites, with five additional suburban sites recently being added. Project responsibilities are allocated among three separate organizations. A Commuter Services office within MTC is responsible for overall management

of the project, including carpool matching and formation and follow-up employer marketing. Public Service Options (PSO), a private, non-profit firm under contract to MTC, is responsible for initial marketing and contact with employers, initial employee surveying, and all data analysis related activities. In addition, PSO was responsible for the design and development of the demonstration program and is directly involved in much of the day-to-day management and operations of the program. The third organization is Van Pool Services, Inc. (VSI), a subsidiary of Chrysler Corporation, who is responsible for marketing and operating the vanpool portion of the program with vans leased on an as-needed basis from a local dealer. Although 29 vans presently are on the road, it is generally conceded that results to date have fallen short of initial expectations. Several factors have contributed to this performance, many of which are related to the finding that travel and working conditions at the existing sites are not generally conducive to vanpooling. There is a wide distribution of working hours, even within single firms; only a small percentage of one-way commute distance is in excess of 10 miles; residential or origin locations are distributed in a very low density manner so that natural clustering does not occur to the degree expected; parking is free and readily available; it has proven difficult to obtain the support and participation of small employers in a multi-employer setting; and vanpool turnover has been high, exceeding 50 percent. Other difficulties are related more to the organization of the program. The current three-party structure - MTC, PSO, VSI - has proven to be operationally difficult and is considered to be too complex by those operating the program. Vanpool pricing also has proven to be a barrier. Initially, fares were set so as to recover all program costs,

including administrative, driver training, and the backup van fleet. It was felt, however, that the resulting fare levels were too high and in November, 1978, fares were restructured so that only the individual fixed van costs are considered to be on a breakeven basis. Currently, Minneapolis fares are considered to be the lowest of the four UMTA SMD demonstrations.

The fourth UMTA demonstration involves the Golden Gate Bridge, Highway and Transportation District in San Francisco, Marin and Sonoma Counties of California (2). Working with 35 purchased vans, program marketing is directed at employers and workers in the corridor north of San Francisco where the commute trip involves use of the Golden Gate Bridge. The program includes luxury as well as standard, bench seat vans with a premium of approximately 20 percent in the fare charged for the more personalized vans having reclining seats. Vanpool groups are expected to eventually purchase or lease their own non-project vans so that the Golden Gate project vans then can be used to create new vanpools. The results to date have been encouraging, although the uniqueness of the corridor is recognized. Allowing for the provision of backup vans, 31 vans were initially established with current effort now being directed to transitioning of these groups into private vans and use of the original vans for new groups. As intended, between 40 and 50 percent of the present vanpoolers are former transit riders. It is felt that the relatively long one-way commuting distance of more than 40 miles, existing congestion in the corridor, the difficulty of parking in San Francisco, and the professional/management status of corridor residents combine to give this region a high potential for vanpooling. The luxury vans have both reclining seats and reading lights and have proven to be more popular than the standard

van vehicle. A problem exists, though, in the transition program since it has proven to be more difficult than expected for individuals to obtain such customized vehicles.

5. National Academy of Sciences

An important Federal-level vanpool initiative involves the National Cooperative Highway Research Program, part of the National Academy of Science's Transportation Research Board[1] which currently initiated its first vanpool-related research effort, effective March, 1979. Entitled "Guidelines for Use of Vanpools and Carpools as a Transportation System Management Technique" (Project 8-21), the research will "analyze individual and household attitudes, preferences, and behaviors related to ridesharing." Being performed by Joseph Margolin and Marion Misch of George Washington University, in association with Crain and Associates, emphasis is on the determination of appropriate incentives categorized by institutional constraints, city size and type, and market segment. The research is emphasizing psychological considerations in ridesharing and will be one of the first efforts to systematically differentiate vanpooling and carpooling. The methodology being employed is similar to that used by Margolin and Misch in similar carpool-related research performed for FHWA (65). A series of decision analysis panels will be developed in four or five urban areas in order to generate hypotheses, which then will be tested in a broader scale survey effort. The final product, expected early in 1981, will be a set of operational guidelines oriented to transportation practitioners and policy makers.

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[1] The National Academy of Sciences is a private, non-profit corporation, not a government agency. It does, however, conduct a number of services in behalf of the Federal government and the nation's scientific and engineering communities.

6. Office of the Secretary of Transportation

Involvement of the Office of the Secretary of Transportation (OST) in ridesharing until recently had been limited largely to the "Double-up, America" promotional campaign. However, as part of the Energy Coordinating Council, a ridesharing task force was created in 1977 and this task force has developed the new program of ridesharing activities being undertaken jointly by OST, FHWA, and UMTA in response to the Surface Transportation Act of 1978 (32,33). The program includes the following elements:

- A promotional campaign based on the theme "Carpool Together, America".
- A two-year series of about 10 urban area demonstrations, to be administered by FHWA, to test innovative ridesharing ideas. The demonstration sites will be chosen from a national competition, and areas are expected to use the available demonstration funding to supplement existing Federal-aid monies. Each demonstration is to include an independent evaluation administered by the Transportation Systems Center.
- Incentives to increase Federal employee ridesharing.
- Technical workshops designed to assist those state and local officials directly responsible for administering ridesharing programs.

The program encompasses vanpooling as well as carpooling and is designed to help overcome existing barriers to increased ridesharing; for example, the need for more personalized matching procedures. A second cited need relates to the development of marketing mechanisms which would reduce the amount of front-end employer staff time and costs that must be invested in order to initiate a program. Other areas of innovation relating to ridesharing being encouraged include preferential parking programs, priority high occupancy vehicle facilities, brokerage services, buspools, variable work hours, and pricing measures. Emphasis in the demonstration is on augmenting existing ridesharing efforts. To maximize the effectiveness of the $2,000,000 of available UMTA and FHWA special

demonstration funding, a local area must commit $2 of normal Federal-aid transportation funds, including the required local match, in order to obtain an additional $1 of ridesharing demonstration funding.

7. Congress

In identifying various Federal vanpooling activities, it is important to include the Congress of the United States. Federal legislation has been an important influence in the development of vanpool programs, and likely will continue to be so. Research support for Congressional initiatives is based in part on the Congressional Budget Office, in part on the Office of Technology Assessment, but primarily on work performed by vanpool advocates within both industry and government. If there is a criticism of this Congressional involvement in vanpooling, it is that special vanpool legislation, by being so narrowly drafted, distorts other transportation programs and may actually work against other desirable para-transit developments. There also is some evidence that interests not strongly supportive of vanpooling are developing their own vanpool legislation. Specifically, the national transit unions supported a provision included in Section 126 in the Surface Transportation Assistance Act of 1978 which would not allow DOT funding of any vanpool project "which will have an adverse effect on any mass transportation system" (33).[1]

Specific functions, other than legislation, provided by Congress in support of vanpooling include the holding of a vanpool hearing in May, 1977, distribution of a periodic letter to "ridesharing advocates" by the office of Congressman Robert W. Edgar of Pennsylvania, covering legislative developments, serving as a clearinghouse for state vanpool-related

[1]The Conference Committee report, however, defines this as an "appreciable adverse impact." "De minimis effects should not bar assistance" (34).

legislation, and communicating key research findings through publication in the Congressional Record (35). In addition, legislation can also mandate that executive branch agencies perform particular research studies. The DOT ridesharing report prepared by Alan M. Voorhees and Associates is one example (36). Section 126 of the Surface Transportation Act of 1978 calls for a study, to be completed by September 30, 1979, of the administrative effectiveness of DOT ridesharing programs with an eye toward the development of more cost-effective program structures.

The most important Congressional influence, however, has been in establishing ridesharing and vanpool program funding and in creating various program incentives. The Emergency Highway Energy Conservation Act of 1974 authorized the first of a series of yearly demonstration programs. Most recently, the Surface Transportation Act of 1978 took several legislative steps in response to Congressional concern that states and MPO's have not freely chosen carpooling and vanpooling projects over highway construction projects. Specifically, the following provisions are established by the addition of Section 146 to Chapter 1 of Title 23, U.S.C.:

- Section 146(a) incorporates ridesharing projects into the regular Federal-Aid Highway Program with Federal-Aid secondary funds available for a 75 percent Federal share, as well as primary and urban funds. The earlier demonstration connotation is removed. Specifically, projects may include "providing carpooling opportunities to the elderly and handicapped, systems for locating potential riders and informing them of convenient carpool opportunities, acquiring vehicles appropriate for carpool use, designating existing highway lanes as preferential carpool highway lanes, providing related traffic control devices, and designating existing facilities for use as preferential parking for carpools."

- Section 146(c) exempts "vehicles carrying up to 15 persons in a single daily round trip for the purpose of commuting to and from work" and crossing state lines from regulation by the Interstate Commerce Commission.

- Sections 146(d),(e) and (f) directs the Secretary of Transportation to take special effort in promoting ridesharing, to provide various types of technical assistance in establishing carpool and vanpool programs, to remove legal and regulatory barriers to such programs, and authorizes a program of grants and loans to state, regional, and local agencies. While the legislation authorizes $4,000,000 for the fiscal year ending September 30, 1979, and $10,000,000 for the 1980 fiscal year, actual appropriation of these additional funds is not expected.

Energy conservation has served as a major impetus to enactment of these special ridesharing legislative provisions. In addition to the above DOT legislation, Sections 241 and 242 of the Energy Tax Act of 1978 provide an incentive to employers to establish or expand vanpool programs by allowing a 10 percent investment tax credit for the purchase of "commuter highway vehicles" that carry at least eight adults (37). Further, the furnishing of such commuting vehicles by an employer is excluded from being treated as employee gross income if certain provisions are satisfied.

Overall, this Congressional involvement in vanpooling is important not only because of the increased visibility and stimulation it gives vanpool programs but also because it tends to set vanpooling apart from other transportation system management measures.

B. Urban Area and State Programs

Carpooling programs in several metropolitan areas have been expanded to include vanpooling, park-n-ride facilities, and other incentives, thus becoming broader ridesharing programs. The Massachusetts Masspool; Tucson, Arizona; and Los Angeles Commuter Computer programs are three examples. In other areas, independent third-party vanpool programs have been initiated, such as the VANGO program in Baltimore and RIDES in the

San Francisco Bay Area. States such as Michigan and Connecticut have initiated vanpool programs for state employees, with Connecticut having 20 such vans operational at the end of 1978. Many, but not all, of these activities are based on FHWA demonstration program funding.

In each case examined, available vanpool evaluation data are much more limited than the carpool evaluations which have been developed. While Caltrans has included vanpooling in the interim reports for Sacramento (38), the much more typical case is Masspool where a systematic evaluation of existing employer vanpooling has not yet been developed (39). Though Masspool was initiated in September, 1975, because of the initial carpool emphasis and the lengthy insurance and other institutional problems associated with starting vanpooling, there is a feeling that vanpooling only now is "really getting started." As evidence of this slow take-off phenomena, Massachusetts had 35 employer-sponsored vanpool programs in the Spring of 1978 but developed another 10 by the end of the year.

A similar growth situation occurred with the vanpool part of Los Angeles' Commuter Computer program. Starting early in 1976 with 20 vans, vanpooling had increased to 127 vans of the luxury type by September, 1978, and was expected to increase by another 60 vans by the end of 1978. A comprehensive set of evaluation surveys were conducted by Peter Valk and Jesse Glazer in Los Angeles during 1978 (prior to their ongoing introduction of bench seat vans), including both vanpool riders and drivers as well as carpool applicants and the general public. This is the first broad scale survey of vanpool users that is known, with final results expected by May, 1979. Preliminary analyses, though, indicate a number of

interesting findings. Vanpool users have significantly higher household income levels than carpoolers, in part because of the luxury vans being used in Los Angeles; approximately one-half of vanpoolers use an auto to get to a vanpool collection point, creating a possible increase in overall vehicular trip making but still contributing to an overall decrease in vehicle miles of travel; approximately 50 percent of vanpoolers are former carpoolers and about a third formerly used transit; monetary savings are not as important an incentive to vanpoolers as is the increased comfort and convenience of the luxury vans; and most riders were convinced to join a vanpool by friends, or peer group pressure, rather than by other marketing techniques.

The Baltimore vanpool program also deserves special mention as it has been more analytical than most other programs in analyzing market demand potential. Their November, 1975, report, "Vanpooling: A New Low Capital Alternative", is widely cited for its section on market potential (40). A June, 1977, Technical Memorandum by Matthew Bert, "Vanpooling: A Technique for Estimating Impacts", is one of the few direct references to a vanpool demand analysis that exists in the vanpool literature(41). Even this, though, cannot be considered a fully calibrated demand model in the strict sense in which this term is usually used within the transportation profession. More correctly, the Baltimore approach can be considered as a sketch planning or sensitivity analysis in which work trip travel patterns for 145 districts were systematically analyzed with respect to typical characteristics of vanpooling (e.g. minimum one-way trip length of nine miles and available only in firms having at least 200 employees) to estimate a maximum potential vanpool ridership.

New York State DOT is one of the few such organizations to independently perform and publish research. While vanpool studies, as such, have not been performed, a November, 1977, paper by David Hartgen, "Ridesharing Behavior: A Review of Recent Findings", has received fairly wide distribution (42). The discussion focuses on carpooling and concludes, "Most studies have found ridesharing to be a complex (and little understood) behavior relying heavily on social and psychological processes, particularly group dynamics, role, attitude, perception, and personality... agencies should begin now to address the basic concerns raised against carpooling by solo drivers, if they hope to significantly increase carpooling incidence." It can be concluded from Mr. Hartgen's discussion, though not specifically stated, that his concern would extend to vanpooling as well.

In summary, conversations with urban area and state officials responsible for the supervision and management of vanpool programs clearly indicate two points relevant to this review. First, these individuals have a wealth of knowledge that can be considered as vanpool research. Second, very little of it is recorded in a form that can be easily transmitted to Federal officials or others with an interest in vanpooling. One possibility would be to convene a series of workshops, which could be transcribed for research purposes only, to permit these persons to interact and state their views in a frank and candid manner. Meetings such as those conducted by NAVPO and the 1978 Baltimore ridesharing conference do not fully provide this opportunity.

C. Employers

Employers constitute by far the largest single source of published material, and knowledge, on vanpooling with a wide variety of progress reports, promotional material and articles being available. Within the State of Texas, for example, 23 employers were operating 373 vans as of the end of 1978 (43). Throughout the country, numerous corporations - 3-M, CONOCO, TVA, Chrysler, General Mills, Aerospace, Gulf - have helped other employers and groups initiate vanpool programs by publishing material describing their own operations (44,45,46,47,48,49,50,51,52,53).[1]

An important contribution of employers has resulted from the National Association of Vanpool Operators (NAVPO). Started in 1976, NAVPO now has more than 80 members, most of whom are private employers. Its purpose is to assist employers in establishing and operating vanpool programs, to promote vanpooling, and to work with governmental agencies, insurance groups, vehicle manufacturers and leasing companies to remove current barriers to the growth of vanpooling. NAVPO activities include the publication of newsletters and technical reports and the holding of an annual vanpool conference to facilitate information exchange. The 1979 meeting, for example, includes discussions of state and Federal regulations affecting vanpooling, third-party vanpool operations, marketing innovations and insurance. NAVPO also has conducted survey research in order to develop a better understanding of current vanpool operations and needs. Two such efforts involve Professor Christine Johnson of the University of

[1] No direct employer contacts, however, have been made as a part of this review and no attempt has been made to obtain copies of all employer-produced vanpool information. Only some of the more widely known documents are identified in the references.

Illinois, Chicago Circle, who has surveyed NAVPO members with respect to current research needs, and Professor Frank Davis of the University of Tennessee who has assessed recent insurance costs and safety records of NAVPO members (54). It is the belief of NAVPO officials that their type of business association has a critical role to play in promoting employer-based ridesharing programs and that NAVPO can help public ridesharing agencies understand the problems faced by private employers in implementing various types of ridesharing incentives.

At present, individual employer reports constitute the best source of information on the impacts of vanpool programs, though they are neither comprehensive nor unbiased. In addition to information on operating characteristics, examples of the data available in these reports include observed changes in modal share, travel time differences and parking needs/cost analyses. A few reports assess broader employer impacts as well; the January, 1977, 3-M Status Report, for example, includes their absenteeism survey, showing no changes, and provides their justification for concluding that vanpooling reduces tardiness (45).

The employer-supplied evaluation data, however, suffer many of the same weaknesses as the FHWA carpool evaluation data. Much information is either incomplete or missing. For example, 3-M provides relative frequency data on use of the car left at home but no quantitative data so that complete estimates of fuel conservation impacts are not possible. Similarly, CONOCO states that administrative costs are subsidized by the company, but provides no specific amounts or data (47). Yet this information would be very helpful in knowing whether vanpool startup costs are $30,000 - $50,000, for an employer, as some are now claiming (66), or

whether they are significantly less, as implied by much of the promotional literature.

D. Universities

University research relating to vanpooling may take place as part of DOT's University Research Program, as unsponsored graduate theses, or in conjunction with other transportation research projects. Activities at 25 universities were reviewed, with identified vanpool-related research summarized in an appendix. While considerable ridesharing work is ongoing, the majority of this research is oriented more to carpooling or other forms of paratransit than to vanpooling. Moreover, where vanpooling research has been performed and published, it is often based on a small number of early and highly successful programs. While we still suspect (or are hopeful) that as yet unpublished vanpool research of a more comprehensive nature exists, such activity has not been specifically identified as part of this review.

There are some notable exceptions, where very interesting vanpool university research either has been or is now being performed. These include the following:

University of Tennessee - Frank Davis and John Beeson are well known for the development of the Knoxville Commuter Pool program, which includes vanpooling as one element (31). Particular attention has been given to the development of the transportation brokerage concept, state regulation, Section 13(c) labor union provisions, insurance coverage and rates, and other institutional-related aspects of vanpooling.

George Washington University - Joseph Margolin and Marion Misch recently completed a study for the Federal Highway Administration involving "group dynamic" discussion panels and a survey of attitudinal issues in carpooling (65). Under the auspices of the National Cooperative Highway Research Program, this research presently is being extended to include vanpooling and to cover a larger number of urban areas.

University of Illinois at Chicago Circle - Published in November, 1977, the "Vanpool Planning Manual" provides the most complete summary of the state-of-the-art of vanpool operations today, though there are certain limitations in the data used (66). Performed largely by Chris Johnson and Ashish Sen, the research also includes assessments of carpooling and of park-n-ride programs, and the development of a procedure to assess the potential for ridesharing within an identified service area. Current research includes a survey of NAVPO private sector member organizations and an assessment of organizational roles and responsibilities vis-a-vis the operation of ridesharing programs.

University of Southern California - Peter Valk has surveyed vanpool riders and drivers as part of the evaluation activities of the Los Angeles Commuter Computer program. The full results presently are being documented, with some preliminary findings presented as part of Section B, Urban Area and State Programs, of this chapter.

University of California at Los Angeles - Thomas Copeland's September, 1976, study, "Economic Feasibility of Independent Vanpool Operations", represents an early comprehensive economic analysis of third-party vanpooling (64). Currently, Jarvia Shu of UCLA's Urban Planning Program is performing, as part of an evaluation of the Los Angeles

Commuter Computer Program, a series of three surveys which are more carpool-matching and program oriented (63). These latter surveys sample applicants, non-applicants from participating employers, and the general public.

University of California at Berkeley - As part of the Institute of Transportation Studies, David Jones has surveyed employers in the San Francisco Bay Area to determine their attitudes toward various types of vanpool and ridesharing programs.

University of Washington - A series of vanpool-related reports were published in 1976, including an analysis of 58 employer-sponsored vanpool programs (85,86,87,88). The study, done by James O. Jacobson, is unique in that it includes failures as well as successes (88).

III. SUMMARY OF RESEARCH FINDINGS

Vanpooling, like the private automobile and the carpool upon which is is patterned, has emerged as a remarkably flexible form of transportation. For every generalization, exceptions can be cited. Some view vanpooling as a new mode; other perceive it as a special form of transit; still others see vanpooling as just a large carpool. To identify research needs that can be operationally addressed, it is first necessary to categorize the areas in which there is some agreement that either existing knowledge or ongoing research is adequate (Table 2).

A. Travel Behavior

1. Service Characteristics

An examination of vanpool economic and operating characteristics indicates that, in most cases, vanpools are successful where one-way trip lengths are long (greater than 15 miles)[1], transit is not available as an alternative mode, employer size is sufficiently large so as to be able to match 10-12 people from roughly the same residential area, and where extenuating travel conditions exist such as traffic congestion or a shortage of parking. There are, however, notable exceptions. For example, while vanpools are most successful where all users live in a common residential cluster (because trip circuity is minimized and the "express" portion of the commute trip is maximized), there are numerous cases where one or more members of the vanpool are picked up during the "line-haul"

[1] There was a general feeling expressed at the 1978 Baltimore ridesharing conference that the widely quoted figure of 10 one-way miles may be too low, especially for third-party vanpool operations (55). In these arrangements, average one-way trip lengths in the neighborhood of 30 miles are not unusual.

TABLE 2

Vanpool Research Issues

Travel Behavior

- Service Characteristics
- User Characteristics
- Ridership and Demand

Program Cost/Effectiveness

- Benefits
- Costs and Revenues

Institutional Arrangements

- Market Orientation and Design
- Insurance and Regulation
- Administrative Structure

portion of the trip. In addition, both the Knoxville and Los Angeles programs have reported a high incidence of park-n-ride as the means of "collecting" vanpool riders, thereby minimizing total pickup time and trip circuity.

The full range of luxury to economy vans have been successfully utilized, though most vanpool programs place a premium on comfort and this implies an above-average cost vehicle. It seems logical to conclude that vehicle characteristics will vary with the region of the country, with more luxurious vans being more appropriate in certain socioeconomic contexts and economy vehicles being appropriate in others. Even where luxury vans are the norm, though, it may be desirable to offer other types of vehicles as a lower cost alternative in order to attract a broader cross-section of users.

2. User Characteristics

Vanpooling is most useful for those having fixed work schedules - regular hours and minimal out-of-town travel. However, even where daily usage is irregular, there are successful instances of over-subscribing (allowing lower monthly rates and assuming one or more persons will be away each day) and the use of trip-based pricing in conjunction with a low monthly base cost.

Other than this relatively simple point, there appear to be few common socioeconomic characteristics that characterize vanpoolers. Many view vanpooling as being primarily white collar in orientation and indeed most vanpools serve primarily professional and clerical personnel, but documentation exists describing vanpool programs serving primarily

production workers. Similarly, the existing literature indicates no significant biases associated with either income or sex. Racial issues, if they exist, have not been documented.

It is commonly agreed that the driver is a primary key to the success of a long-lived vanpool, with commitment, affability, leadership, and driving skills being cited as prerequisite characteristics. Exactly what vanpool program attributes attract a person to want to be a driver, however, are not well understood. Similarly, the characteristics that differentiate vanpool drivers and riders are not clearly known, including the attributes that differentiate vanpooling from carpooling. The development of an improved understanding of the social and psychological aspects of a vanpool, therefore, constitutes an area where additional research would have a high payoff. While vanpooling generally is promoted in terms of cost savings, fuel conservation and air quality, it is nonetheless recognized by both users and providers that for a vanpool to become permanent, it must establish its own social identity and pattern of personal relationships. Understanding the dynamics of this group formation and stability will help program administrators develop better criteria for matching potential vanpool users and will help individuals decide whether vanpooling is an appropriate means of home-to-work travel for them.

An important user characteristic for employer-based vanpool programs relates to the work environment. Specifically, it has been difficult to develop vanpool programs in companies having strong unions or where there is a history of difficult labor-management negotiations. The fear from

management's perspective is that vanpooling services and the coverage of costs of other modes of commuting to work will become a benefit to be addressed in future labor negotiations.

In summary, the existing knowledge of vanpooler demographic characteristics, per se, appears to be adequate. There is, however, a need for an improved understanding of attitudinal issues associated with either riding in or driving a vanpool, and the cross-classification of this information by population segment.

3. Ridership and Demand

While virtually every organized vanpool program has published ridership statistics, a considerable amount remains to be learned concerning the total potential demand for vanpooling. Within an individual company, vanpool mode shares in the neighborhood of 10 percent are not uncommon, with a few special examples existing of about 50 percent of the employees vanpooling. EPA, in a recent report, assumes 3 percent of all marketed employees within a firm in which vanpooling is available will actually choose to vanpool (26). The literature contains various estimates in the range of 25-50 percent of those eligible to vanpool actually choosing to vanpool.

Less complete data are available on other ridership-related data. Generally, about 50 percent of vanpoolers are former carpoolers; and between 15 and 20 percent of vanpoolers either sell an existing automobile or postpone the purchase of a new vehicle.

An important attribute of the vanpool trip on potential demand is travel time; and more importantly, its individual components - wait

time, pickup time or trip circuity and line-haul time. In the Knoxville vanpool program, 44.7 percent of the participants parked their auto at a pickup point, 9.2 percent were dropped off at the pickup point by an auto, and 9.7 percent walked to the designated pickup point; only 36.4 percent of participants were picked up at their homes (31). A similar high level of vanpool park-n-ride exists in Los Angeles. In this regard, then, vanpooling may be considered much more like conventional transit in the service being provided than the traditional door-to-door carpool to which vanpooling frequently is compared.

With respect to increased trip circuity associated with vanpooling, various time and distance related estimates exist. A widely quoted figure is the 3-M Corporation's early guideline that pickup time should not exceed line-haul time (44).[1] The University of Illinois vanpool planning manual derives a total route deviation distance to line-haul distance of about .24 (66).

A major problem in the use of existing vanpool observations in predicting either the demand for vanpooling in a new area or total vanpool potential is that existing observations of employer-based programs generally are "supply constrained" rather than reflecting an equilibrium between supply and demand.[2] Many companies initially establish a vanpool program on a pilot basis in order to gain operating experience; others with a longer vanpool history purposely do not provide sufficient vans

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[1] Subsequent experience by 3-M, however, indicates that this may be an overly conservative indicator of potential vanpool rider acceptance (45).

[2] This supply constraint, however, does not apply to most third-party vanpool operations. More often than not, these programs have had more difficulty than anticipated in putting vans on the road. Ordered van vehicles have had to be stored until sufficient demand was created, contributing to a perception of program failure.

to meet the expressed requests in order to always have a waiting list and to preserve the image of vanpooling as a new, scarce commodity.

This situation creates special problems in performing vanpool-related policy analyses. Current methods of estimating vanpool potential are based, at best, simply on the definition of an appropriate market segment and the use of observed vanpool modal shares. This is in contrast to a more rigorously estimated statistical model. While this kind of approximate, geographic model can be useful for sketch planning purposes, more often than not, individual employers and vanpool programs have not even used this type of market analysis capability. Reliance, instead, has been placed simply on employment size.

One "cost" of this lack of analytical demand capability is a wide diversity in the estimates of the potential of vanpooling. On the one hand, available data indicate that the number of employer-based vanpools are doubling each year. On the other hand, there is evidence that many of these organizations could be described in some way as a special situation, not generalizable to all employers.

The problems become more difficult when attempts are made to extend the vanpool concept to multiple, smaller employers and to third-party leasing arrangements. More reliable, validated methods of estimating vanpool ridership are needed in order to increase the effectiveness of the resources that are devoted to future marketing efforts.[1] Available promotional resources are likely to be sufficiently limited that care should

[1] An example where a three-mode (drive alone, shared ride, transit) disaggregate work trip modal split model was adapted to include vanpooling as an independent fourth mode is described in Reference 56 .

be taken to direct them at those market segments having the largest possible potential for increased vanpool utilization.

B. Program Cost/Effectiveness

1. Benefits

There is wide agreement on the various personal, corporate and societal benefits associated with a vanpool program. Most are well documented, though some difference of opinion may exist over their absolute magnitude. However, certain benefits - morale, absenteeism, tardiness - have proven difficult to measure and remain widely held hypotheses rather than verified facts.

To the company providing vanpooling, documented and quantifiable benefits include reduced localized traffic congestion, reduced need for new parking facilities, and increased accessibility to labor. Tax benefits, public relations and employee morale are additional possible benefits. Attempts to date to measure decreased absenteeism and tardiness have not been entirely successful.

From the perspective of the user, vanpooling generally is marketed almost exclusively on the basis of economics; commuting costs in a vanpool are demonstrably lower for certain travel conditions than for driving alone or for smaller carpools, especially if auto ownership costs can be eliminated. Surveys have shown, however, that while cost savings may be important in a person's initial interest in vanpooling, more important benefits to most established vanpoolers are convenience and the personal friendships developed. These more social benefits, though, have not yet been satisfactorily incorporated into formal vanpool marketing programs.

It has been hypothesized that the benefits to the vanpool driver differ somewhat from those accruing to the vanpool rider. Few studies, however, have differentiated between driver and rider or have examined the particular attitudinal characteristics of the vanpool driver in depth. Normal benefits to the driver have been commonly thought to be the availability of the van for personal use, the no-fare policy for the driver, and the provision for the driver to keep all fares collected beyond the eight or nine required to cover van purchase and operating costs. Some recent studies, though, are beginning to question the desirability of these driver policies. In particular, individual vanpool fares can be lowered if all fares, including that of the driver, go exclusively to the coverage of costs. In addition, morale and group identity may be higher with total cost sharing; no one will be perceived as receiving a "free ride."

Documented societal benefits include reduced congestion, vehicle miles of travel, fuel consumption and vehicle emissions. Vanpooling is commonly perceived as an "incentive" and there is little outright opposition to the idea.

2. Costs and Revenues

Considerable attention currently is being devoted to the relative cost-effectiveness of various paratransit and transportation system management measures. While a wide variation is possible in vanpool costs, vanpooling generally emerges as a very attractive option in most analyses because of the lack of a requirement for a specially paid vehicle driver (57). In most programs, though, a complete and systematic accounting of

all vanpool program-related costs and related impacts has not been maintained.[1] Consequently, a question has been raised as to whether there may be hidden subsidies, provided by either an employer or a governmantal agency, that makes vanpooling look artificially attractive. This question is fueled, at least in part, by the often significant difference in monthly fares between employer-provided and third-party vanpool operations.

Most employers have priced their vanpool programs so as to recover vehicle and operating costs, but not all costs of program administration and support. The rationale for this frequently is that separate personnel are not required to administer the program and that existing corporate accounting practices do not readily facilitate maintenance of costs that may be simultaneously applicable to a number of corporate programs. Monthly per passenger fares in the range of $20 to $30 are common.

While a systematic comparison has not been made, third-party vanpool fares may be from 30 to 50 percent higher. This results from two factors. First, some third-party operations have attempted to recover all costs, including program administration, backup van provisions, and possibly even a provision for profit. Second, third-party vanpooling can be very labor-intensive, requiring considerable personal contact by program staff with both drivers and riders.

The cost of insurance has been a significant problem in several areas (54), generally constituting the second largest cost component,

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[1] For example, only sparse evaluation data are available on the use of the car left at home by a vanpool rider, yet this is critical in estimating fuel consumption impacts.

being exceeded only by the annualized capital cost of vehicle acquisition.

Few good data are available on the costs of organizing and administering a vanpool program to an employer or on an areawide or third-party basis. Both of the following statements are frequently heard:

- The costs of organizing a vanpool program have been surprisingly high.
- The barriers and difficulty in establishing a vanpool program are not as great as commonly perceived.

The University of Illinois study estimates that an employer-based vanpool program necessitates about $30,000 in organizational startup costs (66). It should be emphasized, however, that very little, if any, of this is "new" funding that would not otherwise be spent in administration. It can be characterized, however, as having an opportunity cost as the resources devoted to vanpooling are not available to be applied to other corporate priorities. In reality, it is this latter reasoning that many companies have used in deciding not to initiate a vanpool program.

With respect to pricing and revenues, the majority of installations have adopted the original 3-M formula of a break-even fare based on eight passengers, no fare for the driver, and the driver retaining the fares for the 9th - 11th passengers. A number of experiments with pricing structure, however, have been initiated recently. These include the substitution of free incentive miles for the driver rather than allowing him to keep extra fares, the use of variable distance fares, the use of introductory discounts where new riders may be given either a free or heavily discounted fare for a limited time period upon joining a vanpool, and the use of 15-passenger vans as a means of increasing revenues for only a small increase in cost and possibly a decrease in fare levels. In addition,

in an effort to lower fares, most third-party van programs now recognize that the time is not yet right to attempt to recover all program costs. Consequently, in order to reduce current monthly fares and attempt to attract new riders, certain program administration, overhead and promotional costs are no longer being directly charged to van operations; instead, they are subsidized by available Federal grants.

There is a feeling among vanpool administrators, particularly those in third-party operations, that vanpool use may be relatively price sensitive. The following comments were made at the 1978 Baltimore ridesharing conference by Arthur Schreiber of Los Angeles' Commuter Computer Vanpool Program (CCVP):

> "The fare structure for vanpooling is critical to the success or failure of the program. We have found passengers are extremely sensitive to even the slightest adjustment. Fortunately, however, we have not raised our fares for more than one year. There is an important statistic from CCVP I'd like to share. When we increased our fares by 20 percent because of an insurance rate increase, we only lost 3 percent of the more than 400 ARCO employees in our program (they're subsidized $22.00 per month), but we lost 14 percent of all other employees in our program, none of whom was subsidized" (55).

The area of costs and pricing emerges from this analysis as one of the higher priority research areas. Three specific items are identified:

- More accurate data on program support costs, and associated direct and indirect benefits. Consistent information is needed to better compare the cost-effectiveness of alternative arrangements for administering a vanpool program. Accurate and itemized breakdowns should be obtained of all related program costs for the vanpool supplier, individual employers and users. For the supplier, differentiation should be made among fixed program, vehicle and variable or operating costs, as well as between startup and maintenance/continuing costs.

- Means of reducing vanpool fixed and operating costs, specifically the cost of insurance.

- Development and analysis of alternative pricing policies with particular attention devoted to the differentiation of effects on the vanpool rider and the vanpool driver, and the determination of impacts on revenue to the vanpool program provider.

C. Institutional Arrangements

Institutional issues can be construed to include not only "hard" items such as regulatory status and insurance coverage but also "softer" considerations such as lead agency designation, market design, program staffing, and budgeting. Until recently, nearly everyone has defined "institutional barriers" as the reason for a slower than anticipated growth in vanpooling. As existing barriers have been eliminated, though, they have been replaced by still more barriers. In addition, an increasing number of people are of the opinion that there is a need for an improved understanding of the vanpool market. For example, what common criteria characterize employers that will aggressively promote vanpooling; what is the role of owner-operator vans relative to employer-provided and third-party van operations?

1. Market Orientation and Design

Key decisions in the development of a vanpool program concern the choice of a target group of employers and workers to which vanpooling will be promoted, and the design of the specific marketing materials and approach to be used. While numerous instances exist where individual employers have organized vanpool programs on their own initiative, area-wide employer-based promotion and technical assistance have proven to accelerate program acceptance. If there is a key, it is personalized assistance - to the vanpool organizer (e.g. employers), to the drivers,

and to riders. Obviously, the more personal assistance that can be provided to a company in organizing and operating a vanpool program, the lower the investment that the company itself must make. On the other hand, total public and private costs may be increased with this labor intensive style of approach. In addition, it is still extremely important that an employer invest a meaningful amount of its own staff time in the design and operation of a vanpool program and view the program with a sense of pride and "ownership";[1] this is most easily accomplished with direct employer staff participation. It is generally agreed that active and strong top management support is critical to an employer-based vanpool program. Further, it is generally agreed that a task force of second level management personnel is important to maintain program acceptance.

While personalized promotion is valuable, examination of the geographic clustering of existing vanpool programs implies that areawide promotion and "peer group pressure" also are important.[2] There has been something of an overreaction to the 1973-74 exclusively areawide carpool promotional efforts, with some people feeling that little or no areawide promotion is useful. It is our conclusion based on this review, though, that a blend of areawide and personal promotion is most effective.

In examining the literature relating to vanpool marketing, several high quality guidelines exist that can help employers and individuals organize and operate vanpool programs. With respect to broader scale

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[1] This implies program ownership, not necessarily vehicle ownership.

[2] Based on the 1978 DOE inventory, 60 percent of the states have either no or only a single employer-site with a vanpool program (12).

vanpool marketing programs, however, three deficiencies stand out:

- Most marketing is oriented toward the economics of vanpooling. There is a lack of rigorous understanding of the particular psycho-social attributes of vanpooling that either attract or deter both riders and drivers, and how these factors can be incorporated into vanpool marketing programs.

- Only very rudimentary quantitative techniques exist for analyzing vanpool market areas and identifying areas of potentially high demand. As a result, many marketing efforts, though well intentioned, are relatively ad hoc in their targeting of market segments. There is a need for improved analytic techniques that can be easily used by metropolitan planning organization, employers and other vanpool organizations.

- Vanpooling generally has been promoted in isolation of other incentives. There is a need to examine vanpooling within a broader context of employment-oriented commuting, including parking, transit and work schedules.

2. Insurance and Regulation

An examination of implementation experience throughout the country indicates that regulation and insurance coverage have constituted two significant barriers to the growth of vanpooling of all types. While significant work has been done in both areas, meaningful questions unfortunately still remain. The Davis-Burkhalter December, 1977, study on "Vanpooling: Institutional Barriers" and the Davis-Peterson September, 1978, paper, "An Update on Vanpool Insurance," provide comprehensive and up-to-date discussions of these issues with respect to all types of vanpooling (14,54). Professor Davis has worked closely with the Insurance Services Office (ISO), an organization supported by 1300 member insurance companies to coordinate and approve rate classifications, and these two papers reflect the results of ISO's efforts to clarify vanpool insurance coverage. The Davis findings are based in large part on two surveys performed by the University of Tennessee's Transportation Center. The first,

in 1977, surveyed commuter vanpool operators and was conducted in cooperation with both the Federal Energy Administration and the National Association of Vanpool Operators; the second survey was conducted in August, 1978, and constituted an update of the earlier survey. The 1977 survey developed the following vanpool accident statistics (54):

Deaths	-	0
Bodily Injuries	-	2
Total Accident Costs	-	$36,714.50
for		
Passenger Miles	-	158,436,286
Vehicle Miles	-	14,770,865

Based in part on this rate of 3.76 accidents per million vehicle miles,[1] four classes of vanpools were defined by ISO (58):

- privately-owned, shared driving
- privately-owned, shared expense
- employer-provided
- all other

The first two categories were classified by ISO as private automobiles, ignoring the additional passenger exposure. The second two classes are defined as commercial passenger vehicles, but with factors based on the lowest commercial rate. In addition, the rates for employer-provided vanpools assume coverage by workmen's compensation rather than the vehicle liability policy.

The reaction that the ISO's 1977 memorandum would eliminate vanpool insurance problems, however, has proven to be premature. Current issues include the high cost of insurance still encountered by some vanpool

[1]The corresponding figures in 1974 for passenger cars was 6.36 and for suburban buses was 26.3 (54).

providers, particularly for various (and possibly complex) forms of third-party vanpool arrangements; the continued uncertainty over the applicability of workmen's compensation; and application of the fellow servant doctrine.[1] In addition, attention currently is being given by NAVPO to the possible use of first-party travel insurance to cover vanpool users while commuting (54,59).[2]

Other relevant findings which emerge from both the Davis and other analyses include the following:

- While the regulation of vanpools as common carriers, contract carriers, or private carriers has been clarified in many states, there are still important exceptions. Clarification is important in determining required insurance coverage. In addition, existing exemptions have been oriented to employer-provided vans and may actually hinder other forms of vanpooling.

- The use of the "for hire" phrase in insurance coverage is ambiguous, at best, and provides little useful guidance in vanpooling.

- Existing corporate vehicle fleet policies frequently have been used to provide vanpool insurance. This again tends to orient vanpooling to large companies.

- Uncertainty over accident rates, the concentration of a large number of riders in a single vehicle and a lack of tight control over the selection and training of drivers have been additional disincentives to the ready provision of economical vanpool insurance.

- The tax consequences to the vanpool provider, the driver and the rider are currently unclear, with numerous inconsistencies in existing interpretation.

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[1] The fellow servant doctrine states basically that an employer is not liable to one employee for injuries caused solely by the negligence of a fellow employee. A summary of the relevant issues of applicability is contained in Reference 14.

[2] "First-party trip insurance is purchased to cover a specified group of people under a specified set of circumstances, with a fixed limit for accidental death, dismemberment, disability, and medical payments. A common form is flight insurance purchased at an airport counter for a specific flight" (59).

Our conclusion is that existing vanpool insurance, regulatory and taxation problems have become increasingly well understood, with a reasonable agreement on at least the general concepts of desired solutions. It is agreed-upon specifics and legal language that is now lacking, particularly with respect to the role of third parties in vanpool operations. An additional need is for the relevant set of Federal and state agencies to expend the time and energy required to clarify existing uncertainties.

3. Administrative Structure

An important category of institutional issues relates to the organization of programs to promote vanpooling, especially the designation of an appropriate lead agency. Successful examples can be found of employer-sponsored vanpools, independent owner-operator vans, and a variety of third-party van arrangements.[1] Examples also exist where the same van is used to handle multiple shifts, midday corporate or other uses, and personal use. The principal tradeoff appears to be cost, with the more formal and limited vanpool operations having higher cost and the more informal arrangements, where greater multiple use is possible, having considerably lower costs.

On a national basis, though, there still are a number of state and local ridesharing programs that have not yet attempted to promote and assist groups implementing vanpool programs. In many areas, even where the insurance and regulatory barriers have been overcome, it has proven

[1] Third-party vanpooling may be either non-profit or for-profit, may be either privately or publicly organized, and may either lease or own vehicles. A non-profit commuter club, possibly involving employees from more than one firm, is one possible example of a third-party vanpool program.

difficult to develop an effective areawide vanpool program. While a systematic assessment of this type of institutional barrier does not yet exist in the literature, certain hypotheses can be based on the review which has been performed:

- There is a lack of a clearly defined and logical lead agency for vanpooling, leading to an attitude of "let's just wait and let someone else do it."

- State and metropolitan area vanpool programs have been understaffed and underfunded. Staffing is deficient both in numbers and in qualifications. Ridesharing projects, because of their newness and orientation to "travel demand" rather than transportation supply, have not yet been able to compete successfully for adequate levels of program funding. This is so even though required funding levels are low compared to traditional construction projects.

- Metropolitan Planning Organizations (MPO's) are the most frequent lead agency in FHWA-funded carpool projects (8). The justification for their involvement, though, is that they are providing a matching service. Such agencies, by definition, are oriented to planning; administering a fleet of either leased or owned vans is not the type of implementation activity in which they are either experienced or anxious to become directly involved.

- Vanpooling, like carpooling, lacks a visible, large constituency and this contributes to a lack of initiatives on the part of state, regional and local agencies.

- The Federal-aid vanpool abort provision has not proven to be an effective incentive.

With respect to transit agency involvement in vanpool programs, the key point appears to be the role of the associated transit labor unions. Transit management generally has been convinced that vanpooling is a good idea, that it will not compete with their operations and that it might even help in eliminating certain highly cost inefficient peak period transit operations. The unions, on the other hand, more often oppose vanpool operations and for a transit agency to be successfully involved

in the operation of a vanpool program, careful steps must be taken to obtain labor union involvement.

The conclusion, at this point in time, is that no one administrative structure is inherently superior in all cases to other forms. Flexibility should be maintained, and as simple a program structure as possible should be adapted to the unique agency, employer, and individual characteristics in each area.

D. Research Needs

The assessment of vanpooling that emerges from this review is mixed. On the one hand, there are numerous exciting and innovative successes. In contrast, however, vanpooling has not grown at anywhere near the rate expected by even the more moderate of the vanpool advocates. There are examples of employer pilot programs that have either disbanded or been reduced in size; vanpooling is either non-existent or very limited in at least 30 of the 50 states. Ambitious promotional programs have resulted in only a small number of new vanpools formed. The result is an increasing feeling that much remains unknown about the vanpool market - the driver, rider, and provider. If previous and somewhat simplistic statements had been correct, then vanpooling would be considerably larger than it now is.

An examination of available vanpool information indicates a lack of reliable and objective evaluation data on the relative costs and effectiveness of different vanpooling arrangements. Vanpooling, even more than carpooling, has tended to be promoted by a relatively small number of highly visible advocates. Data presented to policy and decision makers

occasionally have been sufficiently one-sided so as to result in a backlash reaction. Most evaluation data cited are based on a few highly successful examples rather than a more comprehensive sample of currently ongoing activities.

Some, if not much, of the current frustration is undoubtedly the result of unrealistically high expectations, failure to understand basic principles of travel behavior, and a lack of appreciation for the complexities and dynamics of introducing fundamental change into a heterogeneous society. If nothing else, future vanpool implementation efforts would benefit from more patience and a longer term orientation.

A person's decision of what mode to use in commuting between home and work is made in the same mid-term time frame as the decision of how many and what types of automobiles to own. It is made with considerably more thought, for instance, than the decision to visit a local shopping center. This implies that the success of vanpool programs should be evaluated over a three- to five-year horizon; expecting dramatic changes to occur within a few weeks or months simply is unrealistic.

It is with this idea of patience and long-term growth in mind that the following vanpool research needs are suggested. Though in some ways undramatic, the proposals are oriented to those individuals attempting to operate vanpool programs by increasing the current state of knowledge of vanpooling as a travel mode, by developing improved operational techniques in support of program management, and by relating vanpooling to other urban area transportation activities.

1. Systematic Evaluation of Existing Programs

There is a need for a systematic, comprehensive and in-depth evaluation of a random sample of existing vanpool operations, including a consistent and up-to-date comparison of employer, individual and third-party programs.

2. Analysis of Social and Psychological Aspects of Vanpooling

Individual reactions to vanpooling cannot be explained exclusively in terms of level-of-service, economic, and locational variables. Psychosocial aspects involving number of riders, acquaintanceship, sex, race, age/life cycle, peer group/social pressure, and degree of privacy/personal independence need to be investigated.[1] Emphasis should be placed on the vanpool driver as well as the rider, with care being taken to identify those characteristics that are unique to each.

Similarly, the employer is likely to retain a central position in future vanpool efforts. Yet there is an imperfect understanding of employer attitudes for and against vanpooling. Marketing effectiveness could be increased if the justification for vanpooling could be based on unique employer-relevant criteria as opposed to either governmental level goals such as clean air and energy conservation or provision of a lower cost commuting option to a subset of existing employees.

3. Analysis of Program Costs

A more exhaustive accounting of direct and indirect costs associated with initiating and operating a vanpool program is needed. There is a natural fear of the unknown, and a current perception on the part of some people is that the indirect costs associated with vanpooling may be quite large. Consequently, there is a need to clarify this uncertainty. In

[1] Selected reports addressing attitudinal issues associated with ridesharing and modal choice are identified in a supplemental bibliography.

doing this, care should be taken to differentiate costs borne by the vanpool driver, rider, van provider, and any involved governmental agencies. In addition, this accounting of costs needs to be balanced against a more careful measurement of direct and indirect benefits. It can be argued, for example, that employers or individuals now operating vans would not have made the decision to do so if it was not in their economic self-interest.

4. Improvement of Market Analysis Techniques

Many vanpool programs are seriously understaffed. While this is undesirable, it is likely to remain a reality for at least the near-term future. To maximize the effectiveness of those individuals involved in promoting, initiating and maintaining vanpools, there is a need for a more rigorous and quantitative set of market analysis techniques so that staff efforts can be directed toward those markets having the highest possible potential payoff. These techniques should account for the full range of psychosocial, locational, level-of-service and demographic variables known to affect vanpooling; should simultaneously examine vanpooling, transit, carpooling, and driving alone as modal alternatives; and should account for unique urban area characteristics such as population distribution, employmemt density, and transit availability.

Such techniques should consider natural vanpool dynamics such as changes in residential location (origins) or employment levels (destinations); vacation or other periodic absences in which vanpool utilization could be expected to decline; and shorter term changes such as work shift changes, travel absences or the accommodation of transient riders. The idea of examining travel and vanpool behavior on longer than a daily basis

should be examined, including the use of vanpool logs and household trip diaries, so as to develop a better understanding of vanpool stability. Carefully designed evaluation surveys provide a basis for a much more statistically sound set of methodologies than exist at present.

5. Resolution of Regulatory, Insurance, and Taxation Uncertainties

While these barriers have become increasingly well understood and general solutions have been hypothesized, uncertainties still exist. There is a need for a coordinated Federal action program oriented toward obtaining agreement on the specifics of solutions and implementing necessary changes. Simultaneously, there is an ongoing need to provide state and local governments, employers and individuals with accurate and up-to-date operating information so that implementation efforts are not unduly delayed.

6. Improve Integration with Other Transportation Programs

Vanpooling frequently is organized in relative isolation, independent of other transportation activities. There is a need to reduce this fragmentation so as to achieve an integration with ongoing carpooling, transit, preferential treatment, parking management, work hour scheduling, and other transportation systems management actions. A coordinated and broader set of incentives is needed that are specifically targeted to the user, employers, independent owner-operators, and third-party providers. Examples of two questions which have not yet been examined are the potential for a transit agency to utilize vanpooling to provide service for those trips where more conventional transit would be especially inefficient, and the potential role of vanpooling as an available travel alternative

in those areas that are attempting to reduce or hold constant their supply of parking facilities.

7. Contingency Planning

Contingency options frequently are viewed only in terms of fuel rationing and allocation, or restrictions on use of the private auto. Studies have shown, however, that the effectiveness of disincentives can be increased by a factor of three to five where alternative travel modes are readily available (60). For supply restrictions, the effect of available travel alternatives is to ameliorate the direct adverse personal cost of the disincentive. While transit is most often cited as this available alternative, there is a need to develop mechanisms by which vanpools also can serve as a contingency travel mode. Specifically, in the development of localized contingency plans by urban areas, there is a need to examine ways in which preferential treatment might be given both to the formation and utilization of vanpools during periods of fuel shortage.

IV. VANPOOL INITIATIVES - NEXT STEPS

Based on the assessment of current vanpool knowledge and of priority research needs, it is logical to ask, what next? More demonstrations? Categorical program grants? Promotional campaigns? Workshops? The following paragraphs first present some possible evaluation actions that can be taken with respect to either ongoing or new vanpool programs, and then suggest program initiatives that can be taken at the local, state, and Federal levels. The emphasis, consistent with the findings, is on long-term, durable national growth, building on already in-place transportation activities.

A. Evaluation of Ongoing Programs

The ongoing FHWA and UMTA vanpool demonstration projects are, on an individual basis, very useful. Together with existing employer-based and individual owner-operator vanpool programs, they are testing potentially important organizational concepts - third-party, brokerage, transit agency operation, multi-employer orientation - that will produce valuable information for future vanpool operations. Perhaps most importantly, however, they provide the multiple data points necessary for an objective evaluation of all forms of vanpooling, one that is more comprehensive and systematic than any performed to date.

Ideally, each ongoing vanpool program and evaluation could respond immediately and totally to the defined research priorities. Realistically, though, there are severe limitations placed in most cases on the evaluations that can be performed. Nonetheless, the following recommendations are made in order to suggest possible priorities.

1. Emphasis should be placed on a single combined evaluation covering all forms of vanpooling, with the individual project evaluations in effect serving as "technical appendices." Such an integrated document, synthesizing the findings of ongoing vanpool programs and demonstrations and presenting comparison data in a consistent format, could be of significant use to vanpool organizers in all urban areas.

2. There is a tendency in existing evaluations to place emphasis on those data that are most easily quantified. Increased attention should be given to aspects of a vanpool program that are more qualitative or attitudinal in character. On the part of both employers and users, there is increasing evidence that these psychological, social, and cultural considerations are important determinants of vanpool success and failure.

3. Attention should be given to the evaluation of vanpool failures as well as successes. Given the inherently promotional nature of vanpool programs, it is easy to identify only those vanpools that are working well. In determining how to do things better the next time, though, the most effective learning may occur by talking to "drop outs" and to those individuals and employers who, when given the opportunity to vanpool, chose not to do so.

4. Particular care should be given to assessing the transferability of findings to other urban areas. This is especially true in discussing institutional arrangements and the designation of lead agencies. It is our experience that the evolution of ridesharing arrangements in any urban area is heavily dependent on the personalities of the particular individuals involved and the unique nature of the historical interaction of those agencies having an involvement in urban transportation. In assessing any

one agency's contribution, it is necessary to develop an appreciation of the informal or actual ongoing transportation process in contrast to the formally documented process.[1]

In developing an evaluation work program, care should be taken to retain a proper degree of rigor. For example, merely adding a few attitudinal questions to a survey is likely to add little to what is already known about vanpooling. In this case, what is needed is a method of scaling that will facilitate a meaningful comparison of social and psychological considerations with more readily quantifiable cost and travel data. While it is desirable to move in the direction of the recommended research priorities, it is important that such moves be undertaken with correct, consistent, and carefully thought out methodologies.

B. Local and State Government

Vanpool initiatives by local and state agencies have the potential to contribute to an increased understanding of vanpool operations. While the identified research needs suggest specific actions that can be taken in designing either new or expanded vanpool programs, demonstrations in the following areas (beyond the removal of potential regulatory, taxation, and insurance barriers) would be especially useful.

1. The choice of appropriate lead agency for administering a metropolitan area vanpool program, including the specific roles to be played by employers, van providers, drivers and independent non-profit third-

[1] To develop this perspective, it is likely that an independently performed evaluation will be required, involving numerous interviews with local officials and with care being taken to cross-check reported observations. Because of their own political role and responsibilities, no one individual is likely to have either an accurate or comprehensive picture.

parties. In general, a wide range of institutional arrangements have been attempted by existing programs, with a diverse set of problems being encountered. In particular, the appropriate responsibilities for the designated metropolitan planning organization are unclear.

2. The use of marketing programs that address the psychological and social aspects of vanpooling, rather than relying primarily on potential economic benefits. Building upon existing guidelines, research and marketing materials, a new generation of promotional aids can be developed oriented to specific concerns of both employers and individual users.

3. The use of more personalized and more responsive vanpool formation procedures than exist at present. It is generally agreed that the development of a new vanpool involves considerably more than simple matching based on residential location and starting times. Frequently, computer-based matching techniques have been largely independent of the ongoing marketing program, rather than closely integrated so that the two efforts build upon each other.

4. The development of new methods of pricing, with attention given to the employer sponsor, the rider, the driver, and the van provider/administrator. These can include special introductory incentives, and also extend into financing, taxation, and unique incentives for the driver.

5. Integration of vanpooling into a broader set of ridesharing and transit incentives oriented to employers, individuals, and owner-operators. These can include items such as priority treatment for high occupancy vehicles, carpooling, a variable work hours program, and park-n-ride facilities.

6. Integration with transit services, including the use of vanpooling to replace high deficit transit operations and to provide introductory service into low density areas. Vanpooling, though defined as a form of paratransit, often has been viewed independently of (and even as a competitor to) existing transit agency operations. Programs can be envisioned with the transit operator having a larger lead responsibility for vanpooling than generally exists at present, and where vanpool and transit information is provided in a combined employer-based marketing effort.

C. Federal Initiatives

Additional Federal initiatives relating to vanpooling should be consistent with the basic ideas of increased technical assistance and increasing knowledge of current vanpool operations. Specific actions to be considered include the following:

1. Synthesize and disseminate technical information on the organization and operation of existing vanpool programs, with information on "typical" programs in addition to the 3-M's, CONOCO's, Commuter Computer, etc. While several excellent guideline documents exist, individuals and corporate executives are swayed more by peer group pressure. Information on what representative other people are doing would be very helpful.

2. Provide increased quick-response technical assistance to states and urban area programs, with perhaps some attention devoted to a small number of large employers or transit operating agencies. This technical assistance should include visits varying from a few days to a few weeks in length where Federal staff could work side-by-side with local representatives in initiating a program. Because of the diverse responsibilities

placed on understaffed local agencies, there is an important need for up-to-date information on insurance, regulation, promotion, matching, pricing, etc. Too often, there is a tendency to redo work already done by others simply because this is easier than learning what others have accomplished. While there is a limited role for direct Federal promotion and workshops, this assistance can be more effective if channeled through existing state and local organizations.

3. Demonstrate the government's commitment to vanpooling by initiating a nationwide vanpool program for Federal employees. The effectiveness of governmental promotion and assistance is reduced when its own employees cannot lead by example.[1]

4. Undertake comprehensive transportation systems management demonstrations including coordinated areawide, sub-regional, employer and possibly individual actions. Emphasis should be on the integrated design of incentives and disincentives affecting all modes and aspects of travel, including transit and parking, as well as other means of ridesharing. The demonstrations should not be limited to implementation of a set of actions, but should encompass the process by which these measures are planned and designed. It is imperative that vanpool programs and other transportation systems management measures not be developed in isolation; the need instead is for a coordinated, mutually supportive design process where needed support actions can be routinely obtained. In this view, categorical funding structures for vanpooling and ridesharing would be counter-productive. Ridesharing programs, to achieve long-run effectiveness, must

[1] Similar public sector programs at the state and local level are equally important.

successfully compete with other transportation requests.

5. Integrate ongoing Federal programs related to vanpooling. Recently published Transportation Air Quality Planning Guidelines provide an administrative basis for integrating certain DOT- and EPA-sponsored programs at the state and local level (24). The challenge now is to work with states and urban areas so as to successfully implement these guidelines. It is likely that an important component of a revised air quality State Implementation Plan in most urban areas will include a vanpooling program that can contribute as much to energy conservation as to air quality objectives. The opportunity exists then to use DOT resources to help make this major consolidation of programs a success. Additional money can be used as an incentive to support pilot or especially promising local initiatives that are an integral part of a combined energy conservation, air quality, transportation program.

APPENDIX

UNIVERSITY VANPOOL RESEARCH

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This appendix summarizes the university-based vanpool research which has been identified. The intent is more to identify "pointers" rather than to comprehensively summarize research findings. While some work is ongoing, there is a feeling on the part of some people that vanpooling has been oversold and that the immediate need simply is to let ongoing efforts settle into an equilibrium state. Others, however, are much more positive, but even here the emphasis is on implementation and solving insurance and regulatory barriers rather than on developing a better understanding of vanpool behavior.

University of Arizona

Mona Rosenberg, a student intern with the Pima Association of Governments RideShare Program, conducted a survey of Tucson area employers to learn their attitudes toward "alternative modes of transportation," and specifically the reasons why more employers are not encouraging their employees to rideshare (61). No differentiation, however, was made between vanpooling and carpooling. A central finding was that the ridesharing program was not widely recognized or understood on the part of employers; mass transit instead was viewed as the generally available alternative mode. Further, while a majority of firms supported regulation for insulation requirements, vehicle inspection and maintenance, and

vehicle fuel economy standards, this same level of support did not extend into a requirement for employer-based ridesharing programs.

University of California, Berkeley

The university is unusual in that it is operating its own fleet of vans. In addition, David Jones of the Institute for Transportation Studies has surveyed the 150 largest companies in the Bay Area to determine their interest in implementing or supporting various ridesharing measures. He found that 5 percent currently had an operational vanpool program, 14 percent were currently evaluating vanpooling, and 34 percent had at some point considered sponsoring a vanpool operation. In general, however, these firms were approximately four times more reluctant to support an employer-based vanpool program than either carpool matching or variable work hours. Those firms that had considered vanpooling tended to be located in the suburbs, have a large number of employees, and be oriented to research and development.

University of California, Irvine

Daniel Stokols, Raymond Novaco, Jeannette Stokols and Joan Campbell of the Program in Social Ecology have performed research on transportation-related stress and psycho/social determinants of commuting patterns. Using a sample of 61 male and 39 female industrial employees, a quasi-experimental study was conducted to assess the effects of routine exposure to traffic congestion on the mood, physiology and task performance of automobile commuters (62). The intent is to extend this initial research (1) to examine the behavioral and attitudinal adaptations made by industrial employees to the inconveniences associated with commuting and

(2) to compare stress levels of commuters as a function of various modes of transportation such as private auto, carpools, vanpools and buses.

UCLA

At least two research efforts relating to ridesharing have been performed at UCLA. Jarvia Shu in the Urban Planning Program, working with Los Angeles' Commuter Computer program, conducted a series of three surveys to assist in the evaluation of the overall program, with specific attention on the carpool-matching services being provided (63). The surveys sampled applicants, non-applicants from participating employers, and the general public. Analysis results of the surveys are expected to be available during the Spring of 1979.

Thomas Copeland of UCLA's Graduate School of Business completed a report in September, 1976, for the Federal Energy Administration entitled, "Economic Feasibility of Independent Vanpool Operations"(64). Focusing exclusively on the potential of third-party vanpooling, the research surveyed employer-sponsored vanpool program costs and performed break-even and cash flow analyses for a range of hypothetical third-party vanpool scenarios. The report defines revenue and cost assumptions, separating out overhead and startup costs (the latter estimated to be in the order of $50,000 - $70,000). Conclusions include an estimate that 20 vans are necessary to cover program costs, that 30 or more vans can yield high returns on invested capital, that startup costs are sufficiently high that one to two years are required before independent vanpool operators can become profitable, investment tax credits and loan guarantees are of dubious value as government-provided incentives, and that governmental policy efforts should concentrate on the removal of institutional barriers.

University of Colorado

Mary Beth Marks completed a Ph.D. dissertation in the Department of Psychology concerned with behavioral differences in individual participation in various kinds of energy conservation activities. One phase of her work involved surveys of Denver area firms having ridesharing programs. Because of the limited number of employer vanpool programs in the Denver area, the focus of the surveys is on carpool incentives.

George Washington University

The 1978 Joseph Margolin and Marion Misch behavioral study of carpooling incentives and disincentives has been widely circulated (65). Twenty-one "group dynamic" discussion panels and a survey of 800 Washington, D.C., suburban commuters were used to analyze carpool behavior. While this initial work does not explicitly address vanpooling, it currently is being extended both to include vanpooling and to cover additional urban areas.

While Margolin and Misch found a number of social barriers to ridesharing, they concluded that "a far greater number of commuters can be induced to carpool than now do." Examples of specific findings include the following:

- "Carpoolers tended to be older than solo drivers and to have a somewhat higher income level.
- "Carpoolers and solo drivers both tended to see the advantages of their own chosen mode of commuting more favorably, although they showed general agreement about the greater advantages of driving alone.
- "Cost generally is not the major factor in an individual's decision about carpooling. When asked to list their major commuting problems, less than 5 percent mentioned any economic factor. When carpoolers were asked why they had joined a pool, 41.1 percent

cited cooperative or socializing reasons, 31.5 percent said they sought savings of money or gasoline, 14.6 percent either disliked driving or found carpooling more convenient, and 13 percent generally did not have any other option.

- "Carpool programs that have relied on cost incentives have not been wrong, but simply too restricted.

- "Carpoolers do not want to be thrown into a carpool by chance. More personal match systems are required if carpooling is to appeal to a greater number of people; locator lists and computerized match systems have the least appeal. About 85 percent of those surveyed said they wanted to meet perspective pool members at least once, and nearly 50 percent felt they would actually have to know fellow riders first.

- "Time is of great importance to all carpoolers. Those who drive alone regard it as the worst problem of carpooling.

- "Carpooling is perceived by both those who pool and those who do not as a "hassle" or burden, loaded with a tangle of problems.

- "Parking is an important factor in carpooling, but one that is difficult to deal with. The proportion of solo drivers who would carpool in order to gain guaranteed parking was small.

- "Social factors - how carpool members interact - emerged as the primary consideration in decisions to share rides, yet social aspects often are not recognized as important by commuters themselves and are neglected by those setting up pools.

- "Both carpoolers and those who drove along strongly favor the idea of special express lanes for carpool vehicles.

- "Ridesharing cannot increase if the consumer sees it as a loss of what is valued in everyday life, rather than a gain.

- "A disaggregated approach is necessary for carpool programs; they should concentrate on appeals appropriate for particular segments of the population. What works in one city may not work in another."

University of Illinois at Chicago Circle

Work by Chris Johnson and Ashish Sen in the School of Urban Sciences is receiving much current attention. The initial work was completed in November, 1977, and includes separate guideline manuals for vanpooling, carpooling, and park/ride (66). A fourth manual is a computer program

for Service Area Identification Methodology (SAIM). Recent vanpool-related work by Ms. Johnson includes a survey of NAVPO private-sector members to determine their perceived vanpool research needs, a survey of urban area agency involvement with vanpool programs, an assessment of existing urban area organizational roles in the administration of ride-sharing programs, and the development of a ridesharing program in the Chicago area.

The "Van Pool Planning Manual" provides a reasonably concise summary of the state-of-the-art of vanpool operations today examining operating and user characteristics, benefits, insurance, regulation, institutional incentives, and implementing guidelines. Deterministic models, based on market segmentation, for estimating demand and benefits are presented. The major limitation in the research to national applicability appears to be the sample of programs on which conclusions are based. Specifically, much of the data are drawn from published reports or interviews with 3-M, Aerospace, General Mills, CONOCO, CALTRANS, Ralph M. Parsons, and Montgomery Ward. Third-party vanpool costs are based on Commuter Computer of Los Angeles. A comprehensive employer survey (similar to that by the University of Washington) was not conducted. Much emphasis is placed on the relative costs and effectiveness of vanpooling. The following are from the study's Executive Summary:

> "However, like carpooling, this mode does not totally pay for itself. The installation costs of a vanpool program in a company are sufficiently high to limit its spontaneous implementation to those companies with acute transportation problems or to those firms which would substantially benefit from the good public relations.
>
> "These installation and ongoing administrative costs are quite low relative to other transportation subsidies, however. For a typical company implementing a ten-van program, we estimate the annual cost

at about $29 per vanpooler over and above the full cost of van operation or about $60 per car removed since only about half of the vanpoolers can be expected to be former SOA's. The cost of providing "public" vanpool service is considerably higher. Based on (Los Angeles) Commuter Computer statistics (which may be unusually high over the long run), the annual cost of third-party service (with a fleet of 200 vans) would be roughly $83 per vanpooler, or $166 per car removed.

"The cost figures further suggest that every effort should be made to have private companies sponsor vanpooling through both tax incentives and public provision of turnkey installation service as discussed in the Car Pool Report. Where third-party service is warranted, (i.e., small office complexes), we feel there are substantial economies to be realized (similar to those realized in private companies) from adding on to an existing transportation agency as opposed to setting up a separate entity. There are also the additional benefits of creating a coordinated transportation system, and such an approach could eliminate some of the regulatory and insurance problems vanpooling has traditionally faced.

"While we are enthusiastic about vanpooling as an excellent mode for serving some low density transportation needs, we note that ultimately the role of vanpooling in a total transportation system is limited. Nationally, only about 25 percent of the trips are in excess of 10 miles. Many of these trips are CBD-bound and could perhaps be better served by public transportation. Of the remaining trips, only a fraction are sufficiently clustered at both the origin and destination points to be effectively served by a vanpool. In our final tests of Chicago area commuters, we found that only about 2200 vanpools could realistically be expected to form in the six county area."

Other pertinent statements or findings include the following:

- Numerous evaluations have shown that driver commitment has been the key ingredient to long-term success.
- Convenience has been listed more frequently by participants than cost savings as the reason for joining a vanpool.
- Vanpooling has not significantly penetrated the production worker category.
- Vanpooling is successful where the plant is in an isolated area and employees are clustered in one, two or three small neighboring communities.

- Companies with strong unions have not been actively involved with vanpooling.
- The existence of congested roads and low network speed helps vanpooling.
- Vanpooling has a considerably lower diversion of solo drivers than carpooling.
- Costs associated with promoting or organizing a vanpool generally are not recognized and may represent a hidden deterrent to implementation.
- Insurance costs range from $120 to $1700 per year per van.
- Few vanpool programs, private or public, pay for themselves.
- Costs of organizing company-based programs have been "surprisingly high", possibly higher than $30,000.
- Commuter Computer estimates third-party startup costs at a minimum of $50,000.
- Commuter Computer program (not van) maintenance costs are estimated to be $50-$70 per month per van.
- Statistical studies, to date, have not validated the reduced absenteeism and tardiness hypotheses.

Numerous other findings relating to benefits, insurance, regulation and funding are presented as well as implementation guidelines for company-sponsored vanpool programs.

University of Iowa

Irwin Levin et al. have done some small-scale psychological measurement experiments with college students involving ridesharing and the influence of acquaintanceship and sex in two- and three-passenger carpools (67,68). This work, however, has not been extended to vanpooling. With respect to carpooling, the experiments demonstrated "a resistance to contact strangers; economic advantages of ridesharing do not seem to be able to override the interpersonal factor of not knowing others with whom to carpool." "The desirability of ridesharing decreases as the number of non-acquaintances increases, especially for females."

Massachusetts Institute of Technology

While no organized vanpool research, per se, is ongoing, James Womack of MIT's Center for Transportation Studies has had a continuing interest in ridesharing programs, especially their institutional environment. He is responsible for the ridesharing portions of Alan Altshuler's forthcoming transit innovation book and presented an overview or status report of public agency vanpool programs at the Transportation Research Board's 1977 paratransit conference in San Diego (69). Currently, Mr. Womack is the principal consultant to Price, Waterhouse for their FHWA-sponsored study of "Employer Perceptions of Employee Carpooling" (10). The work involves a series of panel discussions with employers to obtain their reaction to potential carpool and vanpool incentives. A final report is expected to be available during the Spring of 1979.

University of New Brunswick

Using the Frederickton area as an example of a small urban community, a computer simulation program, assuming hypothetical demands, has been developed to compare the economic viability of van ownership and lease operations (70).

North Carolina A & T State University

A May, 1976, report, "Factors Influencing the Success of Company-Based Carpooling Programs" by Chi Fai Pan and Alice Kidder documents the results of successive interviews with employees at five Greensboro, North Carolina, companies before, during and after the energy crisis (71). The report is interesting because it is one of the few systematic evaluations of a carpool program and associated incentives. Vanpooling, though, is not separately identified.

University of Oklahoma

Materials developed for a course on paratransit include vanpooling as one of a series of case examples.

University of Southern California

The evaluation by Peter Valk of the Los Angeles Commuter Computer vanpool program was done, in part, as part of a graduate thesis. The research involved a 700-person attitude survey, case studies of individual work sites; an analysis of the potential market penetration of multi-employer, third-party vanpool arrangements; estimates of direct and indirect impacts (e.g. use of vehicle left at home, midday trips); and an

analysis of program costs, revenues, and fares (separating startup from ongoing or operating costs).

Stanford University

A Ph.D. thesis submitted by Guillaume Shearin to the Department of Aeronautics and Astronautics examined the feasibility of carpooling and vanpooling with a third-party coordinator for the Stanford Industrial Park, a multi-employer area containing more than 20,000 employees (72). Based on a 10-year simulation of origin/destination patterns, mode choice, and traffic assignment in which non-monetary impacts were assigned a subjective value and totaled with money costs and cost savings, the author concluded that the potential for vanpooling was limited. Limiting factors included relatively short commuting distances, high van costs, and long pickup times for van passengers. The combination of carpooling and vanpooling was estimated to yield an 8-10 percent reduction in vehicle miles of travel, an increase in overall ridesharing (both carpool and vanpool) from 20 to 30 percent of total work trip modal share, and a vanpool modal share of 2.5 percent.

University of Tennessee

Frank Davis, John Beeson, Frederick Wegmann and others at the University of Tennessee's Transportation Center have been extremely active in all aspects of vanpool operations and have published extensively (31,73,74, 75,76,77,78,79,80,81). The Knoxville Commuter Pool (KCP), developed by the University for the Knoxville urban area, is summarized as part of Chapter II. The work by Davis and David Burkhalter dealing with vanpool

insurance, regulation and other institutional issues is described as part of Chapter III.

While there has been a tendency to view the Knoxville vanpool experience primarily in positive and promotional terms (not without merit), there is also a wealth of practical learning experience that has emerged from this four-year effort which can be of assistance to other urban areas in establishing and operating new vanpool programs. The following are but a few brief examples drawn from the Tennessee work:

- There have been problems in administering the program from both the university and the city. When housed at the university, there was a tendency to view the program as a short-term, temporary research project. In the city, it was difficult to convey the desired regional connotation. In addition, the word "commuter" in the program's name detracted from the desired and broader brokerage concept.

- The original batch-operated computer matching system proved both to be costly and to have an inadequate response time. In addition, providing people with names, addresses and phone numbers of potential matches was not sufficient; people are not yet willing to contact a stranger. Telephone matching and brokering has proven to be much more successful.

- Newsletters, billboards, newspapers, expensive-looking brochures were not felt to constitute an effective media program.

- Ridesharing is a very personal business, but it is difficult to promote ridesharing to the public on a personal basis. A better way has to be found to market ridesharing programs.

- The driver van leases were set up to cover all costs except administration, promotion and backup van provisions. During the entire evaluation period, the program showed a small profit (exclusive of the above costs), although the last 12 months of operations incurred a net loss because of higher than anticipated van maintenance costs.

- Setting up and building a vanpool program is not an easy achievement that should be left to inexperienced personnel; it is a difficult marketing challenge.

- It was relatively easy to find a good entrepreneurial-type driver, but to find the combination of driver and rider potential proved difficult many times.

- With respect to safety, the program had only two minor moving accidents after 745,695 vehicle-miles and 74,569,500 passenger-miles.

- The seed van concept did not work out as well as expected, with a lower than anticipated growth in the number of private vans during the demonstration period. Still, it is believed that the real potential of vanpooling is with privately-owned and operated vans as opposed to either employer-sponsored or third-party lease operations. Considerable difficulty was encountered in keeping priorities in proper perspective. The vanpool portion, although only a small part, had a tendency to dominate all other aspects. In the future, it is recommended by the University that the number of seed vans be limited to 15 rather than the 51 used in the demonstration.

Texas A & M

Don Maxwell, formerly the project manager of MASSPOOL for Alan M. Voorhees & Associates, is now associated with the Texas Transportation Institute at Texas A & M and is participating in a statewide vanpool promotion program administered by the Governor's Office of Energy Resources. University funding is $86,000, with an equivalent level of in-kind services provided by the State. With an objective of making Texas the vanpool capital of the country, the work consists of four basic parts: a vanpool census; solving local and state licensing and other regulatory problems; a series of vanpool background papers; and a series of urban area workshops.

Vanpooling in Texas is almost exclusively employer-based. Of the programs identified to date, only one is a third-party arrangement and one is employee-owned (43). A particularly strong employer incentive in Texas is the expanded labor market available through vanpooling, either in recruiting new employees or in transporting existing employees after a plant relocation. Especially in central Texas, the skilled labor market is very thin; unemployment currently is running about 2 percent.

The vanpool census survey also indicates a tendency by employers to phase out the practice of driver "incentive fares" where the driver keeps all passenger fares beyond a basic minimum of eight or nine. There is a feeling that not only does this constitute taxable income for the driver, but also promotes the overselling of seats (as is done on the airlines), a practice which irritates regular van riders. This incentive is being replaced by "incentive miles" or an increased free use allowance of the van.

The Texas A & M work also is examining the economic and social incentives to vanpooling. "If you talk to the most experienced managers of the most successful company vanpool programs, they will all tell you something like this: 'People get into vanpooling because of the money they save; they stay in because of the convenience and camaraderie.' What this statement really says is this: if the economic incentive is great enough to overcome the social barriers, people will become riders. Then, once they get used to the idea and vanpooling becomes 'ritualized', the social barriers disappear. The truth of the statement is in the fact that vanpool programs require a great deal of effort to get underway, but once they are established, they very seldom fail" (82).

Another focus of the Texas A & M research is on the economic incentives to the employer of providing vanpooling, particularly possible tax benefits obtainable through investment tax credits and allowable depreciation. It is their finding that "the tax shelter available through ownership of the vans and the savings realized from the reduction of parking requirements will assure that a company can afford the administrative cost and financial risks of implementing a vanpool program" (82).

University of Virginia

Lester Hoel and Moreland Herrin published an 18-page paper in September, 1976, entitled, "Organizing and Operating a Vanpool Program: Feasibility of Vanpooling in Virginia" (83). The paper is based largely on published vanpool information available at that time (e.g. 3-M, CONOCO, Aerospace, Maryland) and new work is limited to an estimate of Virginia-specific vanpool costs and a statement of Virginia insurance and regulatory procedures. The paper also references a September, 1976, M.S. thesis by George S. Goodwin III, "Vanpool Costs and Rider Identification," and includes an appendix from this thesis summarizing certain vanpool cost data.

A second paper, "Ride-Sharing Activities of Virginia Industries" by John Austin and Lester Hoel reports on a survey of all Virginia manufacturing and mining firms having 50 or more employees (84). Approximately one-half of the responding firms had some form of ridesharing program, with 9.9 percent of the firms having a van program. Of existing vanpool programs, 36.8 percent were reported as being "firm-assisted" and 52.6 percent were defined as "employee-organized" (10.5 percent were defined as "other").

University of Washington

Dr. Edgar Horwood of the Urban Transportation Program has supervised a series of graduate studies and reports relating to vanpooling (85,86,87,88,89). The institutional analyses by Richard Ford provides a good overview as of the time of the research, but has been dated to some degree by recent state developments and by ongoing work by DOT and DOE. The work

includes extended documentation of Minnesota as a case study, and a recommended state action package.

A second major component of the Washington research is an analysis by James Jacobson of 58 employer vanpool programs. The study is unique in that it includes failures as well as successes. Quoting from the abstract (88):

> "Results show that vanpooling occurs predominantly in outlying regions of the metropolitan areas, among professional and office workers, and not necessarily in organizations with many employees. Management interest played a key role in their existence, and usually no previous carpool program existed. Successful programs were motivated by factors which had some rewards to management. Failures occurred with user, more so than management, apathy."

Other pertinent findings include the following:

- Half of the 58 organizations are engaged in manufacturing activities, but very few of the participants in vanpooling were blue collar workers.
- There is a distinct geographic clustering of vanpool programs.[1]
- There is an "overwhelming pattern" for the employer to overestimate the potential problems that may occur in implementing a vanpool program.
- The most frequent impediment to the development of a vanpool program has been finding riders.
- The surveyed firms are rated by success depending on vanpool mode share, program expansion, and date of initiation. Eight large

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[1] Of the 163 employer sites reported as having a vanpool program by EPA and DOE in their "Vanpooling - An Update" report of May, 1978 (12), 86 (or 53 percent) were located in just five states. Fourteen states were reported as having no employer-sponsored vanpool programs, and an additional 16 states had only a single site.

employers and seven small employers were judged most successful, and carried 8 percent or more of their employees. Most programs had 1-2 percent of their employees vanpooling.

- Six of the eight successful large employers had a parking problem, where only one of the least successful programs was developed in response to a parking problem.
- "Special considerations" played a crucial role in many of the most successful programs.
- In successful programs, the driver was often cited as the key to the continued operation and growth of vanpooling.
- Problems of a lack of summer riders was a major factor in the decision to discontinue.
- More study is needed relating to the provision of vanpool service to small employers through third-party and multi-employer concepts.

The Jacobson study is interesting in that it places emphasis on "travel demand" as a factor or barrier to success. This is in sharp contrast to the usual emphasis on regulatory and insurance issues.

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REPORT OF NEW TECHNOLOGY

Review of the work under this contract has revealed no significant innovations, discoveries, or improvements of technologies at this time. In addition, the methodologies employed are available in the open literature. The report does present findings and addresses several issues relating to the design, operation, and evaluation of van-pooling as a form of paratransit.

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