

1990 NPTS

**NATIONWIDE
PERSONAL
TRANSPORTATION
SURVEY**

**IMPLICATIONS
OF EMERGING
TRAVEL TRENDS**

**Conference
Proceedings**

U.S. Department of Transportation
Federal Highway Administration

**Implications of Emerging Travel Trends
April 20-21, 1994
Conference Proceedings**

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INTRODUCTION

The Federal Highway Administration (FHWA) considers the Nationwide Personal Transportation Survey (NPTS) a valuable resource for understanding changes in travel behavior in the United States. The 1990 NPTS is the fourth national survey of personal travel behavior, preceded by surveys conducted in 1969, 1977, and 1983. By mining the rich data that the NPTS provides, light is shed on understanding why people do what they do relative to transportation use. Such analysis provides valuable insight for effective decisionmaking to meet changing transportation needs. To enrich the interpretive process and to explore specific travel issues implicit in the 1990 NPTS data set, FHWA's Office of Highway Information Management commissioned 12 papers focusing on specific topics to help explain important emerging travel trends and to identify key public policy issues, planning implications, and research needs. The issues addressed in these papers include the following:

- Declines in carpooling.
- Potential saturation of travel by male population.
- Trip linking behavior.
- Travel by women.
- Travel by the elderly.
- Travel by households without vehicles.

The FHWA conference, entitled *Implications of Emerging Travel Trends—What Does NPTS Tell Us?*, held April 20–21, 1994 in Crystal City, Virginia, brought authors together to share their experiences and interpretations relative to the 1990 NPTS among themselves, with NPTS sponsors, and with other users of the survey who may find the NPTS a valuable resource. These findings will inform public policy officials, researchers, analysts and planners, as well as interested citizens about important travel phenomena. In general and breakout sessions, participants discussed implications and potential applications of the authors' findings. A summary of these proceedings follows. The 12 commissioned papers will be issued in a separate three-volume series.

Summary Organization

The following conference proceedings are organized in a loose chronological fashion, following the order of conference events occurring during general sessions held both days. The four breakout session summaries have been grouped separately, organized by letter. Although the topics addressed by each breakout were relatively the same, different findings emerged regarding policy, planning, and research suggestions, so to preserve the "personality" of each group, the sessions were summarized as distinct groups. The appendices include a participant list, the conference agenda, and breakout group members.

OPENING SESSION

Goals and Objectives of Conference

—*Gloria J. Jeff, Associate Administrator for Policy, FHWA*

Ms. Jeff noted that social as well as technological changes work to influence travel behavior and that a national survey provides a useful tracking tool, revealing whether old trends are continuing or if new policies are reversing earlier trends. She delineated the following conference objectives:

- **Achieve a dual focus.** The conference should focus on the implications of emerging travel trends for policy and planning decisions as well as future research needs.
- **Elicit feedback.** Participants were asked to provide feedback on the 1990 NPTS and to offer suggestions for the 1995 survey to better address travel trends.
- **Consider the following points:**
 - How the NPTS data can assist in better decisions regarding environmental quality, congestion management, and social issues, including safety, productivity, and the impact of technological advances.
 - Implications of the Intermodal Surface Transportation Efficiency Act (ISTEA) and the Clean Air Act Amendments (CAAA) on travel behavior.
 - The environmental implications of an aging vehicle fleet.
 - Whether the trend toward driving alone can be reversed.
 - Mobility problems for households without vehicles.
 - Whether specific policies are needed to promote accessibility to jobs or are market forces sufficient.
- **Consider future issues.** As planning occurs for the 1995 survey, the following questions need consideration to better evaluate travel behavior, prediction, and tracking during the coming years:
 - Should we track odometer readings in 1995?
 - How should trip linking be handled?
 - How can we improve transit usage? estimation?
 - How do we look at linkages between modes?
 - What new or expanded research areas should be considered?

NPTS Status: 1990 Reports, 1995 Survey

—Susan Liss, FHWA

Ms. Liss provided an update on planning progress for the 1995 NPTS survey and 1990 NPTS products.

- **Sampling method.** The 1995 survey will sample 25,000 households nationwide, using a telephone sampling frame with random digit dialing (RDD) and computer-assisted telephone interviewing (CATI).
- **Different approaches for 1995.** The following proposed changes are being considered for the 1995 survey, subject to a policy and planning review:
 - The use of pre-interview letters including memory jog cards.
 - More stringent rules on what constitutes a completed response.
 - Oversampling in urbanized areas with rail transit.
 - Collecting odometer readings.
 - Expanding geocoding and on-line edits of trips.
- **State and MPO add-on component.** One goal is the timely dissemination of survey planning information to states and Metropolitan Planning Organizations (MPOs) so that they can make informed decisions about a local add-on to NPTS.
- **New reports.** The *NPTS Databook, Volume 1* is now available, and Volume 2 will be completed late this summer. The *NPTS Urban Travel Patterns* report is also projected for completion this summer.
- **Feedback needed.** Conference participants are urged to follow up in providing feedback on the 1990 survey and on planning efforts under way for the 1995 survey.

Report on Census Conference

—Elaine Murakami, FHWA

Ms. Murakami provided an overview of the National Conference on Decennial Census Data for Transportation Planning, held at the University of California-Irvine in March 1994.

- **Purpose.** The purpose of the Census Conference was to document the use of 1990 Census data for transportation purposes and to document the needs of the transportation community for data from the 2000 Census.
- **Positive aspects of 1990 data.** One positive aspect is that the Census Transportation Planning Package (CTPP) was prepared under one contract between the American Association of State Highway and Transportation Officials (AASHTO) and the Bureau of the Census. Achieving nationwide coverage was an unusual distinction of the 1990 CTPP, which included the Statewide Element and Urban Element packages.
- **Congressional mandate.** Congress has called for reducing the differential undercount as well as reducing costs in the next Census. In 1990, the Census was more likely to undercount

persons of African American, Hispanic, and other diverse backgrounds than to undercount White, non-Hispanic persons.

- **Inclusion of transportation questions?** No guarantee exists as to whether transportation questions will be included at all in the next Census. Where that leaves transportation data is yet unknown.
- **Alternatives under discussion for 2000 Census.** The Bureau of Transportation Statistics will sponsor a study on the continuous measurement alternative to the Census "long form." Matrix sampling is another alternative that would replace 75 percent of long forms with medium-length forms. Instead of asking all sample households the same questions, sample households would be further divided so that each household would answer only part of the questions from the traditional "long form."
- **Main recommendations.** A call for more timely data and better workplace geocoding was made.

I. PAPER PRESENTATIONS—TRAVEL MODE

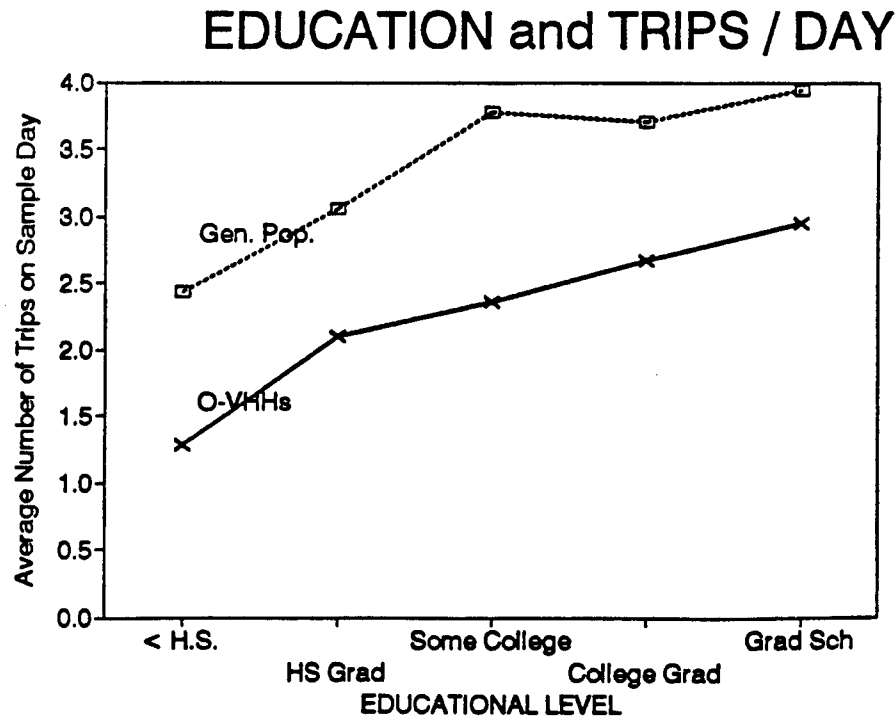
Travel by Households Without Vehicles

Charles Lave, Ph.D., University of California—Irvine

Richard Crepeau, Ph.D. Candidate, University of California—Irvine

Dr. Lave and Richard Crepeau, in studying the travel characteristics of the remaining zero-vehicle households (0-VHHs), seek to provide information to help in understanding the needs of these households and whether adjustments in Federal programs should be made.

- **Trends.** There has been a declining percentage of 0-VHHs over the years.
 - In 1969, 20.6 percent of all HH were 0-VHH.
 - In 1983, it was 13.5 percent of all HH.
 - In 1990, it was 9.2 percent of all HH, representing 6.2 percent of persons.
- **Who are the people in a 0-VHH?** The typical 0-VHH has no one in the labor force, earns a lower than average income, lives in the central part of a large urban area, and is headed by a woman. Most 0-VHHs are retired persons or single adults without children.
- **Where do they live?** Most of the 0-VHH population lives on the east coast in the New England and Mid- and South-Atlantic states. These states account for 36 percent of the total U.S. population and 46 percent of adults who live in 0-VHHs. If Federal policy is motivated by a desire to assure mobility for all, it should focus more on households without vehicles outside the central city—households in which 52 percent of adults took no trips on the sample day.
- **Mode of travel.** Only 31.3 percent of 0-VHHs have someone in the labor force, so commuting is of less concern for this group than for the general population. Adults in 0-VHHs:
 - Make 43 percent of their daily trips by walking,
 - Make 16 percent of trips by transit, and
 - Make 36 percent of trips in private vehicles.
- **Mobility.** Measurements were made to assess whether people in 0-VHHs have sufficient mobility options.
 - Measure #1—Trips per day: Average adult in a 0-VHH = 1.8 trips/day.
Average adult in general population = 3.2 trips/day.
 - Measure #2:—The percent who took no trips:
For adults living in 0-VHHs, 46 percent made no trips during sample day.
For adults in the general population, 21 percent made no trips on the sample day.
- **Demographic effects on travel.**
 - Workers travel much more than non-workers.
 - Young travel much more than the old.
 - Higher incomes produce more travel.
 - Men travel more than women.
 - Travel increases with education level.



- **Travel by persons aged 65 and over.** This group accounts for almost half of all O-VHHs. Their travel in terms of trips/day is unaffected by changes in most of the explanatory variables, such as income, education, MSA categories, and demographics.
- **O-VHHs in the New York MSA.** The NY Metropolitan Statistical Area (MSA) claims 15 percent of all U.S. O-VHHs, and not just among low-income populations; consequently, separate tables for the NY MSA were made, and the majority of tables show U.S. minus NY MSA. New York HHs without vehicles have almost the same number of trips/day as those with vehicles.

The Demography of the U.S. Vehicle Fleet*

Alan Pisarski, Transportation Consultant

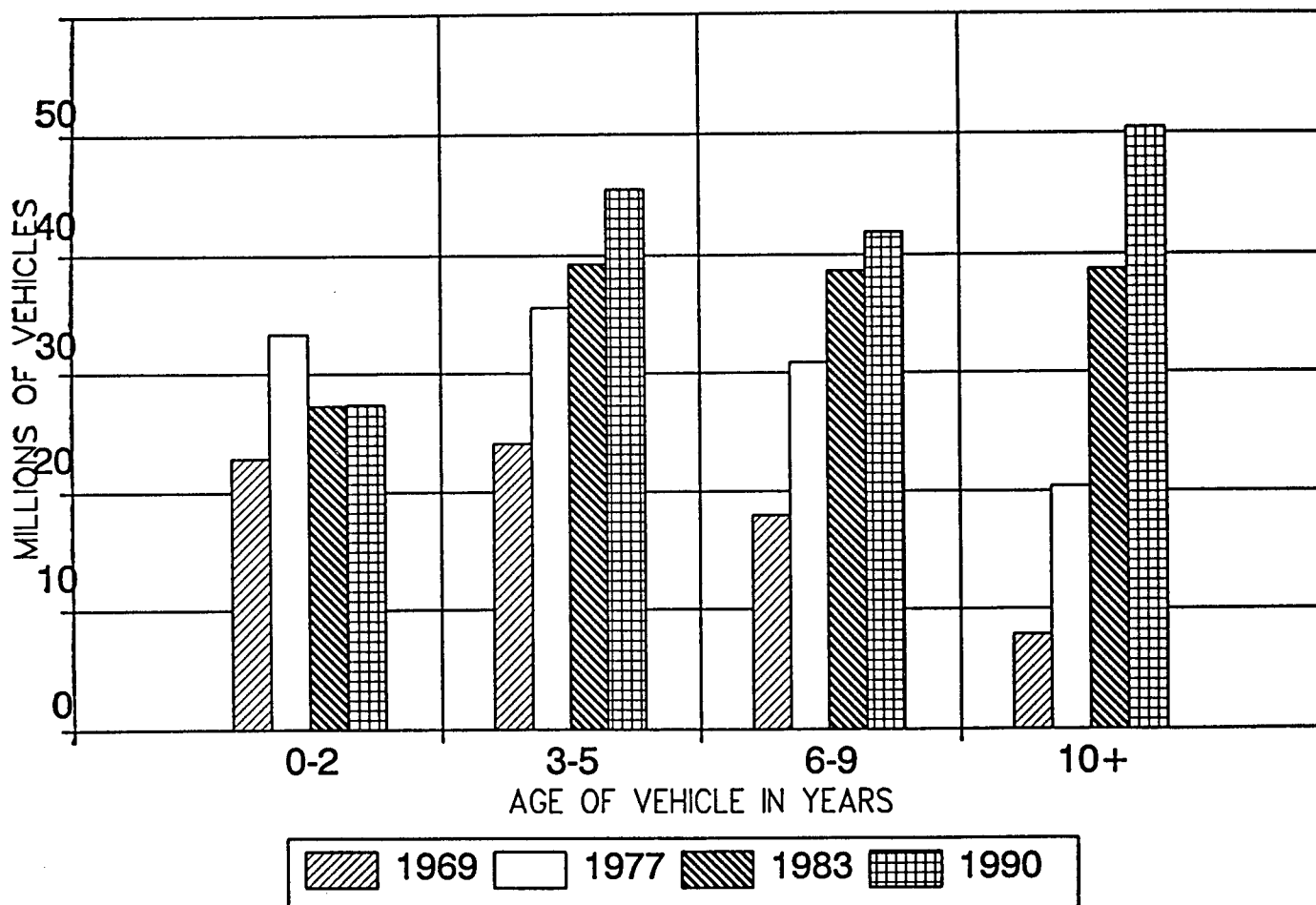
The following represent highlights of Mr. Pisarski's presentation on the aging condition of the U.S. vehicle fleet and its implications for transportation policies.

- **Question of vehicle age.** The dramatic increase in the number of vehicles is slowing. Consequently, the U.S. vehicle fleet is beginning to show signs of aging.
- **Total growth substantial.** Total travel growth has been substantial, almost all of it coming from older vehicles.
- **People are keeping vehicles longer.** Growth in the size of the vehicle fleet has come not so much from expanded sales as from declines in scrappage of vehicles as they age. The vehicle fleet is "accumulating." In 1990, the average vehicle in the household was 8 years old, compared to an average of 5.1 years in 1969.

*This presentation was originally scheduled for the second set (Trip and Vehicle Attributes).

- **Nearly half of current travel by older vehicles.** Forty-eight percent of current travel is generated by vehicles aged 6 years or more, up from 25 percent in 1969.

SIZE OF THE VEHICLE FLEET BY AGE GROUP 1969-1990



- **More older vehicles among ethnic populations.** The Black and Hispanic populations own a greater share of older vehicles than the national average.
- **Women using newer cars.** Women use new cars more than men. This finding may reflect safety concerns and the higher proportion of transporting of children by women.
- **More older vehicles in Pacific and Mountain regions.** These regions have a larger share of older vehicles than their share of all vehicles, perhaps because vehicles driven in these regions are not damaged by the environment as much as on the East Coast. A larger share of recent-model-year vehicles are found in the Northeast.
- **Good news.** Our vehicle fleets are lasting longer than in previous times.
- **Bad news.** The ability to permeate the fleet with new technological changes is limited by the slow turnover rate in the vehicle fleet and has implications for fuel efficiency, pollution generation, and safety.

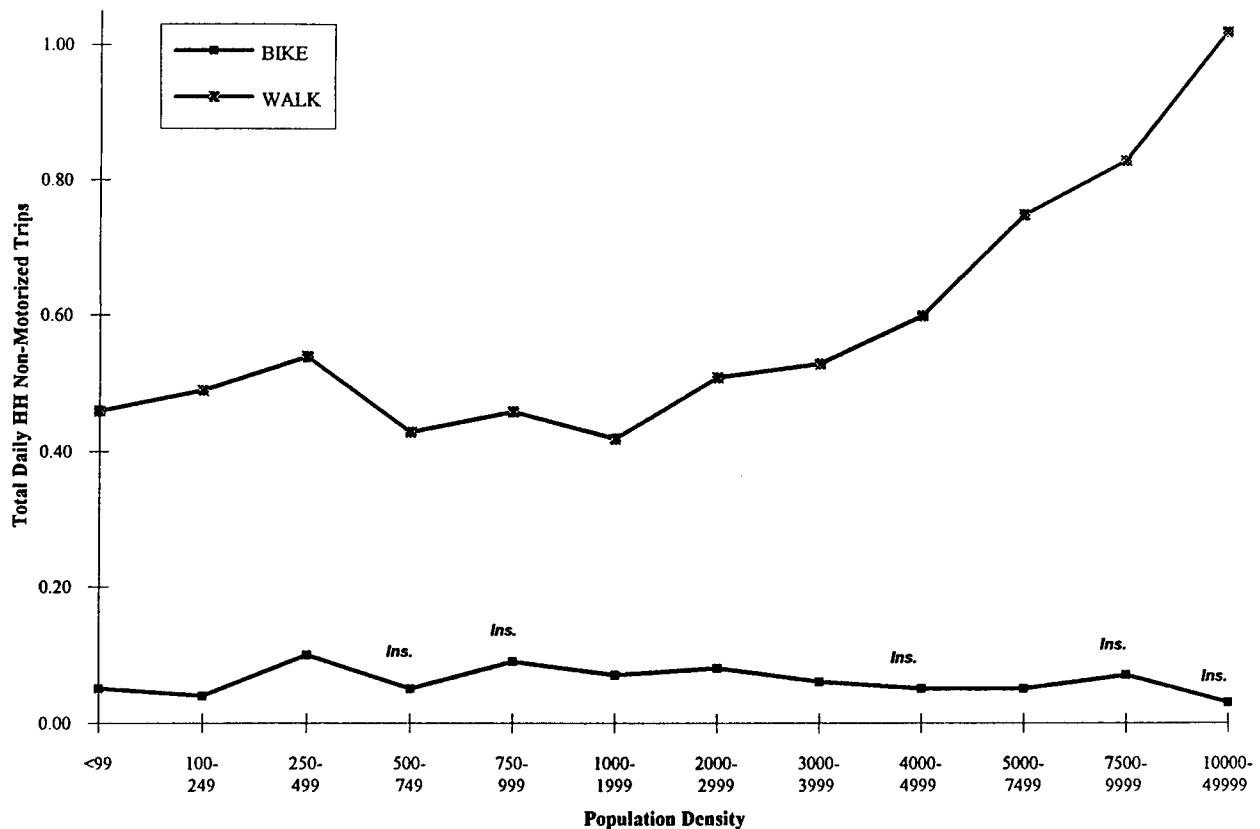
Non-Motorized Transportation

Debbie Niemeier, Ph.D. Candidate, University of Washington
G. Scott Rutherford, Ph.D., University of Washington

Ms. Niemeier presented the results of an evaluation of travel characteristics associated with households and individuals making non-motorized trips. Non-motorized trips account for about 8 percent of total person trips in 1990, showing a slight decline from about 9.2 percent in 1983.

- **Average distance traveled.** The average travel distance by bike was 2 miles, and for walking, .6 miles.
- **Trips by trip purpose.** About 10 percent of all bike trips are for work and/or work-related business. About 12 percent of all walk trips are for work and/or work-related business.
- **Bike/walk trips by population density.** Total daily walk trips show steady increases as population density increases. Bike trips do not show a similar trend.

Total Daily Bike and Walk Trips by Population Density



Ins. - Small Sample-Exploratory Purposes Only

- **Households making non-motorized trips.** Households reporting at least one non-motorized trip consistently make more daily trips, yet accumulate fewer VMT than households making only non-motorized trips.
- **Question.** Do higher trip rates by bikers relate to age? Yes, young people, particularly men, under age 30 are more likely to bike, for work and other trip purposes.

Discussants

Robert Griffiths, Metropolitan Washington Council of Governments

Samuel Zimmerman, Federal Transit Administration

Robert Griffiths' Remarks

- **Relative to MPOs.** NPTS data reflect results that are also showing up in planners' transportation models, e.g., an increase in VMTs that greatly exceeds present capacity.
- **More social/recreational trips.** Increase in trip-making is related to an increase in social/recreational trips.
- **More congestion begs alternative to auto.** Fiscal constraints will limit our capacity to expand as in the past. Excessive congestion levels, in turn, force the issue of finding alternatives to auto-oriented practices—in particular, to the single-occupant vehicle. Carpooling and transit are two alternatives that should not be dismissed, despite current trends showing declines in these modes.

Sam Zimmerman's Remarks

- **Spirited defense of transit.** A stratified sample is needed to draw conclusions about transit trips. NPTS design for sampling is insufficient for analyzing transit use.
- **People without cars not impaired.** It is not necessarily correct to suggest that people without cars are mobility-impaired. Conversely, having a car does not guarantee mobility. One-car families may also have limited mobility because the car may not be available to them.
- **Transit improvements would encourage use.** Greater availability of “great, cheap cabs” (as in New York City) or Americans with Disabilities Act (ADA)-related services would likely prompt an increase in transit use.
- **Transit use sporadic.** The typical transit user in Washington, D.C. uses transit 2.5 times a week. Research is needed to explore the phenomenon of sporadic transit and carpool use.
- **Car ownership begs research.** Research is needed to determine how car ownership reflects changes in transit use, for instance.
- **Reduction of VMT—with and without rail.** In rail cities, a lot of people walk. Is this related to a person's age, availability of pedestrian systems, or land use density? More research is needed.
- **Walk trip chains.** The behavioral phenomenon of walking is not just related to the primary trip, but to a walk-trip chain. In a walking-oriented transit environment, more walk trips are made as part of a walk-trip chain created; in a restricted transit-walk environment, the same short trips are made by car.

Participant comment: Notion of periodicity. We need to adapt to the notion of mixed-use travel—understanding the day-to-day variability of people's transportation use, e.g., using the car 3 days of the week, carpooling 1 day, and taking transit another. Also, people who work at home are very likely to have considerable variation in their daily travel patterns.

II. PAPER PRESENTATIONS—TRIP AND VEHICLE ATTRIBUTES

Time of Day Characteristics of Travel

Ryuichi Kitamura, Ph.D., University of California—Davis

The focus of Dr. Kitamura’s paper is an analysis of the timing of trips made for various purposes to gain a better understanding of temporal aspects of travel behavior.

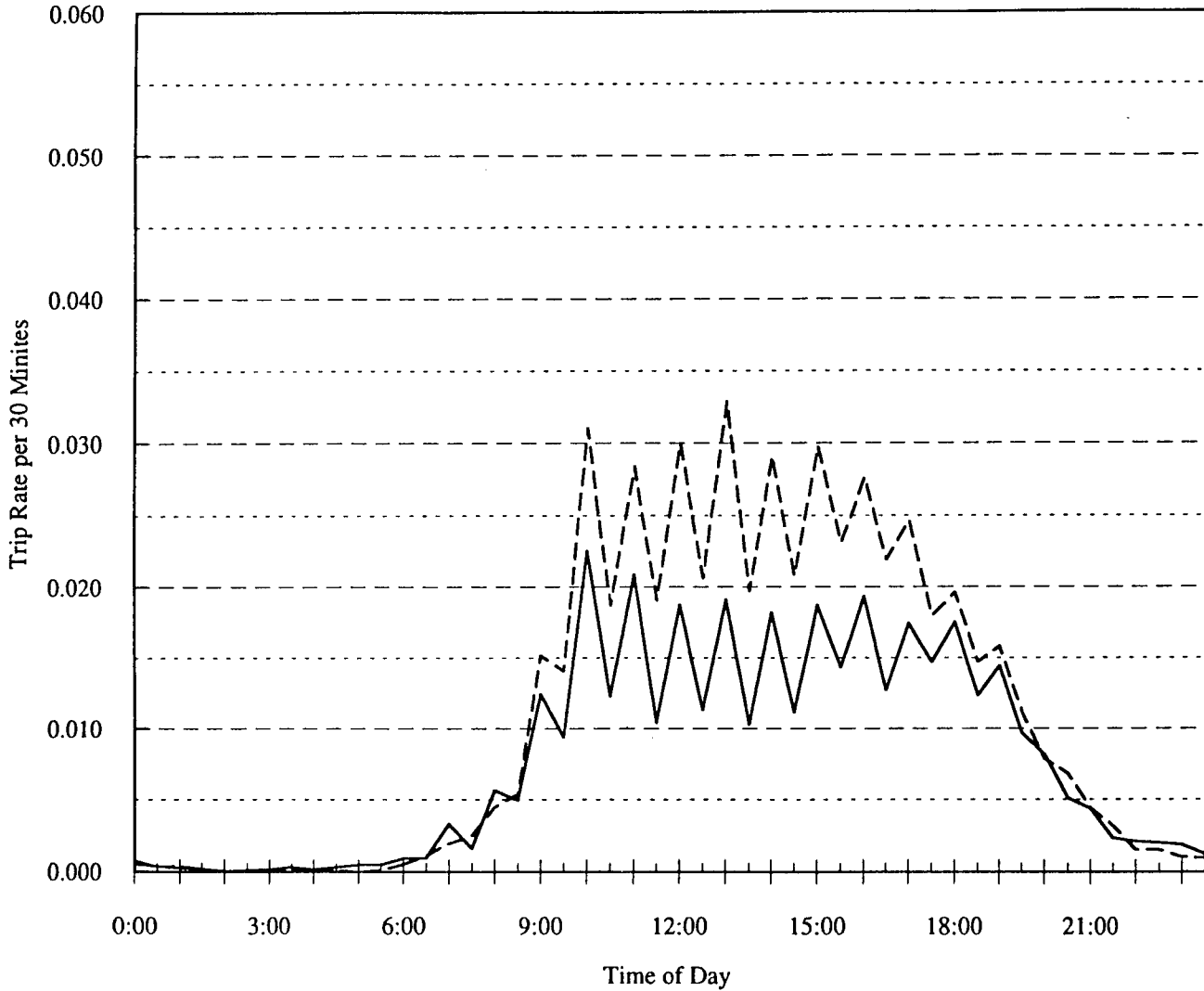
- **NPTS data and results.**
 - 21.2 percent of people reported no trip on the designated travel day. This number is comparable to other data sets.
 - Trip purpose category does not include a “serve passengers” choice.
 - Grouping school/church together is not a good idea because school trips often have characteristics similar to work trips, such as timing, regularity, and frequency. This should be corrected in the next NPTS.

Distribution of Trips by Recorded Starting Minute

Minutes	No. of Trips	%	% (Cumul.)
00	51,999	36.2	36.2
30	39,847	27.8	64.0
45	13,223	9.2	73.2
15	12,433	8.7	81.9
Other	26,043	18.1	100.0
Total	143,545	100.0	

- **Work trip starting times.**
 - By age: A distribution of work trip starting times shows predictable peaks in the morning hours between 6:00 a.m. and 9:00 a.m.
 - By sex: Men make more work trips. Women make more family and personal business trips.
- **Timing is important.** Models are needed to address the relationship between the time availability of individuals and the travel they conduct, particularly given the current focus on congestion management. Dr. Kitamura would like to continue development of duration-timing model systems.

- **Trip purposes by starting times.** The data suggest that a past shopping engagement does not have an impact on the future potential for a shopping trip, which is different from business trips.



Distribution of Trip Starting Times by Sex:Shopping

—	Male	Respondents:18429,	Trips:6927
		0.376trip/respondent	
- - -	Female	Respondents:19706,	Trips:10464
		0.531trip/respondent	

chi-square=234.743, df=47

• **Conclusions.**

- The quality of reporting time variables is questionable.
- He proposes that instead of asking people about the trips they made, ask them about what they did.
- The notion that travel times are fixed is not reflected in the data.

Understanding Trip Chaining

James Strathman, Ph.D., Portland State University

Kenneth J. Dueker, Ph.D., Portland State University

Dr. Strathman’s and Dr. Dueker’s paper presumes that analyzing trip chaining activities rather than collecting individual trips, a basic NPTS unit of measurement, may lead to a better understanding of travel behavior and provide a more appropriate framework for examining transportation policy issues. Although the transportation community has not coalesced on the best way to count and measure trip chains, the trip chaining concept is that people now link many trip purposes together in one outing from home or work.

- **Trip chaining trends.** Fragmentary evidence shows increasingly complex trip-making.
 - The relatively rapid growth of single person households whose trip chains are more complex provide one explanation.
 - The labor force is linking more tasks to the work trip for convenience.

Trip Chain Typology

Trip Chain Type	Configuration*
Simple Work	H - W { - W - } - H
Complex To Work	H - NW { - NW/W - } - W - H
Complex From Work	H - W { - NW/W - } - NW - H
Complex To & From Work	H - NW { - NW/W- } - W - { - NW/W - } - NW - H
Complex At Work	H - W { - NW/W - } - NW - { - NW/W - } - W - H
Simple Non-Work	H - NW - H
Complex Non-Work	H - NW { - NW - } - H

* H = Home, W = Work; NW = Non-Work. The bracketed terms represent additional trips which may be present in the chain.

**Distribution of Main Trip Chain Types and Person Trips
(Millions)**

Trip Chain Type	Trip Chains	Percent	Person Trips	Percent	Trips per Chain
Simple to/from Work	15,834	17.7	32,856	14.1	2.1
Complex to Work	1,184	1.3	4,337	1.9	3.7
Complex from Work	5,724	6.4	22,474	9.7	3.9
Complex to/from Work	1,354	1.5	7,240	3.1	5.3
Complex at work	562	0.6	2,792	1.2	5.0
Simple Non-Work	46,479	52.1	92,962	40.0	2.0
Complex Non-Work	18,126	20.3	69,656	30.0	3.8
Total	89,262	100.0	232,317	100.0	2.6

- **Positive implications of trip chaining.** Need to understand travel behavior to determine why trip chaining occurs.
 - Trips in complex (multi-link) chains are shorter.
 - Trips in complex chains are potentially better for air quality because of fewer “cold starts.”
- **Negative implications of trip chaining.**
 - Complex trip chains are more peak-oriented and auto-dependent.
 - Complex trip chaining makes urban transportation modeling more difficult.
- **Select Findings.**
 - About 45 percent of all person trips are contained in complex trip chains.
 - Work chains are 25 percent more likely to be complex, i.e. to have multiple links, than non-work chains.
 - About 70 percent of the non-work trips linked to the commute occur in the work-to-home portion. About 20 percent occur in the home-to-work commute, and 10 percent occur during the day.
 - Women are 37 percent more likely to form complex work chains and 15 percent more likely to form complex non-work chains than men.
 - Suburban residents are 7 percent and 19 percent more likely than central city and non-metropolitan area residents to form complex work chains.
 - Single person households are 66 percent more likely to form complex work chains than households with more than four members. They are also 17 percent more likely to form complex non-work chains.
- **Conclusions.**
 - The NPTS provides a rich source of data for analyzing trip chaining in the U.S.
 - More attention should be given to analyzing trip chaining behavior rather than trip chaining patterns.

- Better understanding of trip chaining behavior will require broader consideration of household activities, including those that do not require travel.
- **Question.** If non-work-related trips are increasing as part of the leg to and from work, why is there an emphasis on carpooling, HOV, etc.? There seems to be a poor understanding of non-work travel and few options.

Geographic Factors Explaining Worktrip Length Changes

Peter Gordon, Ph.D., University of Southern California

Harry W. Richardson, Ph.D., University of Southern California

The results of Dr. Gordon's study support the view that suburbanization of jobs and residences allows people to live further away from activity centers at a modest cost in terms of extra time travelled, owing to higher speeds on less congested roads. Thus, the premise of this paper and others by Gordon and Richardson is that "urban sprawl" is a transportation solution, not a problem.

- **40 percent growth in U.S. VMT.** Pisarski's analysis of the 1983-1990 VMT growth shows that much of it is due to a 35.9 percent increase in average vehicle trip lengths. Other contributors include the following.
 - Population growth.
 - Decline in vehicle occupancy.
 - Mode shifts to privately operated vehicles.
 - Increased trips per capita.
- **Even more worktrip VMT.** Worktrip VMT grew by nearly 50 percent, due largely to continued increased participation of women in the labor force.
- **Growth in average distance travelled.** Most of the worktrip VMT growth was explained by an almost 27 percent growth in average distance travelled, increasing from 8.6 to 10.9 miles one way.
- **Average trip speeds up.** Depending on how data are aggregated, worktrip durations either fell slightly or grew by much smaller percentages than distances. Either way, there were significant increases in average trip speeds, casting doubt on reports of worsening congestion.
- **Census and American Housing Survey (AHS) data difficult to interpret.** Because only the NPTS data allow for the isolation of direct worktrips, the Census and AHS data are difficult to interpret. The 40-second increase in average trip times recorded by the Census may simply reflect the increase in trip chaining.
- **Reconciling the paradox.** A third view reconciles the seeming paradox: suburbanization of job and residences is such that people are able to exercise the choice to live further away from activity centers, but because of higher speeds on less congested roads, are paying a modest cost (if any) in terms of extra time travelled.

**NONSTOP WORKTRIPS:
COMPARISON OF MEAN TRIP SPEEDS, 1983 AND 1990
TIME OF DAY, METROPOLITAN SIZE, PLACE OF RESIDENCE**

MSA Population Size		AM-Peak	PM-Peak	Off-Peak
Residing Inside Central Cities				
Below 250,000	1983	25.0	22.9	24.6
	1990	29.6*	31.4*	30.2*
250,000-499,999	1983	23.5	25.0	24.9
	1990	29.9*	28.7	31.5*
500,000-999,999	1983	27.4	25.4	25.4
	1990	31.6*	29.3**	32.4*
1-3 Million	1983	27.6	24.2	27.5
	1990	30.7*	30.4*	31.7*
Over 3 Million	1983	25.9	25.5	25.9
	1990	30.0*	28.0	30.6*

Population Size		AM-Peak	PM-Peak	Off-Peak
Residing Outside Central Cities				
Below 250,000	1983	30.3	27.3	28.2
	1990	35.2*	34.1*	36.6*
250,000-499,999	1983	30.7	27.7	28.4
	1990	34.8*	35.1*	34.9*
500,000-999,999	1983	30.6	29.6	28.6
	1990	35.2*	34.9**	35.9*
1-3 Million	1983	28.4	27.0	29.9
	1990	33.5*	30.7*	34.7*
Over 3 Million	1983	28.1	25.8	27.3
	1990	31.8*	30.7*	33.1*

* Significantly greater than 1983 at the 99% confidence level.

** Significantly greater than 1983 at the 95% confidence level.

- **Oversampling of ethnic minorities might help.** The 1990 NPTS data was used to test the widespread notion that the decentralization of employment works only to the advantage of white commuters. Their analysis shows that no systematic disadvantage for blacks was apparent. In black-white comparisons, holding income and metropolitan area constant, 30 pairs of means were calculated.
- **True measure of success.** The responsiveness of urban spatial structure to changing circumstances, including people's lifestyle choices, is the true measure of success of the land-use transportation system. Technological changes are likely to accelerate the process of expanding geographic range in metropolitan areas.

Recent Declines in Carpooling**

Erik Ferguson, Ph.D., A.I.C.P., Georgia Tech University

Dr. Ferguson's report documents changes in carpooling over time, to compare and contrast alternative models of carpool formation and to test one such model using NPTS data.

- **Carpool trends tending downward.** Using the U.S. Census, three time points help to cite carpool trends.
 - Driving increased in the environmental era of 1970-1980.
 - The 1980's saw a continuing decline in carpooling for the journey to work, from 19.7 percent of work trips in 1980 to 13.4 percent in 1990.
 - Between 1985-89, a large decrease was seen in carpooling.
- **Main reason is economic.** Gas prices, which hit a big low in 1985-86, have stayed relatively constant. A point elasticity calculation shows that a decline in carpooling relates to the price of gasoline. A 100 percent increase in the price of gasoline gets a 70 percent increase in carpooling—a point elasticity of 30. Social, demographic, and other factors account for the rest of the carpooling decline.
- **How significant is carpooling anyway?** Except for NPTS, no information exists about shared travel on trips other than for work. Work trips have the lowest average vehicle occupancies compared to other purposes, such as family and personal business, and social/recreation trips.
- **Trip accompaniment.** As people are added to a particular trip, the chance of transit or bike use decreases.
- **Carpooling less sensitive to population density.** Compared to other modes, carpooling shows less sensitivity to population density.

**This paper was scheduled for presentation in the "Travel Mode" grouping of papers, but was presented here.

Discussants

Jon Kessler, Environmental Protection Agency
Eric Pas, Ph.D., Duke University

Jon Kessler's Remarks

Mr. Kessler expressed concern about how to get air pollution related transportation programs under way. Over one-half of emissions are from automobiles, suggesting a need for accurately forecasting emissions and measuring the number of trips taken.

- **Re Peter Gordon's paper.** Is suburbanization a cause or effect of the phenomena he describes?
- **Re Alan Pisarski's paper.** The findings of this paper have major implications for air quality planning and programs. We need to develop better predictors of vehicle aging and the vehicle stock.

Eric Pas' Remarks

Dr. Pas noted that these papers describe many interrelated phenomena and that complex chains are automobile-oriented. The following research implications emerge:

- **U.S. vehicle fleet changing.** We need to study vehicle transactions, acquisitions, disposals, and replacements at certain points in time.
- **Need raw data.** Data should be collected in as raw a form as possible. Data is needed that reflect how people behave on a daily basis.
- **Part-time transit use.** There is a great need to better understand the public's variable use of transit, including the interdependency of transit use and trip chain components that results in a 10% probability of transit use on one day and 100% probability of use on another.
- **Decide what NPTS can and cannot do.** Can it monitor trends? Can it be used to understand and explain changes? It may be that NPTS is not applicable for this purpose.

Group Discussion

- **Complex chains.** Complex chains achieve greater mobility and greatly decrease travel time.
- **Time is the real determinant.** All the other shifts in trip chaining, time mode, etc., can be attributed to how people value their time and make trade-offs with costs, environmental concerns, and other demands.

III. PAPER PRESENTATIONS—DEMOGRAPHICS

An Assessment of the Potential Saturation in Men's Travel

Joel R. Rey, University of South Florida

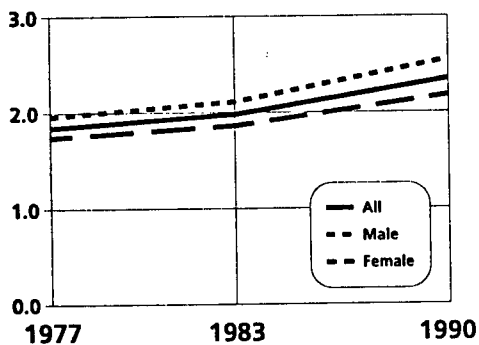
Steven Polzin, Ph.D., University of South Florida

Stacey G. Bricka, University of South Florida

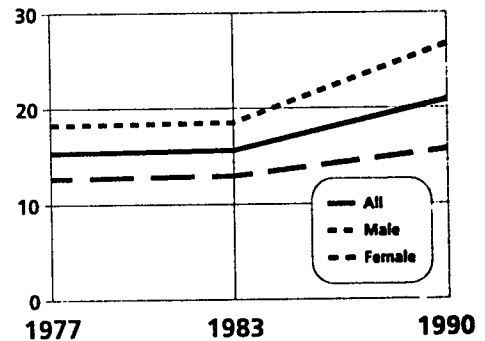
This study analyzed the overall and gender-based trends in person trips, person miles, vehicle trips, and VMT. These categories were subdivided by age, household income, and race or ethnic origin.

- **Male travel up ↑.** Contrary to expectations, total male travel increased at an accelerated rate in almost all categories, although some stability was observed in average daily travel rates.
- **Evidence of stabilization.** Subsequent Nationwide Personal Transportation Surveys should provide evidence of stabilization in person travel in some segments of the population, but saturation has not yet been reached. Travel time might be an area that has reached saturation and this category needs closer examination.

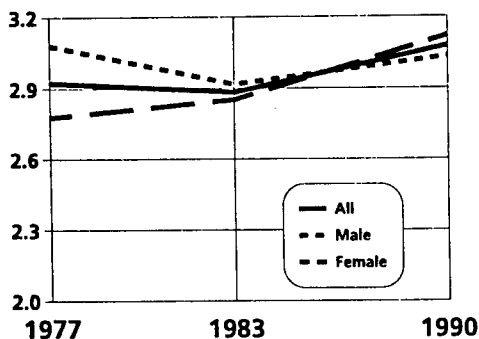
Average Daily Vehicle Trips Per Person (16+ years)



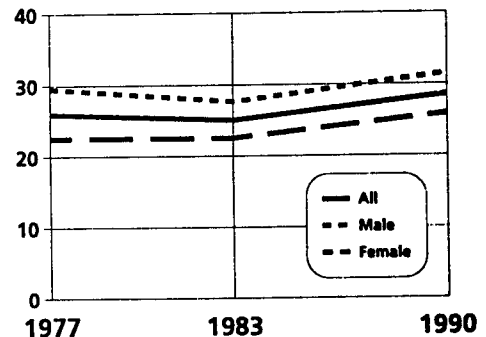
Average Daily VMT Per Person (16+ years)



Average Daily Person Trips Per Person (5+ years)



Average Daily PMT Per Person (5+ years)



- **Has saturation level been reached?** Some segments of the population showed signs of saturation, particularly in person trips; however, there was no significant decline in person miles, vehicle trips, or vehicle miles. The trends were strongly upward. It will be interesting to see the impact of increased speed and trip chaining on the VMT when the 1995 survey data are released.
- **More data points needed.** Desired additional data points include the following.
 - Household income levels rather than gender specificity.
 - Male and female roles as defined within each household.
 - Trip-specific data, including trip type, part-time jobs, and multiple jobs.

Group Discussion

- **Improvements to data collection.**
 - It is believed that the 1983 data are artificially low and that some of the increase shown between 1983 and 1990 may actually reflect increases between 1977 and 1983.
 - Information on segment trip chaining would help in determining if VMT and person miles have reached the saturation level.
- **Recession-based behavioral change.** The 1983 data may be especially low because they reflect the impact of the recession and high oil prices. The data for 1990 may better indicate real-time conditions. When the 1983 data are adjusted to reflect the 1990 CPI, the results are remarkably different. The 1995 data will help clarify the discrepancies and show if the identified trends are continuing.

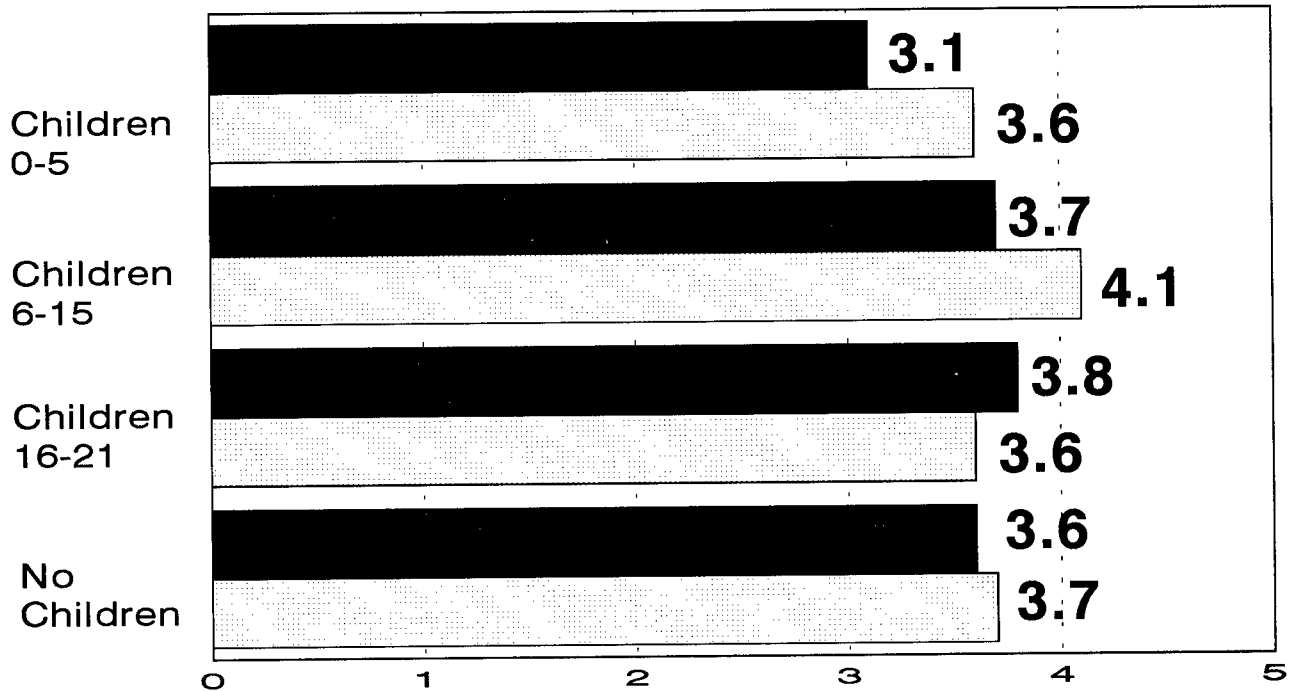
Travel by Women

Sandra Rosenbloom, Ph.D., University of Arizona

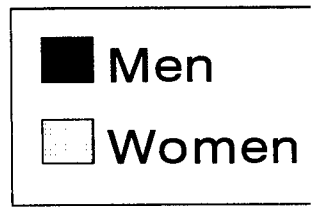
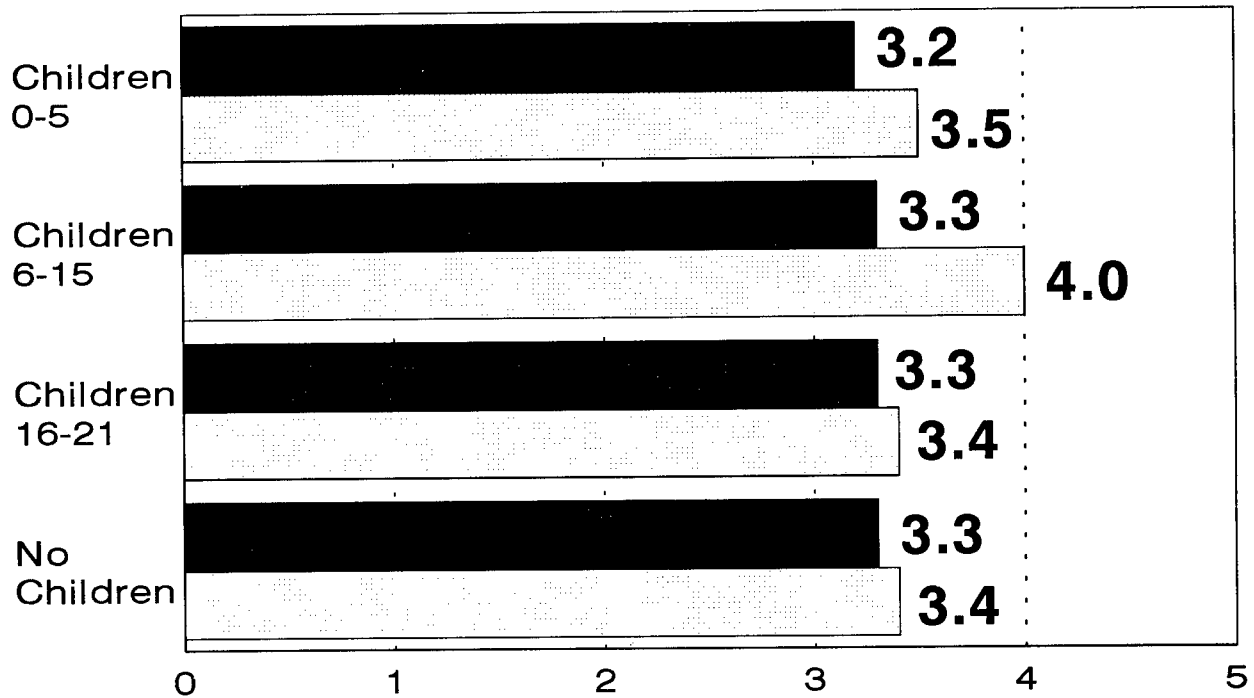
It had been assumed that the differences in women's travel were due to income level rather than gender. However, the 1970's studies indicated that the differences in women's travel patterns were the result of a number of other factors including work status, location of household, number of dependents (children and elderly), income, and number of parents in the household.

- **Relevant statistics on women.**
 - One in five households are headed by women alone.
 - Over 60 percent of married women are in the paid labor force.
 - Over half the women in the work force return to work within 6 months after the birth of a child.
 - Women 16 to 64 make more, but shorter, person trips than men in the same age group, both in urban and rural areas.
 - Women in the labor force retain substantial child care and domestic obligations while assuming duties for aging parents.

One Adult Household
 (Average daily urban person trips)
 BY SEX AND PRESENCE OF CHILDREN



Two Adult Household
 (Average daily urban person trips)
 BY SEX AND PRESENCE OF CHILDREN



SOURCE: NPTS Person Files

- **Observed travel behavior.**
 - Women in low-income households show an increased dependence on the car and travel more work trip miles than women in higher income groups.
 - Single women travel more than married women in the same income category.
 - Hispanic women travel less than women in other ethnic groups.
- **Travel patterns embedded in other lifestyle choices.** Mandatory air quality regulations to reduce travel by automobiles will have a greater impact on women, especially those with low incomes, as the automobile may be the only way they can balance obligations to children and parents in addition to their work requirements. A lack of transportation alternatives for dependents complicates this situation. Provision of better, safer transportation options to meet dependent travel requirements would make travel restrictions on commuter trips more acceptable.

Group Discussion

- **Male/female VMT ratios.** Studies have shown that women in the United States travel at a rate 70 to 75 percent of men's. In Europe, women travel only 30 percent of men's travel. This ratio was not examined in this study but would be an interesting topic, if the analysis included a control for licensing.

Travel by the Elderly

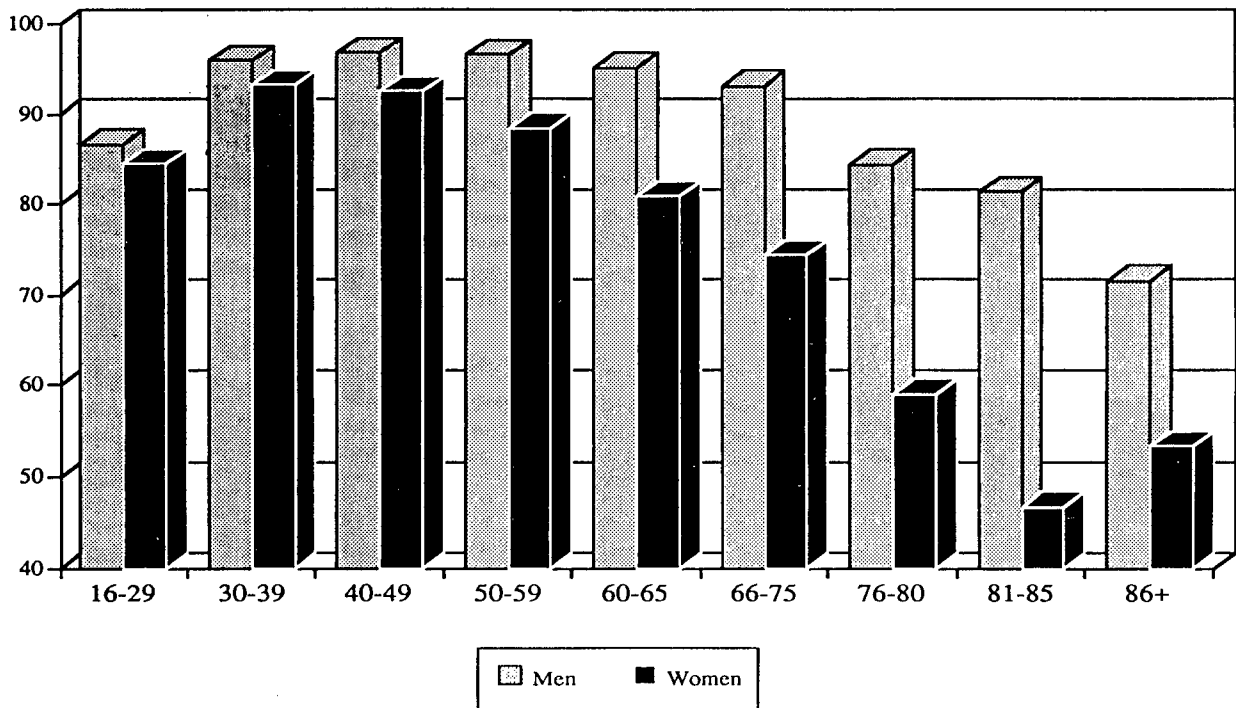
Sandra Rosenbloom, Ph.D., University of Arizona

The growing share of persons over age 65 and their transportation needs are important now and for the near future as the baby boom generation ages. Persons over 80 years of age make up the fastest-growing segment of this population, projected to be over 5 percent of the country's total population by the year 2010.

- **Many elderly are better off than previous generations.** A substantial percentage of the elderly tend to be home owners living in the suburbs; however, there are still pockets of poverty, especially among women, who make up most of the older-elderly population.
- **Elderly lifestyles.**
 - Older men and women are more likely to live alone.
 - Older women are more likely to live in poverty.
 - Men travel more than women but the cohort of elderly women who never obtained driver's licenses is dying.
- **Mobility a critical issue.** Statistics show that the elderly have a growing dependency on the automobile and a declining use of transit. Car use is independent of income level and is based on residential choice. The number of elderly drivers is increasing even though the corresponding VMT are declining.

- **Increased accident rates a major problem.** As the elderly population grows, so does the tendency for increased accident rates. If police take driving licenses away from the elderly, their mobility is severely impacted. Public transit is not the answer. Mobility solutions for the elderly are difficult and require careful planning.

LICENSING RATES AMONG MEN AND WOMEN, By Age, 1990 NPTS



Group Discussion

- **Gap between licensed men and women.** The gender gap in terms of driver's licenses has almost disappeared, but even at ages 16 to 29, the gap still exists. Thus, for future generations of elderly, the gender gap will continue, although less significantly.
- **Attachment to cars.** At least 15 percent of the elderly with licenses did not drive at all but continued to own cars, demonstrating the psychological importance people place on their cars. The elderly also keep their cars to have them available in case of emergency.
- **Mobility issues.** Although very old people, in general, have a higher accident rate than the general population, they still keep their cars and want to drive. They are aware of the problems with increased accidents and are looking for methods to reduce them. Even if their driver's licenses are taken away, they are still unlikely to use paratransit.

Household Structure and Travel Behavior

Norm Coontz, California Air Resources Board

Joan Al-Kazily, Ph.D., California State University, Sacramento

Carol Barnes, Ph.D., California State University, Sacramento

The objectives of this study were to pursue travel behavior based on household structure and person roles rather than on traditional measures, such as household size and income and number of household vehicles.

- **Trip frequency and household structure.** Single household, unrelated and related, single or multiple income households, and ages of dependents were factors used to analyze travel behavior.
 - Households with unrelated adults took more trips, more often, than households with related adults.
 - Single and married households with dependents had the same trip frequency rates.
 - Gender was less of a factor in travel patterns than marital status.
 - Single, unrelated males and females made more frequent trips than married couples.
 - Single males made the longest trips.
 - Trip length was shorter for households with dependents, except in unrelated female households with dependents where the trip length increased.
- **Complex chains per loop.** These were examined by household structure. Complex loops were defined as a sequence of trips beginning and ending at home. Chains were any sequence of trips that fell within the loop.
 - Smaller households had more complex chains and loops.
 - Single households without dependents had the highest number of complex chains per loop.
 - Income and marital status did not impact complex chains or loops.
- **Conventional travel variables have limited use.** Using the traditional variables of number of vehicles, number of licensed drivers and income is useful for predicting some travel aspects but is less well suited for identifying and quantifying people's actual travel needs and developing an equity policy.

Multiworker Household Travel Demand

Siim Sööt, Ph.D., University of Illinois at Chicago

Ashish Sen, Ph.D., University of Illinois at Chicago

Two reasons exist for analyzing the NPTS data by the number of workers in a household: (1) a number of MPOs use multiworker households as part of travel demand modeling and (2) the number of people, workers, and vehicles increase as a household is taking shape. Because the 1990 NPTS did not directly count total workers per household, 5,000 households had to be dropped from this analysis, and a method was needed to adjust and reweigh the remaining data.

- **Trends.** The clear trends from 1960 to 1990 include the following:
 - The number of single worker households declined and the number of multiworker households increased from 37 percent to 59 percent of all family households.
 - The number of multiworker households is greater in New England and the Northwest and relatively small in the South.
 - The proportion of multiworker households increases with the absolute size of a metropolitan area; however, as population densities increase in urban areas, the percentage of multiworker households declines and the movement shifts to the suburbs.
 - The number of vehicles increases more by household size than by number of workers.
 - The largest increase in total miles traveled occurs between households with one worker and households with two workers.
 - Trip length increases with the number of workers but not with household size.
- **In sum.** The number and proportion of multiworker households is increasing.
 - Multiworker households have many vehicles and solo drivers.
 - They tend to take longer trips and drive more miles.
 - They live in low density areas of large cities where transit is not close; however, they are less likely to drive to work alone.
- **Time of day comparison for work trips.** People are less able to conduct trips when they are at work 8 hours a day and, therefore, are out of the daytime transportation mainstream. Obviously, people did not stop shopping; therefore, shopping trips were most likely conducted on weekends, or chained to trips after work.

Discussants

Gary Maring, FHWA

Bob Dunphy, Urban Land Institute

Gary Maring's Remarks

- **Papers and conference timely.** Tough transportation decisions and questions await policymakers and analysts as a result of ISTEA and the Clean Air Act requirements. These requirements are forcing metropolitan areas to look at new strategies.
 - We are seeking technology solutions and watching telecommunicating to see how this new technology impacts transportation demands.
 - We are looking for more congestion management and market and emission pricing solutions but have little experience to draw on in these areas.
- **Few analytical tools available.** Analysts are in a weak position to address trip generation issues. The models developed in the 1960s and 1970s dealt with aggregate data and trip generation equations, and are outdated. We need to get disaggregate household person-level models.

- At the Federal level, an effort is being made to develop a new forecasting procedure, e.g., TRANSIMS. This project at the Los Alamos Laboratory is a defense conversion project.
- We need to be able to pinpoint population segments to determine what vehicles are being used and which individuals are using them, and then be able to measure the impact of a policy on that segment of the population.
- **TDM and TCM travel demand policies.** A number of Transportation Demand Management (TDM) and Transportation Control Measures (TCM) travel demand policies emphasizing carpooling and the use of high occupancy vehicles (HOVs) have come about. ISTEA and the Clean Air Act depended on these approaches as resolutions to some of the issues.
- **Household carpools.** Household carpools are the most significant part of the carpooling market, but we are targeting the use of HOV lanes to nonhousehold, unrelated individual travel—the area that has had the greatest decline. We need to reexamine the market being targeted for HOV use.
- **More study needed.**
 - A heavy burden is being placed on employers to help reduce single occupancy vehicle (SOV) transportation without understanding the impact of such actions.
 - Trip chaining and linking have an enormous impact on TDM policies, with gender implications which must be studied.
 - We have emphasized bicycling and walking, but the number of nonmotorized travelers is declining.
 - We need to look at the equity question to see if we are pricing out owners of older vehicles.
 - Land use is significantly linked to travel behavior, but we have only a casual understanding of the linkage.
 - More information is needed on suburb-to-suburb travel, which is growing in importance.
 - We need to look at the whole connection between land use, housing, and labor policies. Of major concern is the disconnect between policies and the impact on economically disadvantaged segments.

Bob Dunphy's Remarks

- **Transportation policy should be need-based.** We are using a new approach that listens to the travelers, our customers; finds out what they are doing, where they are going, and what their options are; and then tries to determine how we can help them move around. Transportation policies should be established based on the inherent basic needs of travelers.
- **Reality model must reflect movement to the suburbs.** Men, women, the elderly, and multiworker households have all made this move. There is a disproportionate growth of travel in the suburbs, and we do not fully understand the causes of this growth.
- **A car for every person.** The trend today is for every individual to have a car rather than one car being shared by all household members.

- **Travel time.** Studies show that, for working women, using transit often takes twice as long as driving alone—a huge disincentive for using transit.
- **Suburban transit may not reduce vehicle travel.** People are going farther and farther out from historic city centers, and even if transit follows them, which would be very expensive, it may not transport them to where they need to go. We need to look at a better structuring of the suburbs.
- **Smarter, cleaner cars.** This development must be encouraged as it will help solve the pollution problem and permit better congestion management. Technology can be used to design vehicles the disabled can use to access public transit.
- **Better information needed.** Better information on density and better linkage of travel behavior and land use data will help in examining other land use characteristics.

IV. BREAKOUT SESSIONS

Breakout Group A

—*Ed Weiner, Facilitator, DOT, Office of the Secretary*

Participants were asked to identify areas of concern and methods for improving the data obtained so that the 1995 survey meets the needs of the users.

Policy Implications

- **Breaking up grants seen as effective.** The group approved the new approach of breaking the analysis of the 1990 Nationwide Personal Transportation Survey (NPTS) into individual studies, with grants going out to several small, diversified organizations rather than having one megastudy performed by a single, large organization. It helps make the information more accessible to policymakers.
- **Coding and sampling size.** In general, the coding and sampling size is viewed as adequate; however, there is agreement that the sample size should be increased.
- **Value of the NPTS.** Some time is needed to understand the full effect of the NPTS, as the users must digest the data and determine the resulting implications. All participants agreed that the NPTS has the potential of assisting state and local organizations by providing early warning of transportation trends. Feedback from the users is essential to determine its true value.
- **Need to educate policymakers on trends.** The most important policy issue this group identified is the need to educate policymakers on trends identified as a result of the NPTS. Although the information may be very clear to some transportation organizations, it may not be understandable to important policymakers, such as Congress, MPO directors, and state policy officials.
 - To make the information user friendly, it is suggested that the data be broken down by regional areas so that policymakers can better understand the issues that directly affect them.
 - Reports targeting the needs of a particular user could be developed using just a few key graphics and a short two- or three-page summary.
- **Effect of policy decisions on sub-groups.** It is important to understand the impact of policy decisions on sub-groups, such as low income households, the elderly, and single parent households, before a policy action is implemented. Policies may inadvertently harm a particular group while trying to help another group.
 - Additional information on household type, family life-cycle stage, and age of household members, as well as identification of single worker households with children, will assist policymakers in evaluating the potential impact on low-income households.
 - Other decisions that might unfairly impact specific population segments are centralized automobile testing or episodic carpooling based on pollution or weather conditions.
- **Safety of older travelers.** Data indicate that older drivers tend to live in the suburbs and are therefore more sparsely distributed. Additionally, older persons are living longer, more active

lives. Transportation policies must address transit accessibility and highway and vehicle safety for this growing segment of the population. Some suggestions follow.

- Improve the readability of highway signs by increasing the size and visibility of the text.
 - Investigate whether or not it would be advantageous to encourage the use of vans to transport groups of seniors to and from group housing or community facilities.
 - Incorporate the requirement for paratransit and low-floor buses as part of the policies for serving the elderly in the suburbs.
 - Increase transit to the suburbs. Housing industry policymakers should be involved in policy decisions related to multimodal suburban transportation in new developments.
- **Programs to reduce age of vehicle fleet.** Information indicates that the number of older cars driven, as well as the number of new cars, is increasing.
 - Policies must be established for testing older vehicles, as part of the Congestion Management Air Quality (CMAQ), to identify high level emitters, rather than measuring British Thermal Units. Then an effective method for removing the high emitters from the fleet must be established.
 - Based on the CMAQ requirements, cold starts must be reduced; therefore, policies should be established for inspection and maintenance testing as well as for intermittent car and van pooling.

Planning Implications

- **Building mobility and accessibility into the planning process.** Rather than developing the questions only from a system-oriented approach, the respondent's point of view should also be reflected. Usually, households responding to the NPTS first identify activities to be accomplished and then determine the travel mode most likely to permit completion of the activities within schedules, evaluating modal alternatives that exist to meet their needs. Questions should be designed to reflect this activity-oriented thought process rather than requesting information based strictly on the travel mode to be utilized.
- **Comparing NPTS and other data sources.** Comparisons would help local organizations and should be more available to planners.
 - Standardizing definitions and categories would be a significant step in improving data usefulness for the MPOs.
- **Improvement in planning and forecasting tools.**
 - Current tools are not up to the standards that the analysts require. These tools were not designed for many of the issues faced by today's planners and are not sensitive to variables that are now known to be important.
 - Planners need to determine how to build into these tools the knowledge gained from analyzing the NPTS data.

- **Expanding the NPTS.** An expanded NPTS could address safety, transit, and work-at-home issues. Traffic safety organizations should be asked for an outline of the data needed so that the NPTS can provide the needed safety data.
- **The NPTS as a benchmark.** State and local government organizations need to have the NPTS as a benchmark. This can be achieved by adding flexibility to the planning process and allowing the addition of local use needs, origins and destinations, and local questions, as well as the deletion of questions that are not applicable to the local user.
 - Include periodicity, trip chaining, and walk trips in the new survey.
 - Remove vehicle ownership from the 1995 survey, as it is no longer a valuable forecasting indicator, as well as the adjustment of trip generation rates.

Research Implications

A number of areas call for additional information to better understand transportation trends and the resulting implications.

- **Tendency to undercount.** Of special concern is the tendency for NPTS to undercount 0-VHHs, households without telephones, and households sharing telephones and to overcount high-income households. How can the 1995 survey reduce bias in these areas?
- **Define and over-sample low-income households.** The group recommended that the next NPTS establish an operating definition of low-income households, taking into consideration the fact that some low-income households may not be poor, because homes are owned and expenses low. Once defined, the low-income households should be oversampled.
- **Publish sample errors.** Sample errors should be published to assist users in making calculations during their analyses.
- **Underreporting of nonwork trips.** What is not reported and why it is not reported needs to be determined and a method for obtaining the information developed. Without this information, survey accuracy is compromised.
- **More on relationship of trips to activities.** Further analysis of trip chaining activities and linking NPTS with other data sources will help the analysts understand this phenomenon.
 - Linking NPTS data with vehicle odometer reading records will provide more accurate information on miles travelled, as respondents tend to round off numbers.
 - Linking NPTS with the Annual Housing Survey (AHS) will provide additional, valuable information on households.
 - The NPTS should be compared with the Census, local surveys, and other data sets.
- **Adding land use data.** The addition of land use data to NPTS, including structure type, population density, mixed uses, housing price and type, and area location in relationship to community facilities (e.g., schools, transit, hospitals, shopping) is vital.

- **Standard land use definition needed.** Land use will impact several factors, including the following:
 - Location of and times allotted for HOV lanes.
 - Applicability of incorporating bicycle and walking paths. The distance threshold for walking or bicycling to an activity versus using the automobile needs to be determined. It is essential to know if a neighborhood or subdivision is compatible for bicycle use and walking.
- **Multi-day studies needed.** People’s travel patterns vary daily and we need to know more than just the “usual” mode of transportation. This information is becoming more significant with the increase in single heads of households, dual worker families, and telecommuting arrangements. A 5-day survey would be a valuable method for obtaining trend data in these areas, especially if it is accomplished as part of the telephone or in-person interviews.
- **Trip purpose codes could be collapsed.** The group suggested the elimination of trip purpose categories, except for work, non-work, and vacation categories. Other suggestions/concerns follow.
 - Drop the 14–day-long trip diary, as the sample size is thin and the data not valuable.
 - Drop the questions regarding accidents. The accuracy of accident data was questioned, as it is conditioned on being in an accident. However, additional crash data, including time since the last accident, are needed, and a method for obtaining this data should be developed.
- **Understanding the relationship between land use and vehicle use.** A need exists to understand the relationship between automobile ownership, VMT, modal split, and development patterns.
 - Disaggregating vehicle trips into multimodal components and identifying the activities associated with the different modes would be extremely valuable.
 - Identifying the relationship between transit use and the characteristics of the neighborhood is another useful data point.
- **More on travel benefits.** A greater understanding of travel benefits of different household types is required. A method needs to be developed for projecting disaggregated household data and the impact the data implies. It is possible that the single occupancy vehicle is more efficient than we realize.

Breakout Group B

—*Phil Fulton, Bureau of Transportation Statistics and M.J. Vincent, COMSIS Corp., Facilitators*

Policy Implications

- **Congestion pricing/carpooling.** Does HOV use really do enough to reduce congestion when other congestion-reducing strategies (e.g., flexible work hours) often work against carpooling. Carpooling attacks peak congestion and its effectiveness diminishes if you flatten the peak. Planners must look at more than just work trip to ease congestion—much non-work travel is happening in peak congestion periods, especially during the evening peak.

- **Single Occupancy Vehicles.** Why does SOV use continue to increase? Without a change in policy, there is little chance of encouraging fewer SOVs, but first there must be an understanding of attitudinal reasons for carpool use. Economic issues—out-of-pocket costs for toll roads, parking, and gas—contribute to the SOV decision.
- **Trip chaining.** Trip chaining is a significant factor in the decline of carpooling. Restrictions on SOV imposed by TCMs could result in a backlash of additional trips. It is more difficult, from a policy viewpoint, to get people to give up their cars when they are chaining non-work trips with work trips.
- **Land use patterns.** Land use patterns should be changed to accommodate more bike/walk paths, and more land should be developed for such activity. Bikers and walkers shift mode use with environment-temperature and weather. Does land use impact behavior? Is land use an economic function rising to highest use regardless of governmental policy?
- **Policy environment.** Europe encourages bike trips and reduces car trips through significantly higher gas prices and costlier, more complex car registration. Conversely, U.S. vehicle expenses are lower, and insurance prices are not based on the number or length of trips. Few roads have tolls, gas is cheap, and, if parking is free, even bus transit is expensive by comparison.
- **Travel time.** Travel time was often the justifier for mode choice. But trends in increasing suburbanization and the dispersion of origins and destinations have brought with them increased travel speeds. This new environment offers a hardy challenge to transit's ability to be competitive in adapting to demands for suburb-to-suburb mobility and flexible travel times.
- **Air quality.** Pollution factors are related to age of vehicle, with 10-year-plus cars being the biggest polluters. A vehicle age-emissions policy that is technology-driven will take longer to affect air quality, while maintenance-based policies could be more effective. Attempts to “buy out” older vehicles may not be cost effective since those cars may be “naturally” retired in the short term.
- **Vehicle safety.** Safety also is a factor with regard to vehicle age. Older vehicles have no airbags, fewer seatbelts, and no maintenance programs other than state inspections to get them off the road. Older vehicles suffer more from “disinvestment,” and maintenance information should be included in NPTS data. (Japan imposes rigorous, more frequent, and more costly inspections of older cars to remove them from service.)
- **Social equity: Women.** Women travel fewer miles than men but take more trips. A TDM that required carpooling would create a burden for many working women. It might also increase cold-start trips as additional trips are made to compensate for trips lost because of denied trip-chaining. It is necessary to understand the true effect of trip reduction strategies to protect gender equity.
- **Social equity: Elderly.** Better age group distinctions are necessary to uncover the mobility need differences between the young-old and the old-old. (Mobility drops off drastically in the 80-85 year old ranges.) Among no-vehicle elderly, there may be transportation provided by adult children or community-based efforts. The transition from independent living to institutionalization could be hastened by a lack of mobility. Paratransit could support the elderly in suburban settings but more resources will be needed in the future to accommodate aging baby boomers, whose great numbers will influence policy.

- **Social equity: 0-VHHs.** Although people in these households are likely to be non-workers, the retired, and the elderly, consideration of the mobility issue should be expanded to include the needs of no-car workers. When people in these households do travel, they often walk and are not necessarily transit users. Mobility becomes an issue if transit is not available. The right to access to transportation is a complex issue, and data may not be available to address what governs mode choice.
- **Social equity: transit.** Decentralization of homes and jobs makes mobility difficult for workers in the city. As employment moves out of the central city, what transportation options are available for central city residents to follow those jobs?

Planning Implications

- **Land use.** Political issues (such as who pays) affect land use and, although Federal planning does not control land use, it can influence local policy. Land use, if done correctly, reduces mobility concerns. Improved suburban development would benefit an overall transportation policy by reducing the need for car trips. In areas of high density where impact would be greatest, sidewalks could be added to increase mobility and provide access to transit or carpools, and bike paths could be designed into new arterial roads and feeders to encourage biking as an alternative for car travel.
- **Data collection.** Data collection should support the four-step planning process, as well as a new planning model that will aid in forecasting different trip generation variables. Proactive planning is not possible without knowing motivation. More research is needed on the behavioral aspects affecting mode choice. Focus groups, demonstration projects, and small regional panel studies could help collect and duplicate individual variations in behavior.
- **Forecasting.** It was questioned whether or not current strategies and forecasting are sound. The debate over using technological innovations versus rationing to meet air quality standards has to be settled before a new strategy is adopted. Another important issue was the extent to which the metropolitan transportation planning process responds to or encourages transportation trends. Complex simulation models for transportation and land use would be useful, although a significant collection of new data would be required.
- **Travel time by mode.** Planners never looked at mobility as a basis for highway needs. NPTS, even without behavior motivation, validates mobility as a transportation issue. The rise of service industries and other types of jobs (manufacturing versus service) creates different kinds of travel—sometimes the vehicle itself becomes a “significant” place.
- **Elderly.** The elderly segment of 0-VHHs may be declining over the next decade as the percent of older women who have never driven decreases. Safety is a significant factor for the elderly in mode choice.
- **Funding sources.** Planners should look carefully at cost-benefit issues because there is not an unlimited amount of public monies. Who should shoulder the cost of investment in bike/walk paths—developers, motorists, users? IVHS technology could be making auto travel more appealing than more expensive alternatives like “anytime-anywhere” transit.

Research

- **Behavioral aspects of mode choice.** NPTS is accepted as the official source for behavior/travel use data, but the data does not explain behavioral motivation sufficiently. The survey should include attitudinal questions for carpool use, trip chaining, transit use, etc. There should be small group, social-oriented studies of the elderly. More delineation within ethnic groups—breakdown by generation, new immigrants—and an improved outreach of data collection efforts are recommended.
- **Travel time periodicity.** More information is needed to explain why people travel when they do. A comprehensive national on-board ridership survey measuring people “in the act” would more accurately capture their reactions to trip time, trip mode, etc.
- **Sample size.** After cross-classification, the categories get very small. The NPTS sample size is too small to explain metropolitan transit trends (some metropolitan areas were as low as 300). Local government buy-ons would increase the sample size, decrease any biases, and standardize the data, allowing for city-to-city comparisons. Research should take advantage of geocoding and should be coordinated with states and municipalities, with courses for localities on data collection.
- **Forecasting trip generation variables.** Trip destinations should be included in survey questions. There was no way to identify intermodal linkage and more research is necessary to understand trip chaining and cold-start/hot-start issues.
- **Economic impacts on travel behavior.** The NPTS could be used to ascertain whether current economic conditions affect overall travel. What is the link between gas prices and carpooling? How do part-time and multiple jobs affect travel behavior? What are the trends in workplace migration? What does the growth of the service sector mean for transportation management?

Breakout Group C

—*Elaine Murakami, FHWA, Facilitator*

Policy Implications

The group recommended focusing policies on non-work travel and reevaluating policies regarding the potential issues of effectiveness and fairness arising from an emissions control- versus a congestion control-based pricing tactic.

- **Emission Control Programs.** As a relatively small number of vehicles create a large percentage of emissions, there is a move towards emissions pricing based on air-quality examinations as opposed to road use. Can emissions control be best realized by targeting these vehicles through pricing policies? Is it fair to do so?
- **Emission-reducing technology.** A growing older-vehicle fleet and continued use of these vehicles tend to undermine the notion of new emissions technology as the sole solution to pollutant reduction.
 - Can a technology be developed that is effective in improving air quality far beyond what current models predict from implementing TDM and TSM programs?

- Are newer vehicles indeed significantly less polluting or just designed by manufacturers to run clean according to how emissions tests are currently defined but run dirty in other use modes?
- Can technology be used to retrofit older vehicles to lower their emissions?
- **Pricing policies.** How fair is emissions pricing? Those who use vehicles more than average benefit because they pay less per unit cost; those who don't use their vehicles at all are still assessed costs.
- **Congestion management programs.** Do such programs significantly reduce emissions? Programs tend to target commuter trips, but non-work travel is a great contributing factor to congestion.
- **Pricing policies.** Congestion pricing vs. emissions pricing.
 - Most areas are not ready to implement road pricing. To meet air-quality standards, the alternative is emissions pricing.
 - The effectiveness of the Commuter Trip Reduction Program is limited in comparison with emission control programs, especially when considering that 50 percent of peak work-hour travel is non-work oriented.
 - Some studies have shown that trip reduction measures and TSMs, such as carpools, van pools, etc., have debatable impact on emissions levels.
 - In implementing emissions pricing on a per-vehicle basis, invariably there is a bias against older vehicles and the households that use them as their primary transit mode. Do these households cluster within specific demographics?
- **Suburban and non-urban development.** Densities and urban forms are changing in different metropolitan areas, taking on unique configurations. The phenomenon of edge cities and their resulting congestion tends to neutralize effectiveness of traditional radial travel patterns that generally align transportation systems along an inner city/suburban, and not intra-suburban, axis.
- **Land-use design issues.** Implementation of land-use controls includes influencing people's transportation behavior. With regard to the retrofitting of edge cities to make them more friendly to pedestrians and bicyclists—Who shall do this?
- **Transit alternatives.** Declines in transit share of trips and carpooling may be a result of people adjusting activity patterns to circumstances. Understanding the following trends requires that NPTS data be linked with demographic data:
 - Transit declines because jobs are in suburbs and edge cities not served by it.
 - Carpooling declines because of fewer matches of origin and destination among individuals, and its perception as being incongruous with individual rights. Should marketing of HOV be reevaluated?
 - Road and transit systems designed along a radial model cannot handle new growth patterns.

- **Transit accessibility.** A need exists to reach out to those with acute transit disadvantages, such as the elderly in rural areas, the disabled, and low-income populations, to meet their mobility needs.

Planning Implications

- **Expand planning.** Expand planning to include crafting new and improved models that can handle more and different variables, supplying better data to run models.
 - Interaction between land use and mode choice.
 - The use of which vehicles for which trips.
 - Analysis of congestion in time-of-day and seasonal contexts.
 - Metamorphosis of urban form and its effect on trip-making dynamics.
 - Effect of non-work travel on transportation issues.
- **Land use/mode choice interaction.** Greater understanding is needed of the effects of both land use controls and different land-use habits in diverse metropolitan regions on the development of highway and transit systems.
 - Differences between sunbelt, auto-oriented cities and older, Northeastern cities.
 - Differences in trip making between suburbs (driving to lunch) and center cities (walking to lunch).
 - Understanding the nature and change of these distinct urban forms and how that impacts disparate travel flows.
 - Grasping the effects of zoning ordinances and habits in these different metropolitan region's suburban areas.
 - Examining the experiences of other countries while being cognizant of their different transit demands as functions of cultural and zoning differences.
- **New and improved models.** The current data in use is difficult to model for addressing problems. NPTS data accessibility could be improved by having multiple years with standard naming of variables on one CD-ROM. Providing the SAS code would help expedite reproduction of accurate numbers at the national level.
- **Vehicle allocation model.** Which vehicle used for which trip? Greater understanding of emissions resulting from non-commuter travel might impact pricing issues.
- **Better non-work models.** These are not being done. NPTS needs a better understanding of what non-work travel is, leading to better models to address it. What people use their vehicles for when they're not working represents a large and underestimated measure of vehicle use.

Research Implications

The NPTS data collection approach can be refined by reviewing terminologies, avoiding pre-classification of raw data samples, and instituting new data collection technologies. Supplemental surveys should be considered to provide the information necessary for detailed planning about area-specific transit characteristics which NPTS, as a national survey, cannot effectively gauge. Problems addressed included the lack of adequate measure of infrastructure, uncertainty over classification of urban form, undue imposition of definitions on survey respondents, and concerns about under- and over-sampling.

- **Suggested improvements to NPTS.** Suggestions for improving the NPTS include devising measurements for understanding non-work travel, for which there is little data; defining what is wanted before collecting the information; and gaining control over the quality of the answers.
- **How to measure infrastructure.** It is helpful to discover not only how dense the residential environment is, but how the land-use patterns and different forms influence the arrangement of the residential environment's infrastructure. Data worth collecting include distances to banks, gas stations, doctors, and nearest parks (a good measure of non-motorized trips). Obtaining such detailed, area-specific information about special "clusters" of data may best be accomplished by supplemental surveys. Collecting data on access to transit and other services can be used as a proxy for infrastructure analysis.
- **How to classify urban form.** Classification is complicated by new configurations, such as edge cities, which mix both jobs and residences in non-traditional ways that are neither urban or suburban. The role of density and how that changes in different areas of the country may need to be redefined. Current measurements of regional density are crude.
- **Respondent-friendly design.** Asking participants to report their "activities" instead of "trips." To improve the reporting of exact times of departure/arrival and access/egress, the survey should change from a trip approach to an activity approach, keeping track of the activity duration.
- **Clarifying terminology and reevaluating aggregations.** This includes adding more options to multiple-choice questions.
 - Vague terminology can skew survey results: what is a "trip"?; what is a "typical" activity?
 - Such phrases as "carpooling" and "public transportation" mean different things to different people.
 - "How far did you go?": is "far" a measure of miles or city blocks? Is distance a temporal or spatial concept?
 - Disaggregate "school" from "church" as destinations.
- **Avoiding tarnished data from obtrusive coding.** The goal is to collect information that is as detailed and original as possible, inclusive of all stops and trips. Avoiding imposition of definitions on respondents, maintaining an informal approach, and keeping the data free of pre-classification will help forward this goal.
- **Conducting the survey.** There is a tendency to overreport the transit behavior of the better educated and underreport that of the less well-educated. Phone surveys risk undersampling of households without phones (deep South and inner cities).
- **Supplemental surveys.** Areas where the national survey is weak should be covered by a separate data collection effort.
 - Local-level traffic issues can be examined through a family of surveys: "rural," "urban," and "modal".
 - Long-trip coverage is weak in the NPTS; integrate the 1995 survey with the American Travel Survey.
 - Enhance and expand the available data while maintaining consistency in documentation.

- **New technologies.** The NPTS should anticipate future methods of improving data gathering techniques, and the influence technology might have on the way data is analyzed. Examples include hand-held computers and GPS transponders on both vehicles and individuals. How amenable would respondents be to such potentially intrusive methods?

Breakout Group D

—*Kimberly Fisher, Facilitator, Urban Land Institute*

This breakout group found that policy, planning, and research topics could not be discussed in isolation from one another. So many issues seemed to cut across all three categories that it was impossible to circumscribe the conversation in this way. The group discussed larger issues in their many, overlapping ramifications. The discussion of these issues follows.

Disaggregate Analysis Critical

Participants agreed that disaggregate analysis of NPTS data is critical because so many of the “groups” typically discussed are actually very diverse. The policy response, planning concerns, and research direction must be sensitive to the differences.

- **Zero-vehicle households.** Because the reasons for not having a car and the problems this creates differ, so must transportation policies. It is not only the elderly who lack automobiles; another very different group of 0-VHH are adults of all ages in New York City. For example, a 69-year-old in Tucson without a vehicle is in very different circumstances than an automobile-less 30-year-old in Manhattan. The 30-year-old in Manhattan may have many transportation alternatives available besides a car, and walk access to many goods and services. A rural couple in the Midwest probably needs assistance to complete daily activities.
- **Suggested alternatives to the automobile.** What can be done to help those who are too young, too old, or too disabled to drive, those who are disenfranchised in this way? In many communities, this group is shrinking in number or widely dispersed, making mass transit a costly alternative.
 - Conventional mass transit is not the only alternative to the automobile. Alternatives may include taxis, shuttle vans, and flexible carpooling programs.
 - What about providing cars to people who are competent to drive but cannot afford them? Vocational rehabilitation programs often provide cars to people for work access.
- **Mobility-impaired even with car.** It is important to recognize that 0-VHH are not the only ones with members who have mobility problems.
 - Low-income elderly people sometimes let cars sit idle as a result of tradeoffs that must be made between paying the rent, buying medicine, or buying gas.
 - Those concerned about equity err in focusing on 0-VHH as the only group with curtailed mobility.

Mobility and Equity

- **What is the aim of policy?** Is the aim of transportation policy to reduce VMT generally for the sake of cleaner air, less congestion, and so forth? The group seemed to think so, but that opinion was challenged by the view that reducing VMT was all but impossible short of reorganizing cities and peoples' lives.
 - The solution may lie, instead, in people moving even further out from the city. All growth does not take place in older, built-up areas.
 - New communications technologies may allow more dispersion of both residence and employment locations at lower cost, although lifestyles on the outer fringes of metropolitan areas may actually be subsidized by interstate highways and low gas prices.
- **Effects on womens' travel.** Efforts to restrict automobile travel could have severe, detrimental effects on women and others, whose schedules require the kind of flexibility that only an automobile affords.
 - As a practical matter, it may be impossible to cut down on the number of automobile trips by women and increase their use of carpools and mass transit. Women continue to conduct a larger share of child care activities than men.
 - Womens' decisions on travel include complexities of social expectations and decisions about labor force participation as factors, in addition to characteristics of different travel modes.
- **No choice but to drive?** Even if people are presented with the full cost of driving, such as high parking fees and gas taxes, many people may still feel they have no choice but to drive.
 - Some people will substitute telecommunications—shopping by mail order or cable television shopping shows—for short trips. But this may simply free time for taking longer trips.
 - If a person living in the country has to drive 75 miles to see a doctor, is that greater mobility or lack of access?

Access and Land Use

- **Access issues.** Owning a car does not guarantee access to mobility because of the cost of operating it. Mass transit is not necessarily the answer, because transit generally takes up to twice as long and may not be available for many destinations.
- **The importance of land use patterns.** Land use patterns and transportation decisions are closely related, as evidenced by trip chaining behavior of many segments of the population.
- **More transit = more walk trips.** New towns in California using transit-oriented designs show more walking trips, but it is not clear if VMT and the number of motorized trips have been cut. In neighborhoods where small shops are located near bus and rail stops, people run more errands on foot.

Information to Support Developing Policy

- **Telecommuting.** Telecommuting is one of the least controversial and therefore most popular Transportation Control Measures (TCM). But the NPTS tells us little about those who telecommute or otherwise work at home.
 - The NPTS should include the satellite office and its effect on other trips.
 - The NPTS needs to ask not just “Do you work at home?” but “When do you work at home?” Asking only about someone’s travel the day before or even for the current week is too limited to pick up telecommuting.
 - Telecommuting has made the definition of “metropolis” even more difficult because it permits people to live farther from their jobs. Are they considered rural or suburban residents?

Linking with Other Technologies and Data

- **IVHS.** IVHS technology offers remarkable possibilities for data collection and joint projects. Smart Cards might be useful for origin-destination, travel speed, and other applications.
- **Destination data needed.** The NPTS’ lack of information on the geographic location of travel destinations was called the survey’s most fundamental failing. Destination data would lead to better modelling and forecasting; however, several concerns relate to adding destination questions, such as increasing the length (in minutes) of the survey and incurring potential violations of the privacy act.
 - It was suggested that the IVHS program could fund a demonstration project to incorporate GPS technology into the NPTS.

Improvements for Travel Behavior Research

The group pointed to various ways in which more useful travel data could be collected.

- **Less focus on the work journey.** “Ninety-nine percent of the literature is on it, yet it is only one piece of people’s lives.”
- **Better travel predictors.** The field’s two main variables for differentiating and predicting travel—household income and vehicle ownership—have proven poor predictors. Better factors are needed.
- **More exploration of occupational differences.** Exploring how occupational differences between men and women affect travel (Is one group more apt to work close to home?) and studying the travel of low-income and immigrant populations would be advantageous. For example, do trip lengths increase the longer immigrants are here?
- **More attention to rural areas and elderly.** Surveys do not pay enough attention to people in rural areas or to the elderly.

Suggested Changes to the NPTS

- **Trip purpose classification and definition.** Add “serving passengers” to trip purpose classification.

- **Better definition of suburb.** The definition of suburb needs formalizing and should be incorporated into the NPTS data set.
- **Easier trip chaining analysis.** NPTS questions need revising to facilitate analysis of trip chaining behavior.
- **Inclusion of other variables.** The NPTS should add “occupation,” “telecommuting,” and “destination” as variables.
- **Sharing of SAS code.** A mechanism to share SAS code should be established.

CLOSING REMARKS

—Gloria J. Jeff, FHWA

Ms. Jeff considered the NPTS conference a success in that participants affirmed the value of the NPTS in helping bring transportation trends and needs to light for policymakers, planners, and researchers. Conference participants also contributed suggestions for improving the NPTS and applied thoughtful analysis and insight through their discussions of myriad transportation issues. Ms. Jeff identified several important themes emerging from these discussions, which will be considered in implementing subsequent surveys and in addressing the public's transportation needs.

The first of these centers around the question of equity, focusing on how transportation data and trends impact on a host of social issues and how these can be linked. Examples include the interrelationship of multi-worker households and the special transportation needs of women. People's transportation decisions beg consideration of the broader sociological reasons for why we do what we do as human beings. "Why do we need to be alone when moving from point A to point B?" for instance, asked Ms. Jeff. The jobs people have also provide a link to their transportation behavior. To better understand these phenomena and to further more responsive transportation policies, these linkages and others need to be explored, as do opportunities to link with other technologies and with other primary and secondary data sources. Additionally, data need to be collected differently, looking at rural settings as well as urban ones, growing elderly populations, and the special mobility needs of those in 0-VHHs.

Ms. Jeff cited several challenges facing the FHWA. The most immediate may be to reflect the conference findings in the design of the 1995 NPTS. Ms. Jeff advocated, in general, that more frequent and timely meetings such as this one need to be held and that the FHWA will seek involvement from those connected with other issues emerging so that these, too, can be integrated into a study of the NPTS.

Many items are up for immediate action, including the preparation of a "glossy" version of the conference and research paper findings, trends, etc., for use by others. Outreach initiatives will find the data presented here helpful. Meanwhile, the FHWA continues to publish informative reports and address initiatives for finding solutions to changing transportation problems and needs.

Appendices

Appendix A

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Appendix B

FHWA NPTS Symposium Agenda

April 20–21, 1994

Symposium Moderator—Gloria Jeff, FHWA

Wednesday, April 20

Rooms

7:30 – 8:30 a.m.

Registration

Plaza Ballroom Foyer

8:30 – 9:15 a.m.

Opening Session

Plaza Ballroom East

Welcoming Remarks, Introduction of Moderator

Dave McElhaney, FHWA

Goals and Objectives of Conference

Gloria Jeff, Associate Administrator for Policy, FHWA

NPTS Status: 1990 Reports, 1995 Survey

Susan Liss, FHWA

Report on Census Conference

Elaine Murakami, FHWA

9:15 – 10:30 a.m.

Presentation of Papers—Travel Mode

Moderator—Introduction of Speakers

- Travel by Households Without Vehicles

Charles Lave, Ph.D.

University of California, Irvine

- Recent Declines in Carpooling

Erik Ferguson, Ph.D.

Georgia Tech University

- Non-Motorized Transportation

Debbie Niemeier, Ph.D. Candidate

University of Washington

Discussants:

- *Robert Griffiths*

Metropolitan Washington Council of Governments

- *Samuel Zimmerman*

Federal Transit Administration

Moderator—Breakout Session Guidelines

10:30 – 10:45 a.m.

Break

10:45 – 1:15 p.m.	Breakout Session 1 Four Concurrent Sessions Group A Group B Group C Group D	Rooms Parlor A Parlor B Parlor C Arlington South
	Working Luncheon	Plaza Ballroom West
1:15 – 2:41 p.m.	Presentation of Papers—Trip and Vehicle Attributes Moderator—Introduction of Speakers <ul style="list-style-type: none">• Time-of-Day Characteristics of Travel <i>Ryuichi Kitamura, Ph.D.</i> University of California, Davis• Understanding Trip Chaining <i>James Strathman, Ph.D.</i> Portland State University• Geographic Factors Explaining Worktrip Length Changes <i>Peter Gordon, Ph.D.</i> University of Southern California• The Demography of the U.S. Vehicle Fleet <i>Alan Pisarski</i> Transportation Consultant Discussants: <ul style="list-style-type: none">• <i>Eric Pas, Ph.D.</i> Duke University• <i>Jon Kessler</i> Environmental Protection Agency	Plaza Ballroom East
2:40 – 3:00 p.m.	Break	
3:00 – 4:20 p.m.	Breakout Session 2 Group A Group B Group C Group D	Parlor A Parlor B Parlor C Arlington South
4:20 – 4:30 p.m.	Closing Remarks of the Day <i>Moderator</i>	Plaza Ballroom East

Thursday, April 21

Rooms

8:30 – 9:20 a.m.	Presentation of Papers—Demographics Moderator—Introduction of Speakers <ul style="list-style-type: none">• An Assessment of the Potential Saturation In Men’s Travel <i>Steven Polzin, Ph.D</i> University of South Florida• Travel by Women <i>Sandra Rosenbloom, Ph.D.</i> University of Arizona• Travel by the Elderly <i>Sandra Rosenbloom, Ph.D.</i> University of Arizona	Plaza Ballroom East
9:20 - 9:40 a.m.	Break	
9:40 - 10:30 a.m.	Presentation of Papers—Demographics (cont.) <ul style="list-style-type: none">• Household Structure and Travel Behavior <i>Norm Coontz</i> California Air Resources Board• Multiworker Household Travel Demand <i>Siim Sööt, Ph.D.</i> University of Illinois at Chicago <p>Discussants:</p> <ul style="list-style-type: none">• <i>Gary Maring</i>, Federal Highway Administration• <i>Bob Dunphy</i>, Urban Land Institute	Plaza Ballroom East
10:30 – 12:00 noon	Breakout Session 3 Group A Group B Group C Group D	Parlor A Parlor B Parlor C Arlington South
12:00 – 1:30 p.m.	Luncheon Crash Rates by Age and Sex Groups of Drivers Speaker: <i>Ezio C. Cerrelli, NHTSA</i>	Plaza Ballroom West
1:30 – 2:30 p.m.	Presentation of Group Results <i>Facilitators</i>	Plaza Ballroom East
2:30 – 3:00 p.m.	Closing Remarks <i>Moderator</i>	Plaza Ballroom East

Appendix C

Breakout Group Members

Breakout A

Ed Weiner, Facilitator

Kathleen Bradley
Stacey Bricka
Ezio Cerrelli
Norman Coontz
Robert Dunphy
Christopher Fleet
Fatima Hasan
Patricia Hu
Gloria Jeff
Paul Kerkhoven
Jon Kessler
Michael Koontz
Charles Lave
Bill Mann
John Neff
Alan Pisarski
Anant Vyas
Mike Weiss
Rosalyn Wilson

Breakout B

Phillip Fulton, Facilitator

Joan Al-Kazily
Bruce Aunet
Madeleine Bloom
John Byun
Harry Caldwell
Richard Crepeau
Erik Ferguson
Jim Getzewich
Bob Griffiths
John Haifley
Dale Harrison
Christine Kefauver
Teresa Parsley
Steven Polzin
Catherine Shaw
Richard Steinmann
James Strathman
MJ Vincent
George Wickstrom
Jennifer Young

Breakout C

Elaine Murakami, Facilitator

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Bryant Gross
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Breakout South

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William Schroeer
Dee Spann
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