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A Research Agenda for Public Transportation

A RESEARCH AGENDA FOR PUBLIC TRANSPORTATION

**PROCEEDINGS OF THE AUGUST 1990 JOINT SUMMER MEETING OF
THE PUBLIC TRANSPORTATION COMMITTEES OF
THE TRANSPORTATION RESEARCH BOARD**

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Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

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INTRODUCTION

Background and Context

The results of the special conference described in this circular were an outgrowth of efforts dating back to 1986, and mark an important contribution to continuing efforts to reinvigorate a national transit research program.

In January 1986, the Transportation Research Board launched the Strategic Transportation Research Study for Transit ("Transit STRS", pronounced "stars"), culminating in the publication of Special Report 213, *Research for Public Transit: New Directions*, in November 1987. SR 213 focused on the major gap in recent transit research: a program focused on problem-solving needs of the transit industry. Implementing the SR 213 recommendations, however, depended on new funding arrangements which could not be immediately secured.

As the time drew nearer for developing proposals to reauthorize the federal surface transportation program (which expires September 1991), interest again increased in pursuing SR 213's proposals. 1990 proved to be a watershed year. In February, President Bush released the *National Transportation Policy (NTP)*, which set the Administration's intentions for future transportation legislation. The NTP contained the broad objective to:

Increase the Federal transportation budget for research and technology projects, in coordination with the efforts of private industry, the academic community, and state and local governments.

The new Transit NOW coalition representing most transit interests kicked off its campaign in 1990 to support increased funding for public transportation in the federal reauthorization debate, including increased funding for research. The American Public Transit Association (APTA) "Transit 2000 Task Force" had already endorsed the SR 213 recommendations in its November 1989 report, *Managing Mobility: A New Generation of National Policies for the 21st Century*.

It was in this context that this special conference was called. Subsequent to this conference, the Urban Mass Transportation Administration (UMTA) sponsored a meeting in Kansas City on September 17-18, 1990, to further develop federal transit research priorities. The thrust of that conference was more toward national program objectives and the NTP, rather than transit industry problem-solving. The results of that conference were published by UMTA in January 1991 in *Agenda for the Urban Mass Transportation Administration's Transit Planning and Research Program*. Subsequently, the Administration presented its transportation

reauthorization proposal, the Federal Mass Transportation Act of 1991, which contained a substantial increase in funding for a transit industry-oriented research program (Section 26 (b)(1)--Transit Cooperative Research Program).

Conference Objectives

On August 19-22, 1990, the public transportation committees of the Transportation Research Board sponsored a mid-year meeting in Ann Arbor, Michigan, to discuss a national agenda for public transportation research, demonstration and development. The objective of the meeting was to identify and recommend high-priority needs for future research and demonstration, focusing on the problem-solving needs identified in SR 213. There were sixty-three participants (see Appendix B for list), representing transit operating agencies, regional planning agencies, federal, state, and county governments, equipment manufacturers, consultants, and academics. The product of the three-day meeting was to provide input into a public transportation research agenda for the 1990's and beyond.

Applications of the Research and Demonstration Agenda

Development of an agenda for research and demonstration can serve several purposes. At the broad, national level, it can establish linkages and common research goals among various national agencies and organizations including UMTA, APTA, the American Association of State Highway and Transportation Officials (AASHTO), the American Planning Association (APA), and the Institute of Transportation Engineers (ITE), to name a few. At the individual agency level, it can foster consumer-oriented research directions and dissemination tools that coordinate and make the maximum practical use of federal and local research dollars. At the Transportation Research Board committee level, it can serve to organize committee efforts so that these volunteer committees are working to support national and local research and demonstration needs.

Reasons for New Interest in Research and Development

The genesis of revived interest in public transportation research, demonstration and development has come from a number of sectors. As described in SR 213 and in one of the conference resource papers (Nigel H. M. Wilson and Patricia V. McLaughlin), the Federal role has varied over time in both focus and funding level.

However, there is renewed interest from USDOT as part of the National Transportation Policy and,

correspondingly, from UMTA and the Federal Highway Administration (FHWA).

In addition, transit agencies, state Departments of Transportation and others are recognizing the need for additional research and development in an era of more constrained funding. Management and decision-making tools hold promise for making more efficient use of financial and human resources. There is also potential for technology transfer among modes, such as intelligent vehicle/highway systems (IVHS) and computer systems, that will maximize use of existing facilities.

This interest has been heartening to those from the transit industry and academia who had put considerable time and effort into the Transit STRS program in the late 1980's, only to see recommendations shelved for lack of funding and mixed levels of interest on the part of research funders and consumers.

Conference Organization

To focus conference discussion on development of a product that would contribute to a national research, development and demonstration agenda, plenary sessions were held and workshops were organized to develop recommendations.

Plenary Sessions

The first day's plenary session outlined the challenges and needs in research and development and included a review of transit operator needs, the state perspective on research and development and a discussion of a case study in translating research and development needs into an implementable project. The second day's plenary session gave an overview of institutional and organizational issues in research and development. The U.S. and Canadian experiences were discussed and compared. As a context for management issues, integrated management and performance techniques ("total quality management") were discussed. A presentation on U.S. versus foreign investment in technology summarized findings on the effects of technology investment in the foreign and U.S. markets.

Resource Papers

In addition, two resource papers were developed. One focused on the history and experience with UMTA research and demonstration programs. The other highlighted the Canadian experience with conducting and disseminating research. These papers are included in Appendix A.

Workshops

Workshops were organized to follow along the lines of the SR 213 Report, which had identified seven broad areas for problem-solving research (Appendices A through G of that report). For convenience, related topics were regrouped into three headings to reduce the number of workshops. Each workshop was given the appropriate SR 213 appendix as a starting point. The workshops were:

- A. Management, Finance and Human Resources
- B. Service Design, Delivery and Marketing
- C. New Technology, Equipment and Maintenance

The workshops were given a charge to review the following issues and prepare an outline of short-, medium- and long-term research agendas based on the deliberations:

1. What are the emerging areas under the topic that need further research, demonstration or development? Are there ideas of the past that should be revisited?
2. How should research and demonstration in the subject area take place? Where should it be conducted?
3. What techniques could be used to share the results?

Based on these discussions, summaries of each workshop's findings were prepared and are included below.

WORKSHOP A: MANAGEMENT, FINANCE AND HUMAN RESOURCES

There has not been much recent research in the areas assigned to this group and most of what has been undertaken has been performed and focused at the local level. Further dissemination of information resulting of what research has occurred has been sporadic and incomplete.

The public transportation industry is facing a dynamic future where regional decisions based on financial capacity, controlled growth, air quality and energy availability issues may determine their future. In this atmosphere, transportation management must redouble activities to improve service efficiencies and effectiveness to be in the best position to react to future opportunities.

The group divided the work into four categories: 1) Organizational Form; 2) Internal Efficiencies; 3) Innovative Financing; and 4) Resource Management. A large number of individual topics were identified under each category. These topics were then ranked

considering such factors as research time, cost, likelihood of success, complexity, centrality to the topic and clarity of potential research methods. Much of the short-term research could be focused on synthesizing existing literature or practices, while the mid-term research could require development of new methods or technologies.

Recommendations

Short-term

Organizational Form:

- *Total Quality Management (TQM)*. Identify improved methods to manage a growing diversity of employees, and tasks utilizing improved computer-based information systems.
- *Management of Technology*. Document ways to assure that the latest technology is used to provide direct service benefits to customers.
- *Transfer of Ideas*. Document methods used to assure a receptive climate for implementation of new methods and procedures.

Internal Efficiencies:

- *Management of Information Systems*. Evaluate systems that provide management with accurate information on their organization.
- *Contracting Out*. Evaluate the benefits and disbenefits of contracting specific functions or services.

Innovative Financing:

- *Joint Development*. Identify value-capture opportunities, including a synthesis of implemented projects to compare results expected to be achieved.
- *Institutionalization*. Study ways to achieve acceptance of transit so that it is considered part of the basic services provided to modern society.
- *Demand Based Pricing*. Investigate time-based and congestion-based (or rush hour) pricing.

Resource Management:

- *Recruiting Qualified Employees*. Documents methods to improve selection methods as well as to identify potential to improve the pool of candidates.
- *Training*. Identify successes and failures from previous transit training programs and recommend needed new programs.

Mid-term

Organizational Form:

- *Entrepreneurship*. Document ways to encourage competition aimed at providing low cost services from within a public transit organization and in dealing with the broad outside community.
- *Managing in a Public/Political Environment*. Research the public/political environment in which transit functions, including policy board responsibilities and actions.

Internal Efficiencies:

- *Risk Management*. Document techniques that exist to best identify, anticipate, and mitigate risks to employees and the public? What cost savings are possible?
- *Optimizing Cost and Revenue Centers*. Document how management can monitor and control costs and revenues to optimize available resources?

Innovative Financing:

- *Social Service Reimbursement*. Explore methods to capture costs of providing social services - costs which many feel should be charged to the respective social programs.
- *Demand Based Pricing*. Identify how new methods and techniques as well as improved and new technology can lead to pricing which encourages social goals.

Resource Management:

- *Job Design*. Research job related employee health, stress factors as well as causes of absenteeism, and possible remedies. Cross-cultural training should also be included with this topic.

Long-Term

The group felt that the topics assigned did not lend themselves to readily identified long-term research. However, the results of the short- and mid-term research could lead to identified long-term needs - but it would be premature to identify possible needs without proceeding incrementally.

Conclusion

For providing the research, it was felt that the National Cooperative Transit Research Program (NCTRTP) process would be a good model. The group felt it would especially be a good way of providing syntheses of current practice. The reason the NCTRTP process was thought to be most appropriate is that there would be the maximum involvement of potential result users or those who would be most affected by the information provided.

How these should be disseminated, of course, depends upon the product. Because so many of the topics are recommended to be syntheses, published reports were preferred. Some of the findings would undoubtedly be apt topics for Transportation Research Board meetings or sessions at APTA meetings. A personal approach with a question and answer session based on a published report would be invaluable.

A logical implementation tool would be for funding to be made available for appropriate demonstrations of identified new methods, procedures and technologies.

WORKSHOP B: SERVICE DESIGN, DELIVERY AND MARKETING

The US transit industry has been facing shifts in urban travel patterns over the past thirty years which have made the traditional in-bound radial morning commuter trip an ever decreasing component of all urban travel. As the growth in urban travel has been heavily concentrated in suburban origins and destinations, the transit industry has been wrestling with the problem of how to provide a viable option for less concentrated, dispersed trips. While timed transfer networks seem to offer the potential to attract some of these trips, the tradeoffs between different system configurations are still not well understood.

Over the past decade, increasing interest has been shown in alternative service delivery arrangements, frequently involving the private sector as the service provider operating under contract to the transit authority. There is now quite a bit of experience acquired about how these service contracting arrangements work, but there has been little independent reporting and documentation of the results. This type of information is crucial if authorities who are not yet involved in this type of arrangement are to benefit from the valuable lessons learned by others.

As more transit authorities recognize that they need to pay more attention to the needs and preferences of their current and potential passengers, there is an emerging need to understand, document and disseminate the results of alternative marketing strategies. While many agencies have undertaken various marketing initiatives, they tend to be piecemeal and the results have not been made widely available.

These are three examples of current needs for research and dissemination of results in the area of service design, delivery and marketing. This should be a critical area in any new problem-solving transit research program.

Recommendations

Short-Term

- Investigate how effective multiple transit service providers can be in providing integrated transit service. Develop recommendations on how to achieve effective integration from the passengers perspective.
- Investigate and document how to measure success in service design and performance at the system (as distinct from the single provider) level.
- Document the effectiveness of marketing strategies including alternative approaches to market research, promotion and public information. Recommend effective strategies to agencies to achieve specific objectives.
- Document the costs and benefits which have been achieved with alternative service delivery approaches. Recommend effective contract specifications for private participation and appropriate levels of responsibility for the authority and the contractor.
- Determine the potential for entrepreneurial activity by transit authorities such as charters, provision of maintenance service to outside organizations, and sale of other expertise.
- Determine the past effectiveness and likely future contribution of incentives at both the management and labor levels. Demonstration projects are recommended to evaluate the effectiveness of these incentives.

Mid-Term

- Document the results of service re-configuration initiatives designed to provide better service to the non-traditional, transit trip. This would also include documentation of the cost-effectiveness of alternative ways of providing access between suburban line haul facilities and local employment and activity centers (for reverse direction trip-making). Recommend strategies for improving service for the non-traditional transit trip.

- Document the results of attempts to change transit services to meet public preferences as elucidated through market research techniques such as stated preferences. Recommend demonstration projects which would shed more light on the tie between market research and transit service design.

- Document user-side subsidy initiatives in terms of the effect on transit ridership, costs and base fare levels. Recommend additional demonstration projects to further understanding of user side subsidy options.

- Document how cost-effective the transit information center has been in improving the position of the transit operator.

- Document lessons from abroad with respect to alternative institutional arrangements for providing transit service such as UK and New Zealand. Recommend potential strategies for achieving resulting benefits in the US.

- Document the cost-effectiveness of re-structuring strategies which have been undertaken in the last decade to make regional transit authorities more efficient.

- Document the effectiveness of Transportation Management Association (TMAs) in improving public transportation services.

- Document the accuracy of demand forecasts for both major capital investments and for service changes. Evaluate specific demand forecasting techniques and recommend strategies to improve forecast accuracy.

- Investigate strategies for facilitating consideration of alternative service delivery options. Specifically what roles might Federal, State and local government play in overcoming any institutional resistance and regulatory barriers which may still exist.

- Assess the impact on overall transit system cost-effectiveness of dividing a large transit authority into smaller units. This would include examination of (dis)economies of scale, coordination, pricing and public information impacts.

- Investigate the most cost-effective ways of providing high service quality to persons with disabilities. This would include estimating the potential demand for alternative fixed route and paratransit services as a function of request lead-time, and how to improve coordination and planning between fixed route and paratransit services.

Long-Term

- Investigate the most effective ways for transit authorities to influence the development and land use planning process to facilitate high quality transit service. Develop guidelines for transit authorities.

- Investigate the way land use patterns, development controls and incentives, traffic engineering and related policies affect transit service cost-effectiveness.

- Document the costs and benefits of transit transfer centers including economic benefits, land use and environmental impacts and implications for the passenger.

- Develop strategies for transit to participate fully in the emerging Intelligent Vehicle Highway System (IVHS). Determination of the short-, medium- and long-term impact of IVHS on the transit.

Conclusion

The workshop conclusion was that there are numerous high priority research questions which deserve to be addressed in this area, and that a major problem has developed over the past few years in the lack of independent documentation of the results of the many initiatives which agencies have undertaken. Dissemination of appropriately reported results through a range of techniques designed to get information into transit managers hands is also a major need.

WORKSHOP C: NEW TECHNOLOGY, EQUIPMENT, AND MAINTENANCE

Technological advances can find applications in public transit on many levels ranging from minor but cost-effective improvements to maintenance procedures, through computerization of service scheduling, to radically different modes of transport. This varied research and developmental work takes place in a variety of settings -- universities, transit agencies, private sector innovators, and consultants -- with and without federal support.

During the 1970s much attention was given to the creation of "new modes" of transit promising service levels more competitive with the automobile: personal rapid transit, dial-a-bus, dual mode transit, etc. Results of these efforts were largely disappointing, in part because their programs were conceived and executed with little input from transit operators. Dissemination of the information generated was inconsistent or nonexistent.

The 1980s witnessed a dramatic decline in federal support for transit research and development. What activity did take place focused on more modest advances in conventional bus and rail transit modes. Yet significant, potentially transferable progress appears to have been made outside the urban transit sector and outside the United States during this period. A major theme emerging from the workshops at the 1990 Joint Summer Meeting is the need to "catch up" with these advances and, where appropriate, adopt them to the unique needs of public transport planning and operations. AASHTO, APTA and TRB could perform a significant role in disseminating such information.

Recommendations

Short-term

- Develop a manual or guidebook to define and standardize terminology, testing, and data reporting procedures to facilitate the communication and transferability of research results.
- Evaluate various procedures and software for runcutting and scheduling on an ongoing basis to keep them up-to-date. Develop a procedural manual and corresponding training.
- Establish accessibility standards, e.g. for wheelchair lifts with objectives of quick loading and securement. Develop a manual.
- Survey and report near-term use of robotics for maintenance, diagnostics, parts picking, etc. Identify thresholds at which they become viable for transit operations.
- Document UMTA's service aspects provided the transit community.

Mid-term

- Compile and synthesize the results of on-going research on alternative fuels and evaluate their long-term, large-scale utilization in transit operations.
- Investigate and demonstrate technologies emerging from work in Intelligent Vehicle/Highway Systems (IVHS) for use in on-line carpooling and traveler information systems.
- Compile a compendium of transit technologies (e.g. the now dated Lee Compendium). Report on recent operating and maintenance experience with automated guideway transit (AGT) and people movers (e.g. study the need to revive the discontinued UMTA AGT cost report series). Develop expert/mentoring systems for training and retraining knowledge.

- Assess the feasibility and viability of medium- and high-speed trains for urban travel through a cost-benefit study.

Long-term

- Research, develop, and demonstrate the long-term, large-scale operation of transit elements of IVHS.
- Study feasibility of and demonstrate a high-speed (85-150 mph) train systems in a metropolitan setting.
- Investigate and demonstrate the costs and benefits of full automation of rail operations to obtain low-headway service. Assess the full impacts on security, flexibility, and employment.
- Monitor, assess, and prioritize new technologies emerging in robotics, alternative fuels, alternative propulsion systems, and construction methods.

Conclusion

The program summarized above is modest in that it concentrates on summarizing results of efforts already underway largely outside the U.S. transit sector and conveying them in a useful format to the transit profession. Many of the recommendations focus on on-going advances in computer-based technologies: scheduling, software, robotics, IVHS, full transit automation. This focus on compiling, assessing, and reporting results of others' research and development underlines the importance of clear reporting standards and effective means of dissemination and training.

In the long-run, full-scale demonstrations, such as high-speed trains, full automation of rapid transit, and IVHS transit elements, would require more significant funding commitments, whether public or private.

OVERALL CONCLUSIONS AND REMAINING ISSUES

The three workshops developed a large list of discrete research topics that should receive priority attention in the evolving national transit research agenda. Four issues that cut across all the specific research topics remain to be settled before a comprehensive public transportation research program can be brought to fruition. The following observations are offered to help frame the future discussion.

Research Program Organization

The Administration's reauthorization proposal calls for the *Transit Cooperative Research Program* to be directed by an independent governing board established by the Secretary of Transportation, with the National Academy of Sciences to carry out the program. This is consistent with the general agreement of the workshop participants to support a model based on the NCTR, perhaps with a more participatory aspect for transit operators, similar to the Canadian model (see appendix).

It might be better to think of describing the desired result, rather than the specific organization. SR 213 proposed six criteria for selecting an organization: (1) evidence of close ties to transit operators; (2) ability to establish a governing board representative of industry interests; (3) capability of managing a research program; (4) priority given to research; (5) ability to administer federal funds; and (6) ability to disseminate research results (SR 213, pp.71-73).

Based on the workshop discussions, we might add: (7) ability to involve universities, transit operators, local governments, state DOTs, federal agencies, consultants, and equipment suppliers, as appropriate to the research needs; (8) ability to establish multi-year, strategic research (i.e., budget) priorities; (9) ability to undertake the full range of research activities (short-term syntheses of existing knowledge, compendia of current "best of practice," development of new tools and techniques, demonstration and evaluation of new tools and techniques); and (10) ability to establish meaningful standards for the conduct of research (e.g., adequate literature search to avoid reinventing wheels, inclusion of international perspectives, peer and client reviews of products, etc.).

Research Dissemination

The workshop discussions confirmed the findings of SR 213 that multiple methods of dissemination were needed: (1) publication and distribution of reports; (2) packaging results in more "user-friendly" form for operators; (3) newsletters; (4) technical briefs; (5) state-of-the-art reports; (6) films and videotapes; (7) user guides and manuals; (8) trade journal articles; (9) field workshops; (10) training courses; and (11) site visits (SR 213, pp.78-80). Some workshop participants mentioned other models that might be helpful, including the agricultural extension program and the Rural Transportation Assistance Program (RTAP).

There was broad consensus that simple distribution of individual completed research reports was not going to meet the needs of the industry. It was left for further discussion, however, whether the individuals or organizations which conduct the original research would be appropriate for the much broader methods of dissemination desired. It may be necessary to formalize the process of summarizing and compiling research

results into forms that can reach their intended audiences quickly and effectively. At a minimum, the definition of a research project should clearly set out the desired dissemination methods, and the governing board and administrative agency should regularly identify related projects that should be grouped for dissemination. Research projects should build upon and relate to one another, and not be considered in isolation.

Multi-modal Issues

As transportation research continues to be compartmentalized by statutory formulas into highway and transit components, cutting across the modes remains to be difficult. The reauthorization discussions of metropolitan level flexible funding, for example, will demand a more sophisticated planning effort to resolve modal investment decisions. Where is the research to support these system-wide efforts to be housed? Unless the transit and highway research agendas both identify the need to deal with multi-modal issues, they will inevitably be under-funded. All affected agencies should ensure that this important bridge between the programs is solidly built.

Establishing Research Priorities

The three workshops took slightly different approaches to defining research priorities, but there were only brief discussion of explicit criteria for defining those priorities. SR 213 did not produce a "strategic" research program for transit, but rather a much shorter-term perspective responsive to operating agencies' needs. The transit operator focus is inherently, and intentionally, biased toward research that is quick, inexpensive, narrowly focused, low-risk, and achievable. The criterion of "researchability" encompasses many dimensions:

Data Availability

Are there existing data, or is original data collection required?

Research Method

Is the proposed method well-tested and established, or must new R&D be undertaken? There is a loose hierarchy of research that broadly parallels the time frame criterion: (from shortest to longest)

- Synthesis of current literature
- Synthesis of current practices
- Development of new methods and techniques
- Development of new technology
- Focused demonstrations to test specific methods and technologies

Complexity of Research

Are there clear, testable hypotheses, or is the approach more exploratory and ambiguous?

Likelihood of Research Success

Is the subject amenable to conclusive, convincing, factual results, or is there high risk that there will be no useful result?

Centrality to Major Policy Questions

How will answering these questions help to improve the planning and delivery of public transportation services? (One participant called this the "so what?" factor--once we complete the research, what does it tell us?)

Time frame

Is this topic amenable to short (one year or less), intermediate (one or two years), or long-term (over two years) research?

Cost

Is this topic researchable with a low (under \$100K), medium (\$100-500K), or high (over \$500K) budget?

It ought to be possible to devise a research priority evaluation scheme around these and other criteria, but the discussion of the most appropriate measures to use should proceed promptly.

In addition, there may be some "big picture" questions that don't survive this kind of evaluation, depending on how each criterion is applied, and what strategic objectives are set. For instance, how would the following questions fit into the proposed research agenda?

- How can transportation investment decision making be improved?
- What is public transportation's contribution to mobility, social goals, economic development, environmental protection, productivity, and the quality of life?
- What would it take to achieve a massive shift from single-occupant vehicles to transit?
- What are the costs and benefits of past transportation investment decisions?
- What are the determinants of internal operating efficiencies in public transportation?

One could read each of these questions into the national transportation policy, and yet the narrower focus of the proposed operator problem-solving program might preclude this kind of research. Would the federal (vs. operator) research program assume responsibility for these kinds of questions? These questions might be more appropriate for the university research program, but they should find a home somewhere in the new transit research agenda.

Next Steps

This Circular outlines the results of one of the efforts to further define a transit research and demonstration agenda for the 1990's. There is a need to assemble the results of the UMTA Research Priorities conference in Kansas City, the STRS report, and related activities of AASHTO and APTA at the national level to help define a process and program for future action. This is only the beginning of what promises to be a renaissance in transit research. There is still ample opportunity to accommodate new ideas as this program takes shape, so readers are encouraged to contact the TRB with any thoughts they may have.

Acknowledgments

The Joint Summer Meeting of the Public Transportation Committees in Ann Arbor was organized by Patricia McLaughlin of the Los Angeles County Transportation Commission and Nigel Wilson of the Massachusetts Institute of Technology. The conference was hosted by Michael Bolton, Executive Director, Ann Arbor Transportation Authority. The workshops were facilitated and summarized by several volunteers:

Workshop 1: George Smerk,
University of Indiana
George Gray,
California Dept. of Transportation

Workshop 2: Janet D'Ignazio,
Michigan Dept. of Transportation
Nigel Wilson,
Massachusetts Institute of Technology

Workshop 3: Michael Bolton,
Ann Arbor Transportation Authority
Lawrence Fabian,
Trans 21 (Boston)

Joel Markowitz, Metropolitan Transportation Commission (Oakland, California), was responsible for editing the workshop reports into this Circular. Campbell Graeub provided staff assistance from the TRB.

APPENDIX A-1

Unofficial History of Federally Funded Research, Demonstrations and Training: Issues for Reconsideration

Nigel H.M. Wilson and Patricia V. McLaughlin

The intent of this resource paper is to review the recent history of federal involvement in public transportation research and to lay out some of the critical issues which must be addressed in establishing a national agenda for public transportation research, demonstration and development, the charge to this meeting. Given the relatively recent and comprehensive assessment of research needs in public transportation which culminated in the 1987 TRB Special Report *Research in Public Transit*, this paper draws heavily from that source, indeed the first two sections of the paper principally summarize the historical review of the federal research activities and then the proposal for a new research program which emanated from that study. Certain anecdotal observations of Federal involvement in project selection, evaluation and information dissemination are made to illustrate the discussion. In the third section of the program the other major recent initiative in transportation research, the University Transportation Centers Program, is briefly described. Finally some of the key issues in structuring an effective national agenda for public transit research are outlined.

The Federal Role Over the Past Two Decades

The first point that needs to be clearly recognized is that over the past twenty years there has been a substantial amount of research focussed on public transit, with the Urban Mass Transportation Administration (UMTA) playing the lead role. Throughout the 1970's expenditures averaged some \$60 million per year, or about 1.5 percent of the industry's gross revenues. The sharp declines in transit research which occurred in the 1980's, to a low of \$22 million in 1986, about one-fifth of 1 percent of industry revenues, might well be seen as an inevitable reaction to the general perception that the research expenditures of the 1970's had not led to significant improvements in the operating position of the industry. Before considering new research initiatives it is essential to try to learn any lessons from the past which might prevent history from being repeated. While it is true that current research expenditures are extremely modest by the standards of the private sector, or indeed related public sectors such as highways, this is not a sufficient basis for concluding that they should be increased. Rather what is needed is to see whether research programs can be structured to be more effective than those which existed in the past, and whether demonstration projects emanating from such programs can be selected, evaluated and results disseminated to effect a positive change in the transit industry.

This discussion will focus on the UMTA research program since this continues to be the dominant source of funding for transit research, even though individual transit authorities, manufacturers and foundations do contribute to the total transit research picture. While there was a modest amount of transit research funded in the mid-1960's, principally aimed at demonstrations of fare reduction and service improvement strategies, federal transit research since the late 1960's can be, albeit somewhat grossly, characterized in three phases: large scale new technology (late 1960's - mid 1970's), strategies to improve existing systems (mid 1970's - early 1980's), and policy oriented to reduce subsidy requirements (1980's). Recognizing the generalizations involved, each of these phases is described briefly below.

Large Scale New Technology

Emanating from the New Systems Studies which occurred at the creation of UMTA, and in tune with the desire to re-channel engineers from the aerospace and defense industries into tackling pressing civil problems, UMTA's initial significant entree into research had a strongly technological bent. Programs such as personal rapid transit, tracked air-cushion vehicles and computer controlled dial-a-ride required vast sums of money but ran out of support before the promised major technological fixes to the urban transportation problem were realized. In the same era efforts to improve existing systems also had a technological focus, exemplified by the Transbus and the state-of-the-art rail car. The transit industry was extremely skeptical of this adventurous, technologically focussed research program, and was never really a party to it. These UMTA internally determined priorities were of little interest to the industry dealing with day-to-day operating concerns. While there appears to have been considerable focus on evaluation and dissemination of the results, this industry skepticism died hard -- it took years, sometimes decades, for parts of certain innovations to work their way into the mainstream of the transit industry. Some (such as mag-lev and computerized dial-a-ride) are beginning to emerge once again as "new" innovations.

Strategies to Improve Existing Systems

While the large scale technological research begun earlier continued in this phase, increasingly it was recognized that the pressing problems facing the transit industry also deserved a place in the research agenda. Thus while hardware research continued to receive a large share of the federal research budget, the service and methods demonstration program was substantially expanded and the National Cooperative Transit Research and Development Program (NCTRDP) was launched to tackle shorter term research problems identified by the industry. Real progress was made during this period in closing the gap between the UMTA

research agenda and what the transit industry felt were the important research needs. During this time UMTA experienced its greatest success in terms of evaluating and disseminating results of research and demonstration projects. For example, the annual research program summaries "Innovation" started in this period (mid-1970's) but tapered off a few years later (1982 to 83). Other UMTA publications seemed to follow a similar pattern. However results from the more pragmatic, shorter term research projects still seemed to have little impact on the transit industry as a whole, with many demonstrations not being continued past the stage of UMTA funding.

As for new projects, there was some feeling that UMTA was heading toward more policy-based research. In UMTA research and demonstration program cutbacks some independent evaluations were stopped. In part this may have been due to lack of clear demand for the lengthy, complex reports that were often produced. As a result, many valuable lessons learned and new ideas were lost for future research and demonstration.

An example of this was the local Technical Advisory Office, set up with an UMTA Section 6 demonstration grant to provide technical assistance to 82 cities in Los Angeles County that had just begun to receive allocations of a local sales tax for transit. Many new approaches were tried. Several succeeded. Some failed. The final version of the report did not contain the full details of the findings such as the description of successes and failures. Thus valuable observations were lost to any who might read the report in hopes of developing variations of the concept for implementation.

Many of the demonstrations of this period, deemed mixed successes at the time, later became standard service types in some areas. Examples of these programs were paratransit and subsidized taxi services -- paratransit services have tripled since 1980.

Policy Oriented to Reduce Subsidies

During the past decade major changes have been made to the federal transit research program. First and foremost, the level of funding has been drastically reduced. The research program has been shifted away from hardware and technology to emphasize technical assistance for projects which are supportive of federal policy towards public transit, and specifically towards activities likely to reduce future subsidy requirements. The systematic scaling back of transit research has eliminated funding for many initiatives which were of little, or no, interest to the transit industry, but there emerged a strong feeling that the remaining research was following an agenda orthogonal to industry concerns. At the same time UMTA's belief in, and support for, the industry-initiated NCTRTP research agenda dwindled -- and with it funds for the program. Growing disagreement

between the transit industry and UMTA on strategy for the industry and the role of federal government further undermined the potential for research findings to be applied in the industry.

In the mid-1980's, project selection was almost entirely policy-driven. Often these policies reflected neither the transit operators' specific needs or variances in local conditions. This sometimes resulted in "demonstrations" in reluctant or unwilling areas. A case in point was the selection of five sites for demonstration of private sector contracting. Only two of those sites (Snohomish County, Washington and Los Angeles) were able fully to implement the demonstration projects. Other sites ran into either labor or contractor problems, in part because UMTA selection criteria and funding conditions were not adaptable to local circumstances.

The transit industry refers to UMTA and other federal regulations as a key component in cost increases (running the gamut of Section 13(c), contracting requirements, Buy America, Civil Rights and others). However, Federal policies and regulations have often been a constraint to innovation as well. A case in point has been the entrepreneurial services program. Initially conceived to get private sector proposals for the provision of transit services utilizing Federal capital dollars as a "seed" for ongoing private sector support, some local projects encountered Section 13(c) labor constraints early on. Fortunately this program was able to be reconfigured to meet federal constraints, but the example of the impact of regulations on innovation is still relevant.

During this time, written information dissemination has been minimal and mostly focused through PPTN (the Public Private Transportation Network) and various UMTA workshops and symposia. The "hands on" approach of the PPTN, where experts are dispatched directly to a transit property or agency needing assistance, has great promise as a "user-friendly" information dissemination technique. To date PPTN has focused most of its assistance on implementation of major federal policy initiatives (such as privatization, suburban mobility and entrepreneurial services). The program could be strengthened if it supplied a cadre of experts in a variety of fields. PPTN technical assistance documents, while generally recognized as well-prepared and helpful, have shared a similar fate in that they have been targeted at assisting with major Federal initiatives, not always focussed on the broader arrays of issues facing transit operators.

In addition due to financial constraints, UMTA evaluation of demonstration projects has continued to be de-emphasized. While UMTA has occasionally provided funding for transit agency-sponsored projects (such as the Los Angeles bus service contracting demonstration), independent contractor evaluations (such as those done under the auspices of the Transportation Systems Center and by the Urban Institute in the early 1980's) have been rare.

While there have been major shifts in the federal transit research priorities over the past two decades, it would be hard to make a strong case that the federal program has had significant positive impacts on transit industry performance at any point in time. Several reasons might be advanced to explain this lack of effectiveness. First, at no point has the industry been in full agreement with UMTA's priorities, which have frequently been established without substantive input from the industry. In this context it is unlikely that even if good results emerge from research they will be readily embraced and adopted. Second, there has been a clear (and perhaps inevitable) tendency to put the best possible face on research and demonstration project results. This has made the industry even more skeptical about the real impacts of new strategies because of a perception that the written reports may not tell the whole story. Finally, for much of this period dissemination of research results in a form easily accessible to managers besieged with daily operational crises, was lacking. While real progress has been made on this front over this period, effective results dissemination will remain a challenge in any future transit research program.

Transit Strategic Research Initiative

The TRB special committee which was established to examine the strategic research needs of the transit industry identified three distinct types of transit research: technological, federal mission support, and problem solving. While UMTA had undertaken research (albeit with mixed success) of the first two types, it was concluded that the top priority for a new transit research program to meet the most critical needs of the industry was of the problem solving type.

To quote directly from the Executive Summary of the TRB Special Report 213, the committee recommended:

- Transit agencies should sponsor an operator-oriented, problem-solving research program focused on high-priority topics of common interest such as human resources management and maintenance.
- Program funding of approximately \$10 million annually could be provided through a mandated set-aside by local operators of 1/2 percent of their federal formula grants (Sections 9 and 18 of the Urban Mass Transportation Act of 1964 as amended) on which the required local match would be waived.
- The transit industry should seek legislation to authorize the set-aside and clarify that research by local transit agencies is an eligible Section 9 and Section 18 program activity.
- Transit agencies should play a dominant role in managing and implementing the research program through representation on a governing board to provide program policy guidance.

- The transit industry, under the leadership of an organization like the American Public Transit Association (APTA), should assume primary responsibility for broadening industry support for the recommended research program, selecting an appropriate program administrative structure, and seeking the required legislation.

To illustrate the basic thrust of the problem solving research program the committee identified the following promising research topics: human resources management, service configuration and marketing, service delivery models, internal efficiencies, maintenance, equipment and innovative financing.

In the three years since the completion of the TRB committee report the pre-implementation phase has been conducted by the APTA Transit Research Task Force, and UMTA has proposals under study for major restructuring of the federal research program.

University Transportation Centers Program

Two years ago the \$10 million per year University Transportation Centers Program began. Because of its size and newness it seemed appropriate to describe it briefly in this paper, and to discuss its potential contribution for addressing the emerging transit research agenda.

The University Transportation Centers (UTC) Program was established by the U.S. Department of Transportation as a result of the 1987 Surface Transportation Assistance Act to provide research, education and technology transfer in all modes of transportation. After a competitive procurement ten University Transportation Centers, one per region, were selected for inclusion in the program and each developed a program of activities funded at the level of \$1 million per year per center (for the first two years of the program only \$500,000 per center was actually provided annually) with the same amount to be provided in matching funds. The program is now entering its third year of the initial four year authorization. At the full funding level half the funds are provided by UMTA and half by the Federal Highway Administration, thus this program represents a significant fraction of all UMTA research funds.

While in each region there is a designated university transportation center, this title is a little misleading since in most regions there are several universities involved in a consortium with a lead university. In general each consortium was created not only to provide breadth of expertise, but also to maximize the chance of each university receiving some benefit from the program. Unfortunately the existence of consortia places a premium on spreading program funds around each year, and this may impose a price in terms of effectiveness of the program. Highly worthwhile activities at one

university may be deferred in favor of more marginal activities at another university because of the desire to keep all universities funded. A related concern is that although each consortium is funded at an annual level of \$1 million, the size of individual projects may be below critical mass because of the premium placed on keeping all universities involved. Although each consortium has defined a program theme which should define the domain of activities, there is a strong tendency to keep the theme broad so that most activities can be included. Consequently there may be little synergism between the different activities underway in each regional consortium.

There are two other concerns raised by this program which are directly relevant to the topic of this paper. The first is that while DOT is responsible for program review, it is really up to the universities themselves to structure the research agenda, which may, or may not, be consistent with either UMTA's or the industry's views on what research priorities should be. Typically industry provides advice on priorities, but the universities may follow it, or ignore it, as they see fit. Because the structure of the program is a "bottom-up approach" it is unlikely that the UTC program will substitute for a coherent national research agenda either in transit or more broadly in transportation. The final issue is that universities may not be able to respond quickly to increased availability of funding for transit research, because many faculty have become more interested in other transportation research topics as funding availability has shifted away from urban transportation over the past decade. This was evident in the first and second years of the UTC program when much less than half the research was focussed on transit, even though UMTA provided substantial funding. While some faculty, and some universities, retain strong interest in transit research, and the fraction of transit research in the UTC program is now increasing, it would probably be unwise to rely exclusively on universities if a large new transit research program is to be mounted.

Issues for Consideration

To conclude this resource paper we will simply identify some of the important questions that deserve discussion in establishing a new research process and agenda. There are doubtless many more which will be added in the course of this meeting.

- How does the federal government develop a research and demonstration program agenda that is more in tune with transit operator needs and is implementable by them in the short term?

- How do the federal government and researchers further quantify improvements (for example, in mobility produced per dollar)? What are the keys to transit operator acceptance of these methods?
- The new federal policy calls for intermodal and multimodal research. How does UMTA position its research and demonstration program to better correspond to similar programs by FHWA?
- How does UMTA conduct outreach to make research and evaluation more customer-oriented? How can UMTA orient its efforts toward the user-friendly, instant consumption that transit agencies currently demand?
- Why has so little research been done (or at least implemented) to date in high-payoff activities such as timed transfer, labor innovations and marketing?
- Is the Federal government equipped to handle new research and development demands with the staff cutbacks that have taken place in recent years? If not, how can contractors be more effectively utilized to evaluate and disseminate results?
- How should research and demonstration projects be identified and evaluated for potential funding?
- How can UMTA research, demonstration and development programs be designed to foster local research combined with national evaluation and information dissemination?
- Given that the climate fostering "space age" technology in the 1960's and 1970's appears to be re-emerging (cutbacks in the defense and aerospace industries are leading to the need to redeploy these technical resources), how can we learn from R&D projects of the past in designing future approaches to new technology research, demonstration and evaluation?

- How can UMTA demonstration programs be redesigned to be adaptable to Federal regulations and constraints (or similarly, how can constraints be modified to foster innovative approaches and financing?)
- If UMTA's "satisfied customers" such as the authors of this paper are so critical, what does the rest of the industry think?

APPENDIX A-2

REPRESENTING THE CANADIAN TRANSIT INDUSTRY'S RESEARCH AND DEVELOPMENT NEEDS: CUTA'S R&D COORDINATION AND STRATEGIC RESEARCH PROGRAMS

Brendon Hemily

I. INTRODUCTION

Research and Development (R&D) is essential for any industry seeking to improve its effectiveness and efficiency through innovation, and is thus an important concern for the Canadian Urban Transit Association (CUTA).

CUTA is the national association representing the interests of transit systems and all other organizations involved in transit in Canada. CUTA believes that transit-related research is enhanced by a more active involvement of the transit industry. Unfortunately, transit systems generally have little involvement in transit-related research, and are often just the recipients of the end-results of research projects that have been carried out by other organizations. CUTA believes that transit systems and their industry association should be more active in defining research needs and priorities, and in participating in research projects in order to enhance their quality and effectiveness.

This is made somewhat difficult because of the highly decentralized environment for transit R&D in Canada. The responsibility for operational and capital subsidies is shared between Provincial and Local governments in Canada, but subsidy levels vary widely, as does the amount of transit R&D, from Province to Province. The Federal government has no mandate in urban transit per se. However, the Federal government does have a mandate in some related areas, such as technology development, energy conservation, safety, transportation for the disabled, etc., and fund some R&D activities in these areas. As a result of this situation, transit R&D activities tend to be carried out in isolation, with a frequent risk of duplication of effort.

Despite this somewhat confusing situation, there was a belief within CUTA that R&D matters should be a concern to transit systems, and to the industry as a whole. As a result, one of CUTA's eight formal goals is: To promote and support transit-related research and development.

CUTA has also identified three ongoing objectives that are related to this goal:

- to identify and communicate transit-related R&D needs and priorities
- to promote sufficient R&D funding from all levels of government and the private sector, to ensure that Canada's urban transit industry maintain its leadership role in technical innovation, and
- to provide a forum and to facilitate the coordination of industry-related R&D activities.

CUTA established in 1983 an R&D Coordination Committee, and has carried out a number of activities, in particular since 1985, to pursue the Association's research-related objectives. This paper discusses CUTA's R&D Coordination and Strategic Research Programs and outlines in the conclusions three dilemmas that have been identified through our experience with transit R&D. The combination of these two programs has enabled CUTA to pursue a comprehensive approach to the transit R&D challenge, that is appropriate for the Canadian context.

II. CUTA'S R&D COORDINATION PROGRAM

In order to better represent the transit industry's interests in areas related to research and development, the Canadian Urban Transit Association (CUTA) has developed since 1985 a National Transit R&D Coordination Program. This program, carried out with financial participation from Transport Canada, has five main objectives:

- identify and communicate R&D needs and priorities, and promote research projects to address these needs
- facilitate research that addresses priority industry needs
- monitor R&D activities and conduct an annual inventory of R&D projects
- disseminate research results through various means (e.g. articles, newsletters, conference sessions, special workshops)
- generally serve a communications and coordination function among transit systems, funding agencies, R&D institutions, and manufacturers.

Identification of Priority R&D Needs

The first of these objectives, the identification and communication of R&D needs and priorities, is a key aspect of this Program, since this provides the basis for discussing with funding agencies and research institutions specific research projects that would be of benefit to transit systems. As part of its efforts to pursue this objective, CUTA has organized a number of specific activities described below:

- National Workshop on R&D Needs (1985): This brought together transit managers from across Canada to discuss in a highly structured environment areas where research would be needed over the next fifteen years. These discussions and the resulting list of over sixty topics are documented in the July 1985 report entitled "Research and Development Needs of Urban Transit". The workshop led to the identification of an initial list of fifteen high priority research needs.

- Ongoing Process to Identify and Communicate R&D Needs: Following the initial workshop in 1985, CUTA's R&D Coordination Committee has had the ongoing responsibility of identifying the industry's R&D needs. Each year, CUTA's Manager of Research submits to the Committee for discussion, possible modifications to the List of Priority R&D Needs. These suggestions are based on surveys, informal discussions with transit managers and knowledge of projects underway. The Committee discusses and approves an annual List of Priority R&D Needs. This List is then recommended to CUTA's Board of Directors.

Upon approval, detailed research problem statements are developed by the Manager of Research and reviewed by the Committee. Each problem statement outlines the nature of the problem requiring research and specific research elements that would be useful to transit managers. The list of R&D priorities and problem statements are then circulated to transit systems, funding agencies and research institutions for their consideration. The objective is to encourage organizations involved in transit research to carry out research on these identified topics.

- Special Workshops on Automatic Vehicle Location (1987): In some cases, CUTA has organized special workshops on specific topics that bring experts together with the prime purpose of identifying and prioritizing research needs in the given area. For example, special workshops have been organized by CUTA on *Automatic Vehicle Location Systems* in 1987, and on *Urban Bus Design Improvement* in 1988.

Exhibit 1 presents CUTA's *1990/1991 List of Priority R&D Needs for the Transit Industry*.

Facilitation of Research

CUTA's identification of research needs and development of research problem statements have considerably stimulated thinking and discussion of transit research topics in the industry. As a result of CUTA's efforts to promote research in these priority areas, several research projects have been conducted over the last few years by various organizations. Exhibit 2 lists the reports produced as a result of these studies and the organizations involved.

Active CUTA support has been given to all of these projects in order to facilitate their conduct and make them as valuable as possible for transit managers. This facilitation has taken various forms:

- participation by CUTA staff on the project committees
- identification of potential project committee members, either experts or transit staff with a keen interest in the topic

- access to CUTA information sources (Library, statistics),
- suggestions of contacts and references, etc.

As well, CUTA staff have participated in several other R&D projects in the areas of expert system applications, microcomputer-based systems, alternative fuels, fare collection systems, prototype service standards, market research, ride-sharing, and privatization. This has helped provide a transit operator perspective into these projects as well as represent National R&D concerns.

Monitoring Transit R&D Activities

Another important aspect is to monitor R&D activity on a regular basis. This serves as an input into the identification of R&D needs, is an important element in the dissemination of research results, and helps to reduce duplication of research efforts.

Since 1984, CUTA has prepared, on an annual basis, a report that inventories current transit R&D activities in Canada. An effort has been made to develop a format that will be useful to transit professionals while keeping the document concise. Entries are categorized by subject, and contain concise project descriptions and key contacts for further information. Exhibit 3 lists the categories used in the 1989 Inventory, and the number of entries per category.

Exhibit 4 provides a sample page from the Inventory to illustrate the format used. This format has proven to be very useful for transit professionals who typically obtain research results directly from prime project contacts via the telephone. Time constraints are generally severe, and this approach allows them to rapidly determine the relevance of the results for their own context.

Dissemination of Research Results

The dissemination of research results has been a major concern for CUTA's R&D Coordination Program. A variety of mechanisms have been used in order to ensure that the research results reach the ultimate users of this research, in this case transit managers and staff. This not only includes the distribution of the R&D Inventory and other reports, but also such activities as:

- ensuring that R&D activities are presented at CUTA Meetings, including dedicated sessions organized by the R&D Coordination Committee
- preparing articles for CUTA's monthly publication, including a periodic column entitled "Innovations in Transit", as well as special feature articles on technological issues
- responding to ad-hoc requests for technical information

- organizing an annual award program, entitled *The Hector Chaput Award for Transit Innovation*, which has served to document R&D activities conducted internally by transit properties; and
- organizing special workshops or conferences on the following topics: Joint Canadian-German Workshop on Transit Technology (Toronto-1986); Automatic Vehicle Location (AVL) Workshop (Winnipeg-1987); Bus Design Improvement Workshop (Montreal-1988); International Conference on AVL Systems (Ottawa-1988); Workshop on Transit R&D Programs (Hamilton-1988); The Impacts of Demographic and Socioeconomic Trends (Toronto-1989); and Developing Strategies to Respond to Demographic and Socioeconomic Trends (Hull-1990)

Communications and Coordination

Finally, CUTA's R&D Coordination Committee brings together on a regular basis representatives from transit systems, government agencies, and organizations involved in research. This is a unique forum within Canada, which has among other accomplishments, brought together for the first time the key government agencies involved in transit research. This has created a new network of contacts which has stimulated discussion of transit research, and reduced the duplication of research efforts by different organizations.

In spite of the highly decentralized institutional framework for transit research in Canada, CUTA has become a central clearinghouse for information and discussions.

III. STRATEGIC TRANSIT RESEARCH PROGRAM

Although the R&D Coordination Program had achieved substantial results in many areas, its impact on the choice, timing, and direction of studies that were actually being initiated was uneven. As a result, CUTA's Board of Directors decided that there was a need for a National Research Program that would ensure that the strategic needs of the transit industry were being addressed.

It was felt that a National partnership to fund such a program had considerable merit, since there are many potential actors who are, or should be, involved in transit R&D including: the Federal government that has a very strong interest in promoting technology development and transfer on a National basis; the Provincial governments that provide operating and capital subsidies to municipalities and conduct various R&D activities; and the transit systems that have the "needs", and will ultimately implement the research results. CUTA is the only organization that brings together all of these R&D partners. Financial participation encourages a more active interest in the projects by transit systems, but the sharing of the cost reduces the financial burden for each participating organization.

After a complex prioritization process six topics were chosen for research under this program:

- An Ergonomic Study of the Driver's Workstation
- The Impacts of Demographic and Socioeconomic Trends on the Future of Urban Transit; and Potential Strategies
- Procurement Requirements and Practices to Ensure the Long-Term Structural Integrity of Urban Buses
- Standardization of Electronic Fare Media
- The Use of Automatic Vehicle Location for Planning and Management Information
- The User's Viewpoint on the Interior Bus Design

These topics were considered "strategic" for the transit industry for several reasons. In some cases, they are likely to have major structural impacts on transit operations and/or related technology in the future. They are also likely to have broad impacts on the industry, affecting most, if not all, transit systems. In fact, several of these projects would lead to the development of uniform specifications. Finally, in the case of at least three of the projects, the timing is such that there is an urgent need to address the underlying choices before individual technological choices preclude the possibility of any nationally coordinated effort.

After discussions with potential funding organizations, the Strategic Transit Research Program (STRP) was approved and launched in late 1989. This two year, \$600,000 program is being funded by a coalition of seventeen organizations, including Transport Canada, the provinces of Ontario, Quebec, Alberta, and British Columbia, and twelve transit systems. Oversight for the program is being provided by a Steering Committee which includes representatives from the participating organizations. Oversight of the actual projects is provided by ad hoc Project Technical Committees.

The objectives of the program, which is well underway, are to:

- conduct research on the six pre-determined strategic research needs over the next two years
- spread widely the financial burden for conducting this research
- actively ensure involvement of all key concerned parties on a National basis during the research, through the means of committee meetings and conference calls, to ensure the highest quality research and the strongest basis for disseminating and implementing any results or recommendations from this research
- provide a high degree of industry control and participation through CUTA management of this research program, and complement CUTA's R&D Coordination Program
- strengthen the Canadian transit industry through a concerted and cooperative coordination effort that will lead in certain areas to the development of standardized specifications for technology.

This research program is well underway and is now in the process of yielding very interesting results.

IV. THREE DILEMMAS AND CONCLUSIONS

Promoting and conducting research in the urban transit industry is a difficult task, and is especially so in Canada's highly decentralized environment. In the course of promoting and organizing transit R&D activities, three specific dilemmas have been identified.

Dilemma One:

The industry focuses more attention on (maintaining) operations, than innovation.

Generally, transit managers are not asked to be innovative by politicians; managers are typically hired for their operational or administrative skills (in contrast with innovative private sector industries). Furthermore, although risk-taking is essential for innovation, there are high costs and low rewards for taking risks in the political public sector environment in which transit operates. Innovation is further hindered by the short-term perspective of the policymaking environment. Finally, managers are given little analytical resources (staff or money) with which to develop innovations.

Dilemma Two:

There is a disparity of perspectives between R&D users (transit systems) and funders or performers of R&D.

Transit managers are primarily interested in solving existing problems. They tend to focus primarily on short-term needs. They are mostly interested in applied research which documents the "best existing practice" (e.g. syntheses) that help them formulate current operational and capital decisions.

Government agencies and researchers are primarily interested in developing new methodologies or new technologies. They tend to focus more attention on longer-term opportunities that move forward the "state-of-the-art" (e.g. basic research or technology development).

The expectations with respect to research that emerge from these two perspectives are not often compatible.

Dilemma Three:

There is an exaggerated emphasis on demonstrations, technological in particular, often to the detriment of research.

Demonstrations of new technologies have considerable appeal to government agencies (and to suppliers), because of their very tangible nature and government agencies' interest in product development. Demonstrations can also serve the needs of individual transit systems, when they believe that the given technology will address a specific problem they face.

Unfortunately, demonstrations often become closed-circuit experiments where only the individual transit system, technology supplier, and funding agency monitor the demonstration and gain expertise from it. Results are rarely widely diffused, especially if significant problems develop. Furthermore, the amount of resources devoted to demonstration projects often reduces the opportunities for industry-wide research on problems; this is unfortunate since this type of research often enables a better matching of needs and technological opportunities.

Conclusion

CUTA believes that the combination of the R&D Coordination and Strategic Research Programs has been an effective comprehensive approach to address these dilemmas. The two-pronged approach of the R&D Coordination and Strategic Research Programs, has helped to create a logical and continuous chain of communications during the entire research process: from the identification of research needs (as seen jointly by transit systems and government agencies), to the carrying out of research, to the dissemination of research results, to the recommendation of needed demonstrations, desirable practice or National technical specifications. It is only through the successful building of such a continuous chain of communications that effective research, technology development, and technology transfer can truly occur.

The challenge remains nonetheless for CUTA and the Canadian transit industry, to determine whether such a comprehensive, and at the same time delicately balanced, approach to transit R&D can be maintained on an ongoing basis.

EXHIBIT 1

THE CANADIAN URBAN TRANSIT ASSOCIATION'S 1990/1991 LIST OF PRIORITY R&D NEEDS FOR THE TRANSIT INDUSTRY

(Research needs that are being addressed by CUTA are indicated.)

Strategic Management

- The Impacts of Demographic and Socioeconomic Trends on the Future of Urban Transit, and Potential Strategies (CUTA-STRP)

- Transit's Role in Environmental Protection (CUTA)
- The Relationship Between Parking Policies and Transit/High Occupancy Vehicle Modes

Marketing

- Marketing Tools and Strategies
- Advertising Techniques
- User Information; Techniques and Systems
- Bus Destination Signs; A Multi-Perspective Assessment of Alternative Technologies

Fares

- Methods for Measuring and Reducing Fare Evasion and Internal Monetary Losses
- Standardization of Electronic Fare Media (CUTA-STRP)

Transit Planning

- Priority Measures and Systems for Transit
- On-Board Passenger Data Collection; A Review of System Requirements, Techniques & Technologies

Human Resources

- Driver Hiring, Testing and Training
- Strategies in Labour Relations

Operations and Maintenance Systems

- Maintenance Management Information Systems
- Automatic Vehicle Location (AVL) Issues:
 - a) Costs and Benefits of AVL Systems
 - b) Use of AVL for Real-Time Service Control
 - c) Use of AVL for Planning and Management Information (CUTA-STRP)
 - d) Use of AVL for Transit Priority
 - e) AVL for Small Transit Properties
 - f) Real-Time vs. Schedule-Based Public Information Systems
 - g) Voice and Data Radio Communication Systems
 - h) Development of a Bus-Stop Information System Using AVL
 - i) Real-Time Systems for Passenger Counting

Equipment

- Standards for Wheelchair Securement/Passenger Restraint Systems for Specialized Transit (CUTA/CSA) Vehicles
- Urban Bus Design Issues:
 - a) Seating/Steering System
 - b) Ergonomic Study of Driver Workstation (CUTA-STRP)
 - c) Re-Design of Other Workstation Components
 - d) Manual of Standardized Design Options

- e) User's Viewpoint on Interior Bus Design (CUTA-STRP)
- f) Improved Climatic Control/Air Quality
- g) Safety Aspects of Urban Buses
- h) Brake Performance
- i) Vehicle Procurement Requirements and Procedures to Ensure Long-Term Structural Integrity (CUTA-STRP)
- j) Corrosion Prevention
- k) Impacts of Health & Environmental Regulations on Bus Assembly and Maintenance
- l) Identification of Electrical System Problems

Abbreviations used:

CUTA-STRP: CUTA's Strategic Transit Research Program

(This 2 year research program is funded by 17 organizations including Transport Canada, the provinces of Ontario, Quebec, Alberta, and British Columbia, and 12 large transit systems.)

CSA: Canadian Standards Association

EXHIBIT 2

STUDIES INITIATED AS A RESULT OF CUTA'S R&D COORDINATION PROGRAM

Fare Strategies and Their Impacts (1987)

Ministry of Transportation of Ontario and the Centre for Transit Improvement

An Evaluation of Vehicle Diagnostic Systems for Buses (1988)

Transport Canada and the Ministry of Transportation of Ontario

National Workshop on Urban Bus Design Improvement; Background Research on Current Problems and Potential Solutions (1988)

Transport Canada and CUTA

Literature Review on Automatic Vehicle Location and Automatic Passenger Information Systems (1988)

Ministère des Transports du Québec

Fare Collection Systems and Equipment (1989)

Transportation Association of Canada (formerly RTAC)

The Role of Transit in the Subdivision Design and Approval Process (1990)

Guide to Transit Considerations in the Subdivision Design and Approval Process (1990)

Transportation Association of Canada (formerly RTAC)

The Use of Automatic Vehicle Location in Small Transit Systems
 (to be published in 1991)
 Ministry of Transportation of Ontario

EXHIBIT 3

CUTA'S 1989 INVENTORY OF TRANSIT RESEARCH AND DEVELOPMENT; TOPIC AREAS AND NUMBER OF ENTRIES PER CATEGORY

Part I. Vehicle Technology

1. Bus Design and Components (23)
2. Alternative Fuels and Energy Conservation (14)
3. Rail Systems (29)

Part II. Information Systems

4. Planning, Passenger Counting and Data Collection Systems (18)
5. Transit Scheduling and Dispatching Systems (11)
6. Systems for Specialized Services for the Disabled (4)
7. Maintenance Information Systems (13)
8. Integrated Operations Systems (9)
 (Including Automatic Vehicle Location Systems)
9. Public Information Systems (15)
10. General Management Systems (7)

Part III. Managerial Techniques and Practice

11. Marketing and Promotions Studies and Demonstrations (19)
12. Pricing and Fare Collection Studies and Demonstrations (6)
13. Service and Operations Planning; Tools and Studies (24)
14. Studies/Demonstrations of Transportation for the Disabled or Paratransit Services (14)
15. Management and Policy Analyses (16)

Note: Numbers in parentheses indicate number of projects in each category. 222 projects in total are described in this inventory.

EXHIBIT 4

CUTA'S 1989 INVENTORY OF TRANSIT RESEARCH AND DEVELOPMENT; A SAMPLE PAGE

"Timeline" User Evaluation Study

To examine the effect of "Timeline", a computerized telephone information system, on passenger riding habits using the ridership diary methodology. Repeated 4 times per year, with 300 Timeline TTC users and 150 non-Timeline riders each time. Ongoing.

TTC (Toronto)

"Busline"; Integrated Automated Transit Information System

To develop for Victoria a PC-based automated system to provide a range of customer service information on transit, including schedule, destinations, trip planning, and fare information. The system uses a telephone location database, computerized transit network, and an electronic schedule interface, and is accessed by patrons through touch-tone telephones.

BC Transit (Victoria)
 Oracle Communications

Computerized Assistance for Telephone Operators Providing Travel Itinerary Information

To assist telephone operators answering user telephone calls to give the best travel itinerary from one point to another, taking into consideration time constraints, bus schedules, and real-time activity on the road. This system will build on the AVL system. Completed.

CTCRO (Hull)

Schedule Trip Planning Information System

To assist telephone information clerks to respond in a more timely fashion through computer-assisted system.

HSR (Hamilton)

Station Platform Warning System

To develop a system that could detect approaching trains and warn waiting patrons. A feasibility study and a technical evaluation were completed in May 1988 and September 1989 respectively. Design of the system is under way.

GO Transit
 Morrison Hersfield

APPENDIX B**PARTICIPANTS**

G. Robert Adams
Michigan Dept. of Transp.
Lansing, Michigan

Stephen Andrle
SG Associates, Inc.
Annandale, Virginia

Scott Baker
VIA Metropolitan Transit
San Antonio, Texas

Kris A. Balch
Otis Elevator
Farmington, Connecticut

Jeff Becker
Tidewater Transp. Comm.
Norfolk, Virginia

Edward Beimborn
Univ. of Wisconsin-Milwaukee
Milwaukee, Wisconsin

Michael Bolton
Ann Arbor Transp. Auth.
Ann Arbor, Michigan

C. David Church
Michigan Dept. of Transp.
Lansing, Michigan

Ann Ciganer
Trimble Navigation Ltd.
Sunnyvale, California

John J. Clark
Montgomery County
Dept. of Transp.
Rockville, Maryland

Susan G. Clark
Clark & Associates
Annandale, Virginia

Joseph M. Clift
P.E.C. Associates
New York, New York

Sally H. Cooper
Virginia Dept. of Transp.
Richmond, Virginia

James Costantino
George Mason University
Fairfax, Virginia

Janet D'Ignazio
Michigan Dept. of Transp.
Lansing, Michigan

Lawrence D. Dahms
MTC San Francisco
Oakland, California

James C. Echols
Tidewater Regional Transit
Norfolk, Virginia

Lawrence Fabian
Trans 21
Boston, Massachusetts

Phillip Gary, Jr.
Grtr. Cleveland
Reg. Transp. Auth.
Cleveland, Ohio

Thomas D. Gillespie
The University of Michigan
Ann Arbor, Michigan

Lisa M. Glover
Detroit Dept. of Transp.
Detroit, Michigan

Robert J. Good
AEG Westinghouse
Transp. Systems
Pittsburgh, Pennsylvania

Campbell Graeub
Transportation Research Board
Washington, D.C.

Benita H. Gray
Consultant
Daly City, California

George E. Gray
CALTRANS
Daly City, California

Gerald T. Haugh
SamTrans
Burlingame, California

Brendon Hemily
Canadian Urban Transp. Assn.
Toronto, Ontario
Canada

Wendy J. Hoyt
The Hoyt Company
Sacramento, California

Jerry Keiffer
Advanced Transit Association
Fairfax, Virginia

Michael A. Kemp
Charles River Associates
Boston, Massachusetts

Pamela Kincaid
Trimble Navigation Ltd.
Sunnyvale, California

Rollie King
Battelle Columbus Division
Columbus, Ohio

Roy Kohler
Minister of Transp.
& Pub. Works
The Netherlands

Robert J. Landgraf
Consultant
Shaker Heights, Ohio

Roy Lave
Systan, Inc.
Los Altos, California

Ronald Leckie
Hughes Aircraft Company
Fullerton, California

Littleton C. Macdorman
MacDorman & Associates
McLean, Virginia

Joel Markowitz
Metro Transit Commission
Oakland, California

Leo F. Marshall
New York City Transit Auth.
Brooklyn, New York

Albert A. Martin
Suburban Mobility Authority
for Regional Transportation
Detroit, Michigan

Tom McGean
Thomas J. McGean, P.E.
Annandale, Virginia

Patricia V. McLaughlin
Los Angeles County
Transp. Comm.
Los Angeles, California

Roland M. Mross
Urban Mass Transp. Admin.
Washington, D.C.

Robert A. Olmsted
Retired
Jackson Heights, New York

Lynn Ritter Otte
Regional Transportation Auth.
Chicago, Illinois

James D. Palmer
George Mason University
Fairfax, Virginia

John S. Pavlovich
Edwards & Kelcey, Inc.
Livingston, New Jersey

Pat Piras
Piras Consulting
San Lorenzo, California

Lee H. Rogers
Sur Coester Aeromovel
Temple Hills, Maryland

John Sajovec
Suburban Mobility Authority
for Regional Transportation
Detroit, Michigan

Glenn Salpaka
Electro-Moutiue Division,
G.M.C.
LaGrange, Illinois

Robert E. Schmelz
Gannett Fleming, Inc.
Harrisburg, Pennsylvania

Lawrence Schulman
Urban Mass Trans. Admin.
Washington, D.C.

Steven Silkunas
SEPTA
Philadelphia, Pennsylvania

George M. Smerk
Inst. for Urban Transportation
Bloomington, Indiana

Albert J. Sobey
Bloomfield Hill, Michigan

Frank Spielberg
SG Associates, Inc.
Annandale, Virginia

Robert J. Summersell
Otis Elevator Company
Farmington, Connecticut

Michael S. Venter
Otis Elevator Company
Farmington, Connecticut

Bill S. Vickrey
Columbia University
New York, New York

Don Williamson
Conrad & Gargett Pty Ltd.
Australia

Nigel H.M. Wilson
Massachusetts Institute of Tech.
Arlington, Massachusetts

Linda Zemotel
Consultant
St. Cloud, Minnesota