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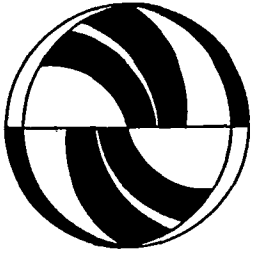
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Policy Implications of
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Symposium Summary

Richard Willson
Elham Shirazi

Working Paper
UCTC No. 29

**The University of California
Transportation Center**
University of California
Berkeley, CA 94720

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Transportation Center

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**Transportation Demand Management:
Policy Implications of Recent Behavioral Research**
Symposium Summary

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The University of California Transportation Center
University of California at Berkeley

Symposium Summary

TRANSPORTATION DEMAND MANAGEMENT: POLICY IMPLICATIONS OF RECENT BEHAVIORAL RESEARCH

I. INTRODUCTION

Public officials and professionals in transportation and research all agree that demand management is an essential part of the overall effort to address transportation congestion. While no one approach can carry the entire burden, if we don't succeed in motivating more people to participate in reducing the number of single occupancy vehicle trips, the quality of service in transportation will deteriorate severely, particularly in the rapidly growing regions of California.

The overwhelming question for policymakers is how to "encourage" greater participation in demand reduction approaches. Fortunately there is a considerable body of research upon which to draw to assess several of these strategies. While additional research, based on evolving experience will be helpful, there already exists a substantial body of research directly related to this issue. The meeting of researchers and policymakers on October 12 and 13, 1989 conducted by the Public Policy Program of UCLA Extension at Lake Arrowhead provided the opportunity to share research and experiences in ways that enhance the utility of that research for policymaking. The results of that meeting coupled with the review of research literature prepared in advance by Professor Martin Wachs of the UCLA Graduate School of Architecture and Urban Planning provide a useful compilation of the current state of knowledge. This symposium summary provides a set of fairly clear-cut policy choices backed up with empirically based research and experience.

This document contains a statement of key findings, a succinct summary of the strategies addressed in the presentations and the dialogue among the panelists and speakers, a description of areas where further research can help with future policy decisions and finally a brief evaluation of the symposium. The appendices contain the program outline for the symposium, a list of the participants, a list of sponsoring organizations and a copy

of the literature review that was prepared in advance of the conference by Professor Martin Wachs.

II. Summary of Key Conclusions

The behavioral research presented at the symposium offers a number of conclusions about proven, effective ways of managing travel demand. A considerable depth and breadth of research is available, suggesting that policy makers and researchers should work closely in developing policy and programs.

A number of key conclusions are drawn from the proceedings and discussions of the symposium, and are summarized as follows:

- A. *Current commuter behavior is rational. Commuters will be similarly rational and responsive when the structure of transportation incentives and disincentives is altered.* Both public policy and employer policy can change travel behavior, if policy-makers and employers have the will to change and develop appropriate policies. For example, numerous case studies show that significant mode changes occur when financial incentives are shifted away from the solo driver and towards rideshare modes.
- B. *Behavioral research offers some unequivocal findings that can be acted upon now.* For example, flat transit fares are inefficient and inequitable. Personalized matching services in rideshare programs increase ridesharing participants. Desubsidizing parking for solo drivers decreases the number of automobiles driven to work. These and numerous other useful findings on how to manage travel demand are summarized in the sections that follow.
- C. *Behavioral research findings can increase the effectiveness of transportation demand management policies.* Program and policy design should take advantage of recent research and experience with TDM policies. For example, case studies have shown that rideshare incentives such as bus pass and carpool subsidies do not significantly change mode split unless parking subsidies to solo drivers are reduced or eliminated.
- D. *Behavioral research shows the importance of taking into account interdependencies among transportation and related policies.* For example, pricing strategies for transit should not be considered without addressing the pricing of the single occupant automobile. In addition, flex-time, while reducing peak period travel, may reduce the level of ridesharing within an individual firm. Given the multi-jurisdictional environment in which transportation policies are developed and implemented, there is a need for political leadership to ensure that agencies consider the interrelatedness of their policies.
- E. *Behavioral research is critically needed in areas currently under policy consideration.* For example, jobs/housing balancing proposals are cited in plans, yet knowledge and policy tools are not well developed. Research is also needed on organizations' behavioral responses to public regulation. Finally, the effectiveness of ridesharing mandates and programs needs study.

III. Discussion of Key Themes

This section discusses some of the key themes of the symposium. Dr. Martin Wachs of the University of California, Los Angeles, helped establish a context for the discussions by providing an overview of behavior research in transportation planning. He noted that while pricing and HOV lanes are often termed 'social engineering', we rarely acknowledge that previous road and highway building decisions were equally 'social engineering'. Past decisions affect the price of travel, and people have responded very rationally to the price of travel. They tradeoff transportation costs against the cost of housing and other necessities. His challenge is as follows:

"The question is not whether travelers will respond to public policy, for the evidence is clear that they will. Rather the literature review leaves us with a far more important question. Will policy makers be sufficiently bold to adopt the policies which research results unequivocally tell us can change travel behavior?"

The discussions summarized below concern three overall issues discussed in the course of the symposium. They are:

- o Travel behavior can be significantly altered through TDM policy.
- o Travel behavior policies can involve incentives or disincentives. Which is best, or is a combination of policies needed?
- o Interdisciplinary research and collaboration broadens our knowledge of behavior and can increase the effectiveness of TDM strategies.

A. Travel behavior can be significantly altered through policy.

Panelists offered strong evidence to support this assertion, as is discussed below. However, agreement about the effectiveness of public policy in changing travel behavior is not unanimous outside academic circles. For example, some are skeptical about the ability of any policy to significantly reduce solo commuting in suburban environments.

Summarized below is some of the key evidence on the factors affecting travel behavior, organized by ridesharing, pricing and flex-time/telecommuting themes:

Ridesharing

Panelists Dr. Erik Ferguson of Georgia Institute of Technology, Mr. Tom Higgins of K.T. Analytics, Inc., and Dr. Genevieve Giuliano of the University of Southern California provided insights on ways of achieving higher levels of ridesharing. The overall theme was that a better behavioral understanding of factors affecting ridesharing can help policy makers target their efforts in areas that will achieve the greatest results. Some of the consistent findings revealed by behavioral research were cited by several of these panelists. These included:

- o *Direct monetary subsidies* for ridesharing modes such as carpool subsidies or bus pass subsidies are of limited effectiveness if not accompanied by policies addressing parking subsidies for solo drivers.
- o *Personalized matching services* in firms do have a significant impact in increasing employee ridesharing.
- o Large increases in ridesharing occur when employers *reduce or eliminate subsidized parking* for solo commuters. (See further discussion below). Shifting employer transportation subsidies from solo commuters to rideshare modes is particularly effective.
- o *Travel time savings* must be quite large if they are to be an effective incentive for ridesharing. For example, an HOV lane for carpools must offer a travel time saving of 15 minutes or more to significantly affect the level of ridesharing. This magnitude of travel time saving is most easily achieved from a network of HOV lanes.
- o Ridesharing works better in *larger firms*, especially those with higher compositions of clerical employees.
- o *Employer commitment and resources* play a large role in determining the outcome of a transportation demand management program.
- o *Public policies* requiring that employers provide rideshare programs should be targeted to those employers with the greatest likelihood of achieving results, because of their size, employee characteristics or location. For example, large employers and those near transit and HOV facilities will be most able to comply with public mandates and can provide larger transportation benefits.

All of the above panelists indicated that the results of employer ridesharing programs and ridesharing mandates are highly varied; the effectiveness of these programs is highly dependent on strength of an organization's commitment to implementation. Public requirements should not specify exactly the measures that employers should

implement; employers can best tailor from among the various approaches a program that works best for their employees.

The Role of Price in Influencing Ridesharing

Panelists Dr. Martin Wachs, Dr. Donald Shoup of the University of California, Los Angeles, and Dr. Robert Cervero of the University of California, Berkeley addressed pricing issues. The overall theme is that all modes of transportation are underpriced in relationship to their social costs, and that pricing of various modes occurs in an uncoordinated fashion. Specific issues addressed by the speakers include:

- o Most firms in Southern California provide *free parking* to all employees; this in most cases is a greater incentive to solo commuting than free gasoline. In higher density areas, free parking primarily decreases the number of transit users; carpool participation is also reduced. In low density suburban areas, free parking primarily reduces carpooling.
- o *Parking pricing policy* is the key predictor of the success of an employer's ridesharing program. Studies of employee transportation programs reveal that when employee parking is free or largely subsidized, employees are more likely to drive to and from work alone. On the other hand, when employees are required to pay for a large portion or all of their parking cost, they are more likely to rideshare, use public transit, bicycle or walk to and from work.
- o *Flat fares* for transit are inefficient and inequitable. A revised fare structure should reflect the higher marginal cost and social benefit of providing peak period, longer distance suburban service. Such a policy can increase the economic efficiency of transit and may increase ridership.
- o Low overall transit fares do not benefit low income transit riders as much as would be expected. *Targeted voucher programs* are a more efficient way of assuring that social goals are met, while higher fares provide transit operators with the revenue needed to expand and improve service.

Flex-time/Telecommuting

Panelists Dr. David Hartgen of the University of North Carolina, Dr. Patricia Mokhtarian of the firm Schimpeler-Corradino and Associates, and Mr. Tom Higgins addressed flex-time and telecommuting. These involve travel demand strategies that do not involve changing travel modes, but altering the time of travel or amount of travel. These strategies require careful evaluation, because while they may reduce peak period travel, they may not contribute to other public objectives, such as air pollution reduction or energy conservation.

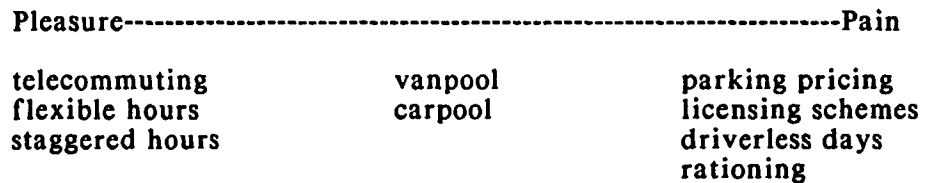
- o *Flex-time* is a relatively easy technique to implement and it can shift travel outside the peak period; employers often adopt this strategy. Its popularity reflects employers' increasing interest in offering employees flexibility. Flex-time can provide meaningful non-transportation benefits, such as allowing sharing of household and family tasks more widely among members.
- o In many cases, flex-time reduces levels of *employee ridesharing*. This can circumvent air quality, energy conservation and urban form objectives. However, strategies can be adopted to avoid this effect, such as instituting flex-time across firms (rather than within firms) or developing employer programs to maintain ridesharing levels when flex-time is introduced. Guaranteed Ride Home programs are an example of an employer strategy for maintaining ridesharing levels when a Flex-time program is adopted. A Guaranteed Ride Home program, through the provision of taxi vouchers, company cars, or by finding temporary ridesharing arrangements, ensures a ridesharer a ride to or from home in the case of emergencies, schedule changes, overtime, etc.
- o The actual *travel time savings* associated with most flex-time efforts is rather small--between 2 and 5 minutes.
- o *Telecommuting* may reduce overall travel. It must be targeted to employers and employee groups well suited to its advantages and disadvantages. However further research in this area is required to identify whether telecommuting leads to increased travel during non-peak hours and furthermore, if these newly generated trips offset the vehicle miles travelled (VMT) saved from the commuting trips.

B. Travel Behavior policies can involve incentives or disincentives. Which is best, or is a combination of policies needed?

Several of the panelists offered different perspectives for modifying travel behavior. As mentioned earlier, both governments and employers were identified as possible change agents in behavior modification. Dr. Mary Lynn Tischer of the Virginia Department of Transportation and Dr. Peter Everett of Pennsylvania State University both presented points of view favorable towards positive reinforcement and voluntary action. Dr. Tischer more specifically viewed the government as a change agent that can set policies in the following ways:

- o by *responding to the market* through actions such as implementing flexible hours, telecommuting, and variable signs.
- o by *increasing market options* through the provision of facilities such as HOV lanes.
- o by *controlling the market* by setting prices, or establishing driverless days, licensing schemes, etc.

Any discussion of incentives or disincentives must acknowledge issues of political feasibility. Ideally, measures should help individuals to achieve social goals that are consonant with their personal needs. Dr. Tischer views TDM options along a pain/pleasure spectrum. The following chart summarizes this point of view.



Dr. Peter Everett also discussed the merits of positive reinforcement versus punishment in behavior modification. According to Dr. Everett, one key area is the marketing and promotion of transportation services. He asserted that one of the main problems with marketing *services* versus marketing *goods* is that little is known about the actual marketing of services. The provision of transit is a classical example of a service, and has the following characteristics:

- o it is intangible;

- o it combines simultaneously the production and consumption processes;
- o there is no inventory; and
- o the customer is part of the actual service.

Dr. Everett suggests that more emphasis is needed in areas such as transit personnel training, management of customer mix, and quality control. Dr. Everett concluded that we communicate with people by establishing status, and that public transportation does not reinforce status in any form. To make transit services more attractive to travellers and commuters, policy makers should find ways of making transit more status oriented.

Both Dr. Robert Cervero and Dr. Donald Shoup, as discussed in the previous section, presented perspectives that fall on the 'pain' side of the Tischer spectrum and could be termed as disincentives. However, Dr. Shoup places the notion of 'disincentive' in context. Automobile use is currently underpriced with respect to its social costs, so in fact the introduction of a 'disincentive' may bring the costs of automobile use in line with its the costs it generates. By replacing "free parking" with alternative benefits, the loss can be offset by a more constructive incentive.

Dr. Cervero contends that the pricing of parking can be the most effective strategy for inducing commuters to use public transit. Dr. Shoup arrives at the same conclusion, after reviewing several examples of mode splits either between companies or at the same company before and after commuters were charged for the price of parking. By charging employees the (full or partial) cost of parking, the employees are more likely to look for alternatives to the single occupant automobile. In downtown areas, they frequently shift to transit, while in suburban areas the common response is increased carpooling.

Although clear findings regarding the equity of TDM strategies were not discussed by any of the researchers at the symposium, both Dr. Shoup and Dr. Cervero did consider equity to be an important aspect of policy making. Dr. Shoup recommends that employers provide *travel allowances*, and charge market price for parking. A travel allowance program would provide a cash commute allowance to those who formerly received free parking. This allowance could be spent as the employee wished--on parking, transit or non-

transportation purposes. Such a program would not reduce the fringe benefits received by employees, and might be perceived as a benefit, because of the flexibility it provides. When employers adopt a travel allowance program, they charge all employees the full cost of parking. Studies have shown that the number of solo drivers decreases in firms having a travel allowance program and charging employees for parking.

Dr. Cervero argues that the current flat fare structure is inequitable because the short distance, low income, non peak, travellers end up subsidizing long distance, higher income, peak commuters and travellers. Perhaps it is not only important to ask what types of policies, incentives or disincentives, work best for altering behavior but also how policies can be made more equitable.

C. Interdisciplinary research and collaboration broadens our knowledge of behavior and can increase the effectiveness of TDM strategies.

Effective TDM policies must draw on knowledge from a variety of disciplines. For example, ridesharing strategies must be crafted with knowledge from economics, psychology, sociology, engineering, public administration, marketing and planning. Better policies can be developed by taking advantage of and integrating research findings in these fields. Panelists Dr. Ray Novaco from University of California, Irvine, Dr. Martin Wachs, and Dr. Everett Rogers from the University of Southern California, discussed applications of psychology, marketing, attitudinal surveying and innovation diffusion research to transportation planning. Summarized below are some examples of behavioral knowledge that can inform TDM policy development.

COMMUTING STRESS

Dr. Novaco has undertaken carefully designed studies of commuters stress reactions to traffic congestion in Orange County. He showed that continued exposure to travel *impedance* (defined as a behavioral constraint on movement and goal attainment--congestion) is stressful, manifested by adverse effects on blood pressure, levels of satisfaction, job attendance and retention and tolerance for frustration. Commuting stress also carries over into the mood at home after work. The stress arises from both physical

and perceptual sources. The study controlled for differences in many other factors affecting attitudes, such as residential satisfaction, job satisfaction, etc. Dr. Novaco found a significant decrease in commuting satisfaction over the time period he has studied (1977-1989).

These findings are of interest to business organizations and social institutions interested in finding ways of reducing commuting stress. The findings also have implications for planners' models of travel patterns and household and firm location. Those models should incorporate behavioral issues such as commuters' perception of stress. Closer links between these areas can help to answer questions about commuters' responses to increases in congestion.

OPERANT CONDITIONING

Operant conditioning studies examine factors which contribute to changes in behavior. Since many TDM efforts involve changing commuter behavior, this field is of considerable interest. The work in this area suggests that reinforcement (rewarding desirable behavior) is a more desirable means of changing behavior than punishment. Reinforcement is more likely to increase the desired behavior, whereas punishment may discourage one type of behavior, but does not ensure that preferred behavioral will occur. An example of positive reinforcement is giving citizens discount coupons for riding the bus.

Another interesting finding in operant conditioning is that random reinforcement is more effective than regular reinforcement. For example, giving discount coupons on a random basis has more of a positive effect on ridership than distributing them at all times. Finally, research shows that reinforcement is less effective if delayed. Reinforcement has to occur along with behavior modification and not at a later time.

These findings both help explain the advantage of the automobile in most settings (driving provides status, convenience and immediate time savings). However they also suggest directions to pursue in structuring transit and ridesharing programs to achieve maximum effect. Marketing for transit and ridesharing should provide positive

reinforcement. Further research is needed on how this positive reinforcement can be provided. The findings of operant conditioning also raise questions concerning the ultimate reaction of commuters to mandated and/or coercive ridesharing measures. Programs must be carefully evaluated for unanticipated outcomes.

COGNITIVE DISSONANCE

Theories of cognitive dissonance are relevant to research and planning for ridesharing programs. Survey information is clearly useful and often used in determining attitudes about ridesharing. However, surveys must be carefully designed to determine whether individuals' attitudes reflect preferences, adjustments to circumstances or some combination of the two. For example to what extent do people who do not have cars and thus rely on public transit adjust their attitudes to more favorably assess the quality of that mode? Some individuals may develop a favorable attitude towards transit so that their attitudes are more in line with the constrained choices they make. The conclusion from this work is that survey and attitudinal data is useful, but must be carefully structured and interpreted.

INNOVATION DIFFUSION

Research on innovation diffusion provides insights on how transportation demand management innovations are diffused. It is concerned with the manner in which innovations are introduced, adopted and ultimately succeed or fail. This area of research may be applied to both the diffusion of effective ridesharing incentives among employers' rideshare coordinators and the diffusion of regulatory approaches among public agencies.

The classic model of diffusion assumes that an innovation is developed and diffused in a standard package from a central, expert source. Individuals or organizations adopt the innovation but essentially play a passive role. An alternative model, which is useful in understanding the diffusion of transportation innovations, is the decentralized diffusion model. In this case, innovations come from decentralized non-experts who experiment with the innovation. Local organizations diffuse innovations through horizontal networks, unlike the vertical network of the classical model.

Dr. Rogers originally studied this concept with regard to the adoption paratransit services. He found the process to be one of 'hybrid diffusion', because a combination of central mandates and local employer innovation were involved. The Regulation 15 rideshare mandate in Southern California could be viewed as incorporating this type of diffusion. It involves a central mandate for ridesharing programs, but local innovations and horizontal diffusion of ridesharing programs that are effective. A key issue in this type of diffusion is maintaining effectiveness of programs altered by decentralized local innovators.

In summary, there is a complex relationship among psychological well-being, attitudes, motivations, socioeconomic conditions and travel behavior. The interdisciplinary research described in this section shows the potential for this type of research in transportation planning.

IV. DIALOGUE AMONG POLICY MAKERS

Numerous issues were raised by the policy makers in response to the presentations and the discussion at the symposium. The policy-maker panel included Hon. Shirley Campbell, Chair, Bay Area Air Quality Management District, Hon. Kay Cenceros, Supervisor, Riverside County, Mr. William Luddy, President, Los Angeles City Planning Commission, Jim Sims, President, Commuter Transportation Services, Inc. and Hon. Judith Wright, Councilmember, City of Claremont. Some of these key issues raised by the panelists include: the role of the employer in determining commuter choice, the relationship between land use and transportation, the development of policies based on existing behavioral research, and the equity or inequity of specific transportation policies.

THE NEED FOR DIALOGUE BETWEEN POLICY MAKERS AND RESEARCH

Panelists commented on a number of issues that point to the need for behavioral research in transportation. For example, the interconnectedness and synergistic effect of various TDM strategies was noted. In addition, policy makers addressed the importance of monitoring programs to avoid unanticipated consequences. There was consensus that

research findings need to be better disseminated to policy makers and the public at large. Researchers and policy makers need to work closely.

THE ROLE OF EMPLOYERS

Employers have a significant influence on commuter mode choice. How can their transportation policies be modified--incentives, disincentives, or a combination of the two? On one hand, some research indicates that organizational commitment is the key to an employer's successful rideshare program. On the other hand, voluntary and incentive-based programs have not resulted in major increases in overall ridesharing rates. The current severity of problems has led to more regulatory and mandated approaches. Will they be effective? And how can they be structured to achieve maximum effectiveness?

TRANSPORTATION AND LAND USE

Policy makers face major decisions regarding land use distribution, type and density. Land use and transportation policy should be addressed in a coordinated fashion. For example, there is a strong relationship between housing markets and transportation issues. However, there is a lack of unequivocal research on urban forms that moderate travel demand. Further work is needed on the contribution that land use policy can make in solving transportation problems.

POLICY DEVELOPMENT

Given that behavioral research shows that some strategies are indeed effective in increasing ridesharing, how should policies be designed to accomplish these ridesharing goals within the political and institutional context?

For example, research clearly shows the relationship between free parking and driving to and from work alone. What public policy instruments would be most effective in changing employer policies?

EQUITY

Debates about the impact of TDM measures on the poor accompanied many of the pricing, telecommuting and flex-time proposals. Some of the discussion concerned distinctions between short-term and long-term equity effects. For example, some pricing

schemes may increase the costs faced by the poor in the short run, but lead over time to denser land use patterns that can have advantages for the poor in the long run (better transit, closer proximity to jobs and services). The overall question is as follows: how can pricing achieve a more efficient use of the transportation infrastructure without widening the gap between rich and poor? One strategy discussed is to distribute the revenues from pricing mechanisms to low income and other needy groups.

V. AREAS FOR FUTURE RESEARCH

There is a great need for additional behavioral research in the field of transportation demand management. Federal funding for behavioral research has declined at a time when localities are considering unprecedented TDM strategies. Local, regional and state agencies need to support additional behavioral research. Listed below are some key areas of needed research identified during the symposium.

- o Research is needed on *organizational behavior and decision making* with regard to employer transportation policies. Why do so many employers confine the transportation benefits they offer to free parking? How can employers be convinced to change their transportation subsidies? How will they react to mandated rideshare programs such as Regulation 15? How can an organizational commitment to programs be achieved?
- o *Jobs/housing balancing* strategies are being considered as a way of reducing travel. Yet little is known of how such strategies should be structured, and how they might be implemented. Research is needed on the potential effectiveness of this strategy as well as its implementation feasibility.
- o Research is needed on ways maintain or improve rideshare participation while instituting *flex-time* programs.
- o Additional evaluative research is needed on transportation demand strategies, focussing on *secondary and unintended effects* of programs, their cost effectiveness and overall contribution to transportation objectives.
- o Research is needed on the effectiveness of TDM programs implemented by *smaller employers*. Most of the current research has focused on employers with 100+ employees.
- o Research should investigate the *synergistic effect* in TDM program development. For example, research should assess the effect of telecommuting, ridesharing, alternative work hour programs on each other within and among companies.
- o Several *new technologies* are being developed and research should shed some light on the impact of these new technologies on travel behavior. These areas can include: real-time information systems, teleconferencing, telecommunications, etc.

VI. EVALUATION OF THE SYMPOSIUM

All symposium participants were invited to complete evaluation forms and to suggest topics for future programs by the UCLA Extension. Additionally, the participants were extremely satisfied with the exchange of ideas, the discussions, and the topics that were covered at this symposium. They found the sessions of value in advancing their knowledge of the behavioral research in transportation. The sessions on transportation demand management strategies, pricing, and behavioral responses to flextime and HOV lanes were particularly valued.

The question and answer session following the presentations were seen as very useful. Some attenders would have appreciated even more time for questions and discussion. Others suggested that additional and more up-to-date research discussing successful and unsuccessful implementation of current projects would be extremely valuable.

The majority of the symposium attenders expressed a strong interest in attending a similar symposium in a year to further discuss the role that behavioral research can play in policy development and implementation.

Some of the key areas for further research as identified by the participants were covered in the previous section of this report. An overall theme of these comments was that an additional symposium could focus more on policy development, i.e., given the findings of the research, what are the most appropriate policies for implementing TDM measures? Interest was also expressed in symposium that could address evaluative research of programs currently being implemented, such as Regulation 15 and other air quality measures affecting transportation, and jobs/housing balancing.