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Transportation Data Needs: Programs for a New Era

Proceedings of a Conference

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TRANSPORTATION DATA NEEDS: PROGRAMS FOR A NEW ERA

IMPLICATIONS FOR STATE DOTs AND MPOs

Proceedings of a Conference

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INTRODUCTION

This document reports on a conference held in Irvine, California in May of 1992 called "Transportation Data Needs: Programs for a New Era—Implications for State DOTs and MPOs." This conference was sponsored by the TRB Committee on Transportation Data and Information Systems, Federal Highway Administration, and Federal Transit Administration.

The last major conference related to transportation data needs was held in October 1989. The challenges envisioned for the 1990s at that time included highway safety, congestion, and mobility planning. Institutional forms for meeting the planning needs was of major interest. Three workshops--urban, statewide, and national--provided recommendations related to data.

For urban areas, the recommendations included: reinstituting previously mandated continuing processes for monitoring and reporting trends; supporting the production of the special census journey-to-work package; encouraging collateral collection activities to complement the census; development of a congestion-monitoring data set; and a condition and performance monitoring capability for transit, akin to Highway Performance Monitoring System (HPMS).

For statewide planning, conclusions and recommendations included: greater coordination between data bases (e.g., pavement management, HPMS); better truck related data collection procedures; better data for intermodal planning; inclusion of performance and level of service (LOS) data in HPMS; a set-aside of at least two percent of federal transportation funds for transportation planning and research; and a review of management strategies for data collection.

For national data, conclusions and recommendations were: development of uniform measures of congestion; several improvements to HPMS (trip length, functional classification, sub-area geography; expansion of the Section 15 transit data base to obtain condition data on fixed plant; development of aggregate measures of local road needs; need for collection of data on longer trips; and collection of commodity O/D data.

The 1989 conference recognized many of the needs and issues related to data which were considered when developing the new highway legislation. Since that time, there has been a major refocusing on planning requirements and the data needed to support planning resulting from the Clean Air Act Amendments (CAAA) of 1990 and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The requirements of this legislation demand a rethinking of the traditional approaches to planning and the required supporting data. The traditional models and forecasting procedures may no longer be accurate enough, and may not provide the appropriate feedback between land use and travel demand forecasts. New data are required to support the new emphasis on intermodal planning and the ISTEA requirements the development and maintenance of management systems related to highway pavement, bridges, safety, congestion, public transportation facilities and equipment, and intermodal facilities and systems.

The new requirements have resulted in data collection management challenges in the areas of quality control, effective use of limited resources, use of technology, effective use of sampling and statistical analysis, and staffing issues.

Because of the importance of the data issues and the need of the profession for guidance, this national conference was organized to bring together transportation professionals from federal, state, and local planning groups, as well as academicians, consultants, and researchers to generate and present ideas that would help develop positive and productive data programs which are cost effective and will support the new demands of decision makers.

The anticipated result of the conference was guidance to states and MPOs in developing their work programs for upcoming years. Such programs will take into account the new requirements of the ISTEA of 1991 and the CAAA.

There were four panels with presentations and discussion on the first day. The panels were on issues and implications for data and collection procedures in the following four areas: the environment; management systems; transportation policy, finance, and evaluation; and land use, economic development, and growth management. On the second day there were four concurrent workshops organized in the four areas described.

About one hundred professionals participated in the conference and applied considerable energy and knowledge in the development of recommendations related to the data needed for this new era in transportation.

Arthur B. Sosslau
Chairman, Committee on Transportation Data and Information Systems

SUMMARY AND CONCLUSIONS

Presentation of Conference Findings

The Development of State and MPO Work Programs

George V. Wickstrom, Consultant, and Neil J. Pedersen, Maryland Department of Transportation

George V. Wickstrom

The main purpose of collecting data is to support the decision-making process. The complexity of the planning/decision-making process is evidenced by the multiplicity of characteristics that require attention and integration in the process, such as:

- Multiple Issues—in the past, it was very much a single issue of focus; today it is a range of issues that must be addressed.
- Multiple Options—current practice dictates dealing with many different options simultaneously, TSM, TDM, HOV lanes, freeways, transit, etc.
- Time Scales—no longer planning for just a 20-year horizon as much more attention is being given to the short range.
- Process is Cyclic—it is no longer a linear process. It used to be four steps; land use, trip assignments, analysis, and results. The process now has to take into account the impacts of facilities on land use, on accessibility, and further deal with feedback loops in the process.
- Focus is on Change—but many areas are reasonably stable. The question is do we need a complex data information system for areas that are not changing? Does the same scale of analysis apply to new facilities and old?
- Level of Detail—the process must deal with more strata and detail which places tremendous demands on the data collection process and in the planning/decision-making process. Indices and methods of presenting information to the lay person that are understandable must be developed.
- Participation—the process can be characterized as dealing with different and diverse viewpoints. It is not only the geographical area of impact, but also the people impacted by transportation decisions. Attention must be given to the users/consumers of the systems. The process must satisfy a lot of people, citizens, businesspeople, politicians, executives. There are many decision makers, requiring that one anticipate the data needs that will satisfy all of the decision makers. It is essential to agree on the inputs to a planning/decision-making process and the outputs.

The basic elements in a planning/decision-making process consist of the "old" measures and the "new" measures. The "old" measures are demand, supply, and system performance. The "new" measures include, access and mobility, impacts and the quality of life, costs and trade-offs, and financing and values. The same basic data items can be used for many elements of a planning decision-making process.

The data needs to be organized such that the geography maintained on the basic records are satisfactory for an EIS evaluation. In many cases, too much work and too many decisions were based on routes that will never be built because of wetlands or other environmental issues.

- Research—the issue of sample size is important. What is the benefit-cost of more data items and more accurate data? With a finite amount of resources, how much should be allocated to a data program?

  The issue of new and emerging technology also needs to be addressed. The issues of remote sensing, AVI, the use of secondary source data often lack a user-friendly organizational structure of data. There needs to be further use and evaluation of secondary source data, such as Census, land use, private sector data, environmental data, and GIS systems.

Neil J. Pedersen

It is key in terms of conclusions of this conference to note that the major purpose of planning is to provide the decision maker with the information that is needed to make good program decisions.

An important element of both the Clean Air Act and ISTEA is that the institutional environment for decision-making is changing at the state and metropolitan level. One important element to consider is who are those decision makers? To whom are we providing the information for decisions to ultimately be made?

If decision makers are the major consumers of the

planning process, transportation planners must recognize that:

- There is a need to find effective approaches in determining the specific data needs of decision makers.

- The nature of decisions has changed. Trade-off analysis must be made that cross the modes including operational decisions versus capital decisions. Decisions are not strictly transportation decisions, they must be made within a quality of life context and considering both social costs and benefits. Planners must be reeducated to listen to those that are served and to work to satisfy their informational needs. This relates to the issue of total quality management—listening to your customer, find out what their needs are, and adapt your processes and systems to meet those needs.

- Communication skills are very important. Planners must learn to more effectively communicate data so that it is more useful to the customers.

A need exists to develop a comprehensive data collection and analysis plan that includes:

- Zero-based approach to looking at our data collection/analysis plan to determine if all of the data collected and analysis done is necessary? Are there more efficient ways of operating this effort?

- The data collection and analysis should be customer driven and extend beyond a single year. A longer range program is needed so that each year's program is established and evaluated in the context of a five- to six- year program.

- Identification of resources, and more importantly, the opportunities in addressing interagency coordination and duplication of effort. Significant to note is that the steering committee that structured the conference felt it would be possible to identify separate work programs for state DOTs and MPOs. However, each workshop independently reached the conclusion that you can not clearly differentiate between a state DOT work program and a MPO work program; they really need to be done in a cooperative partnership manner.

This cooperative partnership effort should include:

- A jointly-developed work program.

- Communication between state, MPO, and local governmental staffs about the types of data that each is collecting and on what frequency.

- A flexible work program that would recognize the agencies staff capability, institutional arrangements, and pressures of other work. Some agencies that have flexible staff ceilings can hire at a given time in order to achieve short term goals. Consideration should be given to capabilities of various state DOTs and MPOs. States also need the flexibility to allocate staff among various projects.

The new ISTEA of 1991 gives the states and MPOs no choice but to work in a cooperative mode with joint authority. This law is structured so that cooperation must be achieved.

There is a definite need to address precision and accuracy requirements. Issues will be driven by the requirements of the federal officials in U.S. DOT and EPA. There will be a need to invest time and energy in educating officials about these issues.

The data collection management challenges are in the area of:

- Quality control;
- Effective use of limited resources;
- Use of technology;
- Effective use of sampling and statistical analysis; and
- Staffing issues.

It is difficult to determine how the states and MPOs can possibly collect all the data that is required by law. It will be necessary to develop improved systems for managing and processing data. One of the serious management problems will be how a state can staff the projects with current reduction-in-force programs currently in operation in many states. Training, by necessity, will be a long-term investment. The use of high tech equipment issues will dominate the decision process as a strategy to cut personnel costs.

The analysis challenges are:

- Transportation Planning Models—the current transportation planning model set does not deal

with the problems that are being asked by the policy makers. How does the profession acquire a set of new procedures?

- Perceived Data Needs—satisfying the policy makers with the proper data will be very difficult. The problem is, "How should the analyst address the data needs of the customer and keep the costs within reason."

- New Data Requirements—what are the new types of information that will be required to respond to the needs of the customers?

- Staff Experience—considering the fact that many valuable staff analysts have been lost to the profession over the last ten years, there are significant issues of current staff training and skills development.

- Manual of Procedures—need to develop guidance and procedures manuals.

- Training—training requirements; provide training courses; develop course structure, outlines and details.

- Information Sharing Systems—establish an information sharing system that will allow the states and MPOs to communicate with each other with either newsletters or experience-based papers. Under the current system, experience shared through papers lack timeliness because of the significant time between the writing of the papers and having them made available to others. The most significant value derived from a conference like this is in the area of information sharing.

It was generally agreed that it was a successful conference, because it made the participants think about the complex task of designing data programs for their states and MPOs.

The real measure of success is what the participants do when they arrive back at their jobs. This will be answered at the next conference.

Overall, it was concluded that states and MPOs will be looking to the federal government for further guidance.

CONFERENCE RESEARCH RECOMMENDATIONS

Arthur B. Sosslau
COMSIS Corporation

As part of the workshop activities and discussion at the concluding session of the conference, a number of recommendations were made regarding research needs related to data and collection activities. The recommendations are listed in three primary areas:

Analysis, Models, and Measurements

- Enhance the predictive ability of models and procedures to meet current requirements for planning based on air quality requirements and provisions of the ISTEA of 1991. Determine reasonable accuracy and precision levels of the data needed to apply the models in a cost-effective manner within the limits of current "best" practices.

- Quantify the impact of incidents (breakdowns, accidents, etc.) which cause a substantial amount of highway delay. Determine the factors that are common amongst the various random incidents in the past as a first attempt to predict the magnitude of future incidents.

- Determine the performance measures that portray the quality of life aspects of the transportation system. An example might be the ability of inner city people to travel to the suburbs for employment. Transportation should provide equal access to opportunities for all citizens.

- Develop a nationally coordinated approach to ascertain the degree of change in the performance of the network that could be expected from various levels of success of the various traffic demand management techniques being advocated.

Surveys and Data Collections

- Develop more cost-effective data collection methods that provide a greater accuracy as

required by the new requirements of the CAAA of 1990 and the ISTEA of 1991. A good example is urban vehicle counting and vehicle classification on high volume congested facilities.

- Determine the type and amount of goods movement data required for appropriate analytical and planning purposes, and develop the appropriate data collection methods to obtain data that can be used for analyzing the movement. The area of goods movement measurement has been a problem area for some time and currently requires priority attention.

- Research is required to define the data needs and methodologies of collecting data for intermodal planning purposes as recently highlighted in the ISTEA of 1991.

- An initiative is required to promote consistency in various data collection efforts and provide replicable information from multiple sources such as the federal efforts with the Census and NPTS data, MPO data with local travel survey, and state data with counts and classification.

- Research is needed to determine the measurements and analysis required to determine the land use impacts and changes resulting from increasing facility capacity and reducing travel time in a corridor.

- Identify the types and amounts of data needed to determine with a reasonable degree of certainty the degree of impact of various transportation control measures.

Education, Training and Technical Assistance

- Consideration should be given to developing a new set of manuals that were previously developed in the 1950s by the National Committee on Urban Transportation, and in the 1970s by the Highway Users Federation "The Planning Process for Smaller Cities." These manuals provided considerable guidance to the professionals of the time, especially with regard to data and collection methods. This material would provide the best practices with regard to data collection.

- State and MPO work programs should be widely distributed which would provide useful information to agencies to upgrade their own activities. These work programs could be collated by subject and would be a resource for others in the development of their own programs of work.

- Training courses should be developed to provide agency personnel with the current state-of-the-art in survey design, collection, and analyses methods. These courses should be developed in the various media available and should be made available for various audiences in a variety of ways.

- A national conference should be undertaken by the Transportation Research Board every other year in which various state and MPO staffs could highlight their procedures for collecting different types of data. This conference would be developed by the states and MPOs jointly and would illustrate the latest methods and procedures used in their data collection program.

KEYNOTE PAPER
DATA, DATA, AND MORE DATA: THE FOUNDATION TO PERFORMANCE-BASED PLANNING

Michael D. Meyer, Georgia Institute of Technology

"Without a store of basic data, urban transportation problems cannot be accurately defined or measured. Without facts, it is hard to determine the potential solutions; it is even more difficult to select the most practical ones. Moreover, it is virtually impossible to present to legislative bodies and to the general public a clear picture of needs--or to create public understanding of the benefits that will accrue from improvements."

— National Committee on Urban Transportation, Better Transportation For Your City, 1958

How little things have changed over the past 34 years. Just as engineers and planners at the beginning of the highway construction era in this country argued for a decision-making process based on fact, so too we, 34 years later, have gathered to argue for better and higher quality data to support the transportation decisions that must be made over the next several decades. And yet, a great deal has changed since 1958. Certainly, the technology of transportation planning (for example, the widespread use of the microcomputer) provides data handling capabilities that the planners and engineers in 1958 could only dream of. We presumably know more about the fundamental characteristics of transportation systems and their relationships to the such things as the economy, natural environment, and travel behavior. And importantly, the types of decisions that must be made

are very different than those facing decision makers 34 years ago. It is this last point that I want to use as a theme throughout my remarks. I have for many years argued that a major purpose (if not the major purpose) of planning is to inform the decision-making process. If you accept this, then an excellent point of departure for any discussion on data and on the changing needs of data collection will be to first look at what types of decisions, and what types of decision-making processes, will likely occur over the next several years. I will do this in the first half of my discussion. The second half of my presentation will focus on some key data challenges and opportunities that will present themselves to planners and engineers over the next decade. If these challenges and opportunities can be met, transportation planning ten years hence will be a much more effective and important part of decisionmaking. Hopefully, this conference will be an excellent starting point for accomplishing just that.

THE CHANGING DECISION-MAKING ENVIRONMENT

The form and substance of transportation planning is very much influenced by the political and institutional environment within which it occurs. It is not surprising then that the evolution of transportation planning and thus of the types of data that needed to be collected reflects the changes occurring in this environment. Clearly, goals, decision-making processes, available resources, and political commitment and leadership will vary from one community to the next.

Instead of deciding on massive new facility construction (which was the decision-making context for Better Transportation For Your City), many decisions will now be oriented toward improving the performance or lessening the impacts of the existing transportation system. I call this *performance-based planning*. One of the most important characteristics of such planning is that it is based on a comprehensive and high quality data base.

A simple look at the recent Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and the Clean Air Act Amendments (CAAA) of 1990 shows how the decision-making, and thus the planning, environment has changed. Not only did the ISTEA mark the end of the Interstate Highway program begun in 1956, but it greatly loosened the institutional, financial, and thus political, framework within which decisions on transportation investment had been made over the past 40 years. Over $150 billion was provided by Congress to carry on the important work of building, operating and maintaining the transportation infrastructure so critical to the U.S. economy and the quality of American life. Of this sum, significant amounts were allocated to support mass transit, to fund actions that will improve air quality and enhance the environment surrounding transportation facilities, and to provide seed money for research and demonstration of advanced technology applications to the transportation system. More importantly, however, the ISTEA established a new program structure for investing transportation dollars.

Where federal funds once had to be spent only on projects that were eligible in specific program categories, now many of the funds can be used for any transportation project. Where the federal program was once designed to provide uniformity of transportation investment from one state to the next, a necessity for a program like the Interstate Highway System, the ISTEA now encourages states and localities to seek solutions to transportation problems appropriate to their needs and desires. Where the federal program historically emphasized transportation investment as an end in itself, the ISTEA provides transportation funds to meet other societal goals, thus viewing transportation as a means of achieving some greater aim. Where the federal program separated transportation investment into highway and transit pots of money, the ISTEA now encourages transportation decisions that are undertaken from a multimodal perspective (known in Washington, DC as "flexibility"). Lastly, the federal program once emphasized the construction of new facilities, now the ISTEA encourages better management and operational improvements of existing facilities with such things as incident management programs and the application of advanced technologies.

The Clean Air Act Amendments also provide a strong basis for a changing transportation planning focus in those metropolitan areas in non-attainment of air quality goals. There has been a long history of linkage between transportation planning/decision-making and air quality planning. However, never before has Congress made the linkage stronger. Certainly, the transportation portions of the CAAA will greatly influence the focus and scope of many transportation decisions during the next decade. With a stringent schedule of anticipated emission reductions from stationary and mobile source controls, a significant number of areas will have to consider, and possibly implement, transportation control measures (TCMs) to demonstrate attainment. In addition, because of concerns about both attainment and maintenance, Congress has supplemented or reinforced the SIP revision process with specific requirements for non-attainment areas to periodically assess and mitigate on a continuing basis increases in VMT, congestion, and vehicle trips.

Importantly, the CAAA reflects Congress's concern with past and anticipated growth in VMT and congestion as a primary cause of non-attainment. Congress viewed past failures to accurately predict/monitor these travel indicators as a main reason for overly optimistic attainment demonstrations following the 1970 and 1977 Clean Air Act Amendments. Regular determinations that transportation plans, programs, and projects conform to the state implementation plan (SIP), and this means a lot of data collection, could be the greatest cause of change to how transportation agencies conduct their business.

A simple example of the new decision-making context for transportation illustrates the challenges facing the transportation planning profession. I was reading a newspaper from one of our larger cities and came across an article that described a major transportation decision that was facing the region. The transit agency, strapped for funds, was going to ask the MPO to adopt the flexible approach to resource allocation that was inherent in ISTEA and approve the use of $6 million of Surface Transportation Program (STP) funds to retrofit its buses with wheelchair lifts. It seems the state department of transportation had been counting on these funds to construct and improve the area's road system, and had warned local officials that such a use of funds would reduce the number of road projects in the region. What data are necessary to provide local officials with some sense of trade-offs associated with such decisions? Do we even have the technical methodology to analyze such trade-offs? Or do we simply throw our hands in the air and say that such decisions are political and thus it is useless to attempt a trade-off analysis? My guess is that more and more metropolitan areas are going to face such decisions in the very near future.

CHALLENGES/OPPORTUNITIES FOR TRANSPORTATION PLANNING

There are many challenges/opportunities that face the transportation planning profession over the next decade, and which should guide your discussions over the next several days.

Decision-Making Flexibility

It has been estimated that if state and local officials chose to do so, $103 billion of the $151 billion provided by ISTEA could be spent on transit. How will the decision of how to spend federal dollars be made in our metropolitan areas? What criteria will be used to determine the trade-offs between different transportation alternatives? What data are necessary to support these types of decisions? It seems to me that what we need to support this type of decision-making is a set of criteria that is generic enough that will allow some sense of cost effectiveness across the options being considered. This will not be easy. In the above wheelchair lift example, it is hard to develop a measure of benefit for bus retrofit (cost per non-ambulatory person served) that is easily compared to benefits associated with road improvements (usually time savings, lives saved, and reductions in vehicle operating costs). And yet, a way of doing just that is needed.

Multimodal Transportation Planning

This requires, for the first time, that state departments of transportation develop a statewide multimodal transportation plan. These plans are not simply to be a document which examines highway, transit, rail, aviation, and port issues separately, but rather a process and a plan that looks at transportation as an integrated system, related to multiple societal goals, and, in particular, emphasizing efficient and productive people and goods transfer from one mode to another. This requirement will be a particular challenge to those states which have traditionally emphasized highway planning at the expense of other modes. This multimodal planning approach could, and probably should, characterize planning at other levels of application.

The implications for data collection are similar to those described above for decision-making flexibility—the data needed relates directly to the types of evaluation criteria that are in place. In those cases where the types of projects under consideration are trying to serve the same function, such criteria are not difficult to envision. For example, in a corridor analysis, the impact of a highway widening project versus an HOV lane versus a strong incident management program versus light rail could all be evaluated with criteria such as time savings for targeted markets, impacts on existing freeway users, air quality changes, etc.

Management Systems

The ISTEA requires state departments of transportation to develop management systems in six areas: congestion, pavements, bridges, safety, intermodal activities, and public transit. It is too soon to say what many of these systems will look like. However, Congress is clearly telling transportation officials to develop the capability to better manage the transportation facilities and systems that currently exist. For congestion management systems, this will likely entail the consideration and implementation of regional

incident management programs, coordinated traffic signal control systems, preferential lanes and/or other incentives for multioccupant vehicles, and the like. For many highway agencies that have reputations for high quality freeway construction, the question becomes can they also become leaders in managing the road system that they have so effectively constructed? An obvious challenge for all of these management systems is to provide an overall framework in which they preferably are all part of the same system, but at a minimum all coordinated.

With respect to data base management, the required management systems provide a unique opportunity to develop a coordinated and common data base for all of the transportation decisions to be made in a metropolitan area, as well as serving the reporting functions that will be required from the federal government. There is little doubt that data requirements for each management system will vary, with some data items (e.g., volumes) common to all systems and others (e.g., pavement conditions) specific to one. The coordination among the management systems can be provided by an overarching management system, or the coordination could be achieved through a common database. Of particular importance in this regard is the use of geographic information systems. The "layering" of data in such systems will allow a common data base to be developed around a common base map which will allow the user to locate the specific facility or part of facility that is of interest, and to also define the attributes associated with these facilities. I would strongly urge MPO and state DOT planners/engineers to consider the use of GIS in developing their management systems.

Performance-Based Planning

The ISTEA and CAAA provide an impetus for state and metropolitan agencies to establish more systematic approaches to managing system performance. The management systems that are required by ISTEA are inherently a performance-based approach to decision-making. A key issue for metropolitan planning organizations and state transportation agencies over the next several years will be the development of comprehensive strategies for the collection and analysis of system performance data. One note of caution. Transportation planners and engineers tend to focus on performance of the transportation system, certainty something that is definable and measurable. I suspect that political decision makers will not respond well to single indices of system performance, but rather will be much more interested in metropolitan or regional indices of economic performance, or quality of life measures, or other important variables to political leaders. Instead of transportation system indicators, perhaps we should be looking at much broader social and economic well-being indicators within which transportation plays a role.

Goods Movement

The requirement for an intermodal facility management system underscores the importance that goods movement should play in transportation planning. Although this management system is not focused exclusively on goods movement, certainly one of its major emphasis areas will be on the interchange of freight from one mode to another. This is one of those topics that only a few states and metropolitan areas have spent much time in investigating, and yet freight movers are major customers of the transportation system. The intermodal facility management system will likely be the most difficult one to develop because of very little understanding of what "intermodal" means and of the types of data that are necessary to collect. Clearly, however, the most important purpose of this management system, as it is with the other systems, is to provide information to those allocating resources where the most cost effective investments will be in improving goods movement and passenger interchanges.

New Techniques for Collecting Data

We need to be "smarter" about collecting data. One of more intriguing experiments in this area is the ADVANCE demonstration in Chicago where instrumented vehicles themselves will be used as traffic probes to provide real time monitoring of system conditions. With the many opportunities that IVHS will provide for enhanced vehicle guidance and information, why not also look carefully at how such technologies can be used for the collection of data that might be useful for transportation planning purposes.

Another area in the technology of data collection merits some attention. Transportation agencies are not unfamiliar with remote sensing technologies. Traditional air photos have been used in the planning and engineering of transportation facilities for well over fifty years. Over the past 20 years, however, the use of satellites for remote sensing has expanded dramatically, although much of this use was in the natural resources planning area. Newer remote sensing technologies have increased both the spatial and spectral resolution over that of their predecessors. Today, we have the ability to integrate and use remotely sensed digital data that only a few years ago was impossible. I can imagine in the not

too distant future the widespread use of such technology for urban growth pattern modeling, environmental assessment along transportation corridors, and area-wide traffic volume counts.

Coordinated Data Collection and Use

Because the effectiveness of planning and, thus hopefully of decision making, depends so strongly on the existence of a good data base, designing a data collection and management plan for an urban area becomes an important task in transportation planning. Indeed, I would argue, just as our predecessors did in 1958, that you really cannot make good decisions without the facts. Therefore, I would recommend that just as the transportation improvement program (TIP) outlines the projects, agency responsibilities, funding sources, and timing of the key projects in a region, so too should there be a data improvement program (DIP). This program would provide a schedule of data collection activities over a specified period, identify likely unmet data needs, establish priorities among these needs, determine the level of resources to be devoted to each of these needs, and estimate the cost of the data collection efforts on an annual basis. Of great importance in this exercise would be the required interagency and intergovernmental coordination that would be required for such a program to be successfully implemented.

Before ending, I would like to add a personal note. I have been a participant and observer of transportation planning over the past 18 years. I have held positions where I was the producer of information for decision makers and also held positions where I was the end user of information produced by the planning process. I have participated in several expert review panels for transit investment where billions of dollars worth of public funds were going to be spent on systems or facilities for which the data base and planning tools were totally inadequate to answer some of the most basic questions. I have participated in debates over system performance monitoring (primarily for air quality purposes) where the level of precision and accuracy of data collection demanded by some far out-stretched even the best capabilities in the country. I worry that many of our public policies and subsequent policy requirements have gone far beyond the data base and technical modeling capabilities that exist in our profession. There is little doubt in my mind that we are about to play a catch-up game, due in part to many years of neglect and limited resources. However, I hope that our profession, and this conference, goes beyond simply looking at what is necessary to support the decisions of today. Because if we do, my fear is that once we finally have in place the data base and analysis methods that are needed for today, the decision-making environment will have changed again. In all of our discussions, the importance of data and of the analytical we need to provide some strategic perspective on capability it supports. Will they be useful 10 years from now? 20 years from now? 50 years from now? I know the answers to these questions are not easily forthcoming. However, by simply asking them, we might be able to put in place a data base that truly can support the decision-making process of the 21st century.

PANEL ON ENVIRONMENTAL ISSUES AND IMPLICATIONS FOR DATA COLLECTION PROCEDURES

Gary Hawthorn, Gary Hawthorn Associates, Ltd., moderator

OPENING COMMENTS

Gary Hawthorn

The Clean Air Act Amendment (CAAA), in advance of ISTEA, first spotlighted concerns about the adequacy of existing analytical tools and data needed to carry out the clean air requirements.

A NARC conference in November 1991 focused on these concerns, emphasizing data problems as major obstacles to improved emission estimates--in particular: no data, data of uncertain quality/precision, bad data, and the expense/time to collect new data.

In an eye-opening/overwhelming exercise, a workshop at that NARC conference demonstrated the wide range of data needed to determine accurately the emission reductions resulting from employer trip reduction programs. (The CAAA specifies only that required employer programs achieve a 25% increase in AVO above the area-wide average--which, if achieved, reveals little about the emission reductions from such programs.)

Compatibility and cultural gaps exist between transportation and air quality professionals and their data/models. Accuracy needs are also significantly different.

Sometimes the data in hand may not represent the truth. Employer trip reduction plans, submitted in response to Regulation XV, may feature preferential parking as a major incentive for carpoolers. But a site

visit to the parking lot may reveal that the preferential space is only 15 feet closer to the plant entrance--not really much of a mode-switching incentive.

TRANSPORTATION DATA IMPLICATIONS OF THE CLEAN AIR ACT OF 1990

John H. Suhrbier, Cambridge Systematics, Inc. and
Greig Harvey, Deakin, Harvey, Skabordonis, Inc.

NOTE: Attachment 1 is a longer version of Suhrbier's conference presentation and represents the main resource paper for this session. During the Conference Suhrbier presented overheads (Attachment 2) on:

- CAAA Transportation Analytical Requirements (emissions inventory, VMT projections, measures of effectiveness, employer trip reduction programs, emissions from VMT/vehicle trip growth, VMT/congestion, monitoring etc.).
- Conformity (required consistency between SIP mobile source emissions estimates and emissions from transportation plans/TIPs) .
- Section 108(f) Transportation Control Measures.
- Key Vehicle Emission Variables (emphasizing trips/trip end emissions rather than trip length and vehicle operating characteristics).
- CO Speed/Emission relationships (showing higher emissions at speeds above 45 mph).
- CAAA/ISTEA/Development Issues Requiring Enhanced Modeling.
- "States" of Transportation Practice (Need to move from state-of-the-practice to best practice to state-of-the-art, with continuing research advances pushing the state-of-the-art).
- Next Generation of Travel Demand Forecasting (wider range of policy sensitivity, feedback loops in modeling steps, GIS integration, forecasts based on disaggregate households/marketing surveys vs. zonal approach, more customizing of models and post-processing techniques, trip-based emissions vs. link/traffic volume-based).

In addition to the overheads, Suhrbier emphasized that: (1) the CAAA creates very significant analytical requirements that state DOTs and MPOs are not now well prepared to meet, (2) while not all of the CAAA and EPA objectives will be met, data/modeling improvements must occur--partially because of threatened/actual litigation, and (3) many ISTEA objectives/provisions reinforce the data/analytical demands of the CAAA.

Greig Harvey made the following points:

DATA NEEDS

- Demographics—smaller/variable zone systems, GIS-based, wider range of data (e.g., employment categories, housing/rental prices, crime rates).
- Networks—greater detail (down to arterials because emissions are estimated for the entire network), consistent with zone system scale, GIS-based, reflect economies of scale).
- Facility Performance—need improved speed/flow relationships, validation data.
- Conventional Home Interview Data—needed for model development/refinement, detailed spatial emissions analyses (in San Diego, such data revealed orders of magnitude differences in emissions projections).
- License plate surveys/cordon counts—for off-model flows.
- Longitudinal surveys/panels—to evaluate response to TCMs and land use dynamics.

SAMPLING OF CAAA/ISTEA ANALYSIS NEEDS

- Better information on real world conditions of the transportation system (actual flows/speeds by time of day) and precursors of travel (demographic/socioeconomic data).
- Accurate modeling/forecasting of the genesis of vehicle trips, including: trip generation by related land use, trip distribution, mode choice, and time of day.
- Accurate modeling of network travel flows.
- Improved understanding of travel patterns/traveler response to changes in service, price, and land use.

CONFERENCE PARTICIPANTS SHOULD AIM TO

- Prioritize, stage, and schedule data activities because of danger of spending all funds on what is immediate, familiar, and understood.
- Identify opportunities for synergy, research economies of scale, cooperative efforts, parceling out pieces of problems, and applying new technologies.
- Decide important data activities to continue and those which should be eliminated or redirected because of inadequate funds to do everything.

OTHER ENVIRONMENTAL REQUIREMENTS

Neil J. Pedersen, Maryland Department of Transportation

INTRODUCTION

The panel's focus so far has been on air quality, but there are many other environmental issues that are key for planning decisions that all of us are involved in making.

I've called these other environmental issues the forgotten element of transportation systems planning. I'll explain why and also explain why we can't afford to forget these issues. Some of these issues are ultimately critical in determining whether projects in our plans are implemented.

Some of the issues that I'm going to talk about have been really the key factors in terms of fundamental decisions that have been made regarding transportation planning over the past 34 years since 1958. Yet, when the systems planning was done, these issues often weren't taken into account. And because they weren't, we did not make the best transportation planning decisions.

If these issues were not taken into account, why not? Data/information are not available. And it's too costly or burdensome to compile the data/information. Also, the people responsible for compiling or presenting the information aren't always aware of the information being available. Or they don't even care about the significance of the issues--and that may be the biggest problem. Finally, the expertise isn't always available to compile, analyze, or interpret data within the organizations responsible for doing systems planning.

TYPICAL SYSTEMS PLANNING CONSIDERATIONS

Systems Planning Defined

What do I mean by systems planning? Generally, it's the planning that goes into development of long-range plans, by MPOs and state DOTs. Certainly both organizations emphasize in the long-range plan and transportation improvement program (TIP), the fundamental capital program.

Travel Demand

We spend lots of money on travel demand projections and we're going to spend lots more, as you've heard, particularly to meet clean air requirements. We end up comparing projected demand to capacity. We identify deficiencies in capacity and alternatives to address those capacity deficiencies.

Level of Service (LOS)

Ultimately, we try to measure our success through LOS measures. Many different, very sophisticated LOS measures have been developed by your different organizations.

Cost

Usually, cost is a major factor in evaluating alternatives, although we haven't done a very good job of projecting costs, particularly at the systems planning level. Many fundamental decisions--made late in the process of putting together our five-year capital programs--are based on poor cost estimates. Consequently, we make bad systems planning decisions.

Cost-Effectiveness

We include some type of cost-effectiveness measure to see what we're buying.

Community Acceptance

To the degree plans result from a political process, whether MPO boards or state legislatures, and to the degree that elected officials really know community preferences on these issues, then community acceptance does end up being a factor. Although, regarding systems planning, we probably haven't done as good a job in this area as needed.

Air Quality

Air quality has been--and will become more of--a consideration.

Financial Feasibility

Financial feasibility hasn't been a major factor in the past, but under both Clean Air Act and ISTEA requirements, will become a major factor in systems planning.

KEY PROJECT LEVEL DECISION FACTORS

The priority or importance of these factors varies from project to project, depending upon individual circumstances. Based upon my experience, I will suggest the priority of these factors regarding their potential impact on project decisions. Note that most of these factors were not included in my previous discussion on systems planning.

4(f) IMPACTS

4(f) Impacts are--because 4(f) is such an absolute rule in terms of federal law--a very major factor in project level decisions. For those of you not familiar with 4(f), I recommend becoming familiar very quickly, or you're really not making good transportation decisions.

The law says that transportation projects must avoid impacting 4(f) resources--whether park lands, historic sites, archaeology sites, wildlife management areas, public recreation areas, and the whole litany of different land types protected under Section 4(f). I find the failure of good system planning studies to really address 4(f) impacts to be incredible--particularly when system planning is done at the local government level.

In Maryland, we have a very, very strong form of local government planning. Yet, very few of our 23 county planning directors really understand Section 4(f) requirements. Consequently, 4(f) factors are consistently not taken into account, yet local jurisdiction projects end up in MPO/State DOT long range plans.

In terms of local government data sources, it's amazing that park directors don't understand what park land is protected under Section 4(f). When we get into projects, we have to go round and round trying to establish whether property is actually protected under Section 4(f). And we simply do not have good data.

I particularly want to emphasize historic sites. We have a really good working relationship with our state historic preservation officer in Maryland. We have a great inventory of historic sites eligible for the National Register within Maryland. Many states do not have this quality of data. These data are important factors in project/systems level decisions.

WATER-RELATED IMPACTS

During the past three to four years, there has been a fundamental change in application of Section 404, under the Clean Water Act. Following the 1985 Supreme Court ruling, the Corps of Engineers recognized they had to take Section 404--particularly the three-step process of avoidance, minimization, and mitigation much more seriously than in the past. Also, the 1990 EPA/Corps memorandum of understanding and the Bush Administration no net loss policy have caused a significant tightening up in applying Section 404.

While some in the environmental regulatory community, claim no change in the regulation, others who are honest will admit to fundamental change in the regulation's application.

At the same time, our data are is woefully inadequate in this area, particularly at the systems planning level. In project planning, very detailed refined data must be developed causing a realization about how bad systems planning data is in the wetland area.

Environmental agencies state that National Wetland Inventory (NWI) maps, the fundamental maps used at the systems planning level, aren't worth the paper they're printed on. We really need much better wetland information for both project and systems level planning and decisions.

Maryland is often cited as having one, if not the best state wetland laws in the country. A major effort is underway right now to refine system level data for wetlands. Transportation and environmental agencies should be discussing how to develop better data for system planning decisions.

Flood Plans

FEMA mapping is adequate for systems planning.

WATER QUALITY

Don't underestimate this area. A number of projects within Maryland either have been stopped or changed significantly, with major cost increases because of water quality.

The Chesapeake Bay is our single most important natural resource in Maryland. Major laws and initiatives protect water quality in the Bay, and we've paid a price within the state DOT. But my value system says the price is justified.

OTHER FACTORS

Some other factors with lesser impacts: socioeconomic impacts, noise displacements, adjacency impacts, minority community impacts. People left adjacent to the facility create the biggest problem, not the people displaced to a more desirable location. The ones left adjacent to improved facilities must be better taken into account in systems planning decisions.

Biological Impacts

Be sure to have good information on rare endangered species. Bald eagles' nests have affected fundamental decisions in Maryland on more than one occasion.

Agricultural Impacts

Again, do not underestimate this area. Previously in Maryland the easiest place to locate new facilities was in open land through agricultural areas. Well, an agricultural community has become much better organized to prevent transportation agencies from doing that.

Hazardous Waste

This is another area needing better data and more attention--especially at the systems planning level. Inadequate information can stop projects and substantially increase project costs. The Blue Route in the Philadelphia area, recently opened to traffic, could not avoid a major hazardous waste site that cost millions of dollars to relocate waste.

Pre-NEPA/Corridor Studies

Preliminary studies at the corridor level are necessary to support decisions on what projects go into the system plans even before doing detailed NEPA EIS studies. Both FTA and FHWA are pushing a concept called tier EISs as a way of doing that. Experiences in Maryland cause me to caution you. Environmental agencies have a very, very hard time dealing with broad brush level analysis. And they still end up demanding the same detail at the project level. So transportation agencies go through the process twice.

GIS

The environmental community is starting to really grab onto GIS for their databases. Take advantage of these GIS data bases. One word of caution: Being in a computer doesn't make the data better data. Assess data quality in GIS databases, otherwise garbage data will just be more readily available through GIS.

Agency/Public Involvement

Early involvement of environmental agencies is absolutely critical for: credibility, agreeing on information to identify the issues, and available data sources. They can be a tremendous resource. And they will be a tremendous pain later in the process if not adequately plugged in early.

Coordination among state DOTS, MPOs, and local government is absolutely critical for flushing out issues and identifying data and information availability. It has to be a fundamental part of good, sound systems planning.

Public involvement: After eight years, with lots of scars on my back, I have learned that the public can be a tremendous resource for data. They can identify issues very early on, identify good information sources, and be a good information source. Don't underestimate that.

Corridor Preservation

ISTEA, U.S. DOT, and AASHTO have been emphasizing corridor preservation. It is very important. A lot of states and metropolitan areas have not done a good job in corridor preservation. This is a data/information area needing more attention in the environmental area: developing the level of information on what needs protecting and monitoring land development activity to ensure corridors are being preserved.

Enhancements

The final opportunity area is enhancements. Maryland's DOT is genuinely excited about this area. Too often, if not all the time, state DOTs wear the black hat. This provides the opportunity to, at least, get a tinge of gray in that black hat.

Maryland's DOT has really been aggressive in developing an enhancement process: putting together an inventory and getting good information. We've recognized that good enhancement decisions require a lot of good data and information, if you're going to maximize opportunities to truly enhance the environment through funds available under ISTEA. This is another opportunity to develop good data/information sources.

DISCUSSANTS

Michael Scheible, California Air Resources Board and Arnie Sherwood, Southern California Association of Governments

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Michael Scheible

INTRODUCTION

I will concentrate on one issue; the relationship between vehicle emissions and speed. I will discuss recent Air Resources Board work, its implications, and how it leads us to conclude that much more needs to be done before we feel comfortable.

Five years ago we were pretty happy with emission inventories. We had lots of assumptions which were not challenged. They were used by lots of folks. In general, we assumed that the faster you went, the lower the emissions on a per mile basis. Lots of analysis and EIRs were done on that premise. Our air quality plans were based on that premise.

But we did more testing and analysis--especially testing our assumptions. Unfortunately, we found that a number of old data interpretation techniques were wrong, and that the emissions changed with time as cars/control systems evolved.

Regarding the first graph, this is information just released last week that will be the subject of a workshop next month. **NOTE**: Attachment 3. A notification of this workshop, is a self-standing document containing all graphs that Scheible refers to below in his presentation at the conference. Attachment 3 supplements/clarifies the presentation summarized below.

NEW SPEED/EMISSION RELATIONSHIPS

These new curves showing speed/emission adjustment factors between 10 and 65 miles per hour, based on emission testing by both EPA and ARB. The earlier curve shown by John Suhrbier was the previous generation curve. Regarding emissions, the old/new curves are somewhat similar in the range of 15–35 mph.

At 15 mph, we have tens of thousands of tests--many data points--at a cycle averaging 16.9 mph. Also, at very low and high--somewhat above 45--speeds, we probably have scores to hundreds of vehicle tests.

Three or four years ago, we only had tens or twenties of vehicle tests, so our data has been evolving. But it's still not strong--we'd much rather have a great deal more information because the data are not perfect for their use.

The emissions on the graph correspond to three different modes. At low speeds on a per mile basis, cars emit at a very high rate--even catalyst-equipped cars. For many cars, the low air flow through the catalyst results in a catalyst less hot than it ought to be. As the catalyst cools down, emissions go up. Rather than being 99 percent or 97 percent effective, the catalyst drops down to 80 percent, resulting in the dramatic emissions increases at lower speeds. But there is not much of idling in the federal test procedure, so these emissions at low speeds do not count against you when you design your emission control system.

Engineering-wise, in the middle of the curve, the catalyst is working pretty well. And the system is working pretty well in terms of energy efficiency.

But at the high speed end of the spectrum, you have a whole different situation. You want high performance, but the concern is a catalyst that gets too hot. But this doesn't count against you on your certification test. We don't test at high speeds. The car system doesn't have to perform real well there.

The cars are designed to go fuel rich, which adds to performance, adds to the 0 to 60 time, or the quarter-mile time that appears in Road and Track, while you still certify for emissions. But when the car goes rich, excess hydrocarbons pass through the catalyst without burning. However, you don't want them to burn in the catalyst, because the excessive heat will cause the catalyst to fail.

Then, ARB will catch the manufacturer later during recall testing. We will tell them their catalysts have failed, and are not designed right.

So, we have this new bi-modal situation here. As, I believe happens in the transportation arena where speeds above 50 and 55 aren't modeled very well because with free flow, new facilities are not needed. There are not many reasons to model such high speeds. Although we know from the California Highway Patrol and other data, and from driving in LA, that if the car in front is not slowing you down, you're probably going 60 or 65. The lack of good modeling also applies to low speeds, which represent neighborhoods, parking lots, or highly congested areas.

The next slide shows hydrocarbons and CO. Our old curves were similar to those for CO. But the new curves are radically different. NOx is the other pollutant of concern. As with hydrocarbons and CO, NOx emissions go up at low speeds. However, no dramatic high speed effect occurs. Instead, NOx emissions increase gradually from 20 mph.

If you're operating a transportation facility to minimize air pollution and your problem is ozone, you have to worry about hydrocarbons and NOx which react in sunlight to form ozone. California has a dual

pollutant control strategy which I think most of the nation will imitate over this decade.

So the old information showed that driving faster across a broad range of speeds was better for air quality. But now the data suggest a different assumption if your problem is ozone: There's no great incentive/benefit from an air quality standpoint to increase speeds.

The next slide compares old/new California hydrocarbon emission factors, showing the diversions. On the low speed end, emissions are qualitatively similar but quantitatively different--i.e., the slopes are different.

The upper curve shows revised ROG (reactive organic gases--i.e., hydrocarbons) emission factors. (Regarding data support, this curve represents a smooth line through the existing data points.) There's really not much difference in emissions between 25 - 40 mph.

But the curve does show a very great difference between the old/new assumptions. The old numbers showed considerable emission reduction benefits from increasing facility speeds from 30 to 45. But the new numbers show little benefit. In fact, increasing speeds from 30 to 45 may increase emissions. This obviously has major implications for transportation-air quality decisions--and radically alters the old way of thinking.

MORE ACCURATE DRIVING CYCLES

In the last five years, the thinking about speed/emission relationships has evolved. Every emission estimate includes a speed assumption. For a long time, we just assumed all cars travel at 30 mph on that cycle. Then, we got a little bit fancier, saying: "Well, some cars travel at 25, some of the VMTs are at 45, and some at 55." The current approach is a bit more statistical--estimated with a distribution shown in the next slide.

This is not a real distribution, but just assumes a standard statistical spread around the peaks, around the average speed. The average speed in all these is 30 miles an hour. And now we have a last distribution, which probably more accurately reflects typical driving habits, which is bi-modal.

You roar down the freeway for 40 miles going as fast as you dare, looking over your shoulder for the highway patrol and ahead at the person in front of you. Then you hit the congested area near the city center or your destination where you creep. So, all of these distributions have the same thing in common: The average speed for the trip, comes out to be 29-30 mph.

The next slide presents the emissions differences in the trip using the emissions model. If you assume 30 mph alone, you get in each of these cases an estimate of one relative to the other. But once you go to the modal distribution, you have almost a 50 percent increase in ROG and CO, but not much effect on NOx. And then you go to the bi-modal distribution, which I personally think is more like real driving habits, with not much VMT at 35 or at low speeds. But the emission factors are so high because the trip time is greater due to congestion at the trip end and a fair amount of VMT is at the much higher speeds than previously assumed. This causes dramatic increases in emissions.

Well, what does all this point out to us? I think this new information affects both the technical side and the policy side of transportation decisions we make on what's good and not good for air quality.

I'm not saying that every single project or plan has to be good for air quality. I think ARB's view is that we need a transportation system that over time is doing more for air quality. We're combatting growth, emissions, congestion, and energy together from a systems level, not from insisting that every project has to decrease emissions.

I think the new information suggests that we all need to go back and look at the fundamental way we collect data. On the air quality side, we're committed to getting more information on real life driving.

Over the last year we have used chase cars in LA to follow drivers to obtain real life driving cycles. We want to know: How hard is the acceleration? How fast are the speeds? How much time is spent in congestion? How much time is spent on the open road? That way, we can test a real-life distribution of vehicle speeds and operating conditions.

We need to go into our testing and create better cycles for determining speed factors. We need to work with the transportation community to improve models, data, and our assumptions about the two ends of the curve where emissions are critical. These assumptions affect both the estimate of what an individual project does to emissions and what the transportation system as a whole does.

We need more information on TCM impacts, e.g., information on traffic management measures at an events center where there's a lot of congestion. Do such TCMs have great benefits because that's the area of few VMT, but much time spent.

So, I will end this presentation designed to provide some new and evolving information and to highlight the need to improve our data estimates and make them less assumption-driven and more data- and fact- driven.

QUESTIONS AND ANSWERS

Question from audience: Do the data that you've shown take into account acceleration and deceleration? And to what extent does an average speed of 10 miles an hour,

that's mainly all acceleration and deceleration, alter emissions?

Michael Scheible: We used about five or six speed cycles. None of them are steady state speed cycles. They do have accelerations in them. One has a lot of accelerations. The trouble is that they're still the old cycles where the acceleration from 0 to 60 is 19 seconds. Acceleration from 0 to 30 is 9 1/2 seconds, and we all drive that way, right?!!! We all drive off very smoothly because that was what the dynamometers in the old days limited us to. So, when we increase the number of accelerations, we're going to see greater emission estimates than what we have here.

I don't think these emissions increases will be a function of speed, though. They are going to be a function of particular driving habits. For example, an on-ramp with ramp metering will be an instantaneous point of emissions. A long hill may have a lot of extra emissions that are not speed dependent, but are load dependent. Unfortunately, we don't have very much data between 30 and 40.

We have a speed cycle that averages about 36 miles an hour, but we had to throw out the data, because we found we got an average speed of 36 because of a lot of high speed travel and a lot of low speed travel. This particular cycle gave a hump to the emissions curve that wasn't realistic. It really didn't represent travel at 36. It represented travel at either extreme that averaged to 36.

Question from the audience: Are the data used from ARB or EPA or both?

Michael Scheible: The low speed data is mostly EPA data. The intermediate speed data is a combination of both, but it doesn't really matter, because they've tested 10,000 cars. We've tested 10,000 cars. Most of the high speed data is ours. They are using our data now. Again, there are different rational assumptions you can make about how you apply the data...We used to use EPA's assumptions. Then we hooked our high speed data on top of theirs and linked it. We went back to each individual car and said how do we best treat the data? A lot of the difference ARB vs. EPA emissions factors is from the re-treatment of the data. We've decided that the previous methodology/assumptions were not as good as they could have been.

Arnie Sherwood

INTRODUCTION

I'm going to talk about SCAG's experience with the Clean Air Act and, particularly, the last transportation improvement program (TIP) that we submitted last year. We got caught in the middle, sort of. We finished the TIP, and then the Clean Air Act passed and EPA said that they would review the TIP based on the new Clean Air Act (even though we had prepared the TIP under the old).

I just want to say a word about SCAG. We're the MPO for Southern California except for the San Diego portion, covering a six-county region containing about 15 million people, currently, 38,000 square miles, and 138 cities. We straddle three air basins in this region.

It's a very complex region to model. We divide it into sub-regions, sort of like metropolitan areas. You're currently sitting in one of them of about one million people.

Of the travel between sub-regions, about 25 percent of all trips are inter sub-regional, and probably, over 40 percent of VMT is inter sub-regional.

FIRST TIP ANALYSIS/CONFORMITY DETERMINATION

When faced with the TIP analysis, we were trying to improve existing models and data. SCAG had very little money at the time, but we were in the process of forming consortia, or had formed some consortia to finance some model/data improvements.

SCAG's UTPS model for the region actually only modeled 9,500 square miles of the region. It did not include, and still doesn't include, two urban areas that had been added to the region since the last census, one of which is 3,000 square miles. The other, which is 900 square miles, contains an additional .5 million people.

We had, at the time, a land use model being tested, called DRAM EMPAL. As I mentioned, we were forming consortia to improve some of the data. As Greig mentioned, one of the major items was origin/destination data. We obtained financing from various sources in the transportation community $1.6 million to do a 16,000 home interview survey.

We had an aerial land use survey for land use data financed by a consortia of government and utilities for $600,000. We also had a $100,000 study to get income data, because SCAG lacked good income data between censuses from the State Franchise Tax Board, which is like the IRS for California.

The conformity determination for the 1992 TIP was very, very important. It was the first one since the state gas tax increase and since many counties passed half cent sales taxes for transportation improvements. It contained billions in transit, HOV, and some mixed flow projects. A nonconformity finding would have stopped

or delayed funding for these projects.

SCAG decided we had to do a work program to get agreement with the federal agencies, particularly EPA, on how to do the conformity determination. With only three months to complete the conformity finding, we spent one and a half months negotiating with EPA on a work program.

We finally negotiated with EPA a program that required some new improvements. EPA wanted: (1) the land use model to address the sensitivity of speeds on land use and then on transportation, (2) a feedback loop of speeds back to trip distribution and mode split, and (3) better network definition, especially of arterials.

We did 13 full UTPS runs. We did five DRAM EMPAL runs. We spent about $600,000, of which $125,000 was just for ADP costs.

FUTURE TIP ANALYSES/CONFORMITY DETERMINATIONS

We did get federal agency approval of the TIP, but in their approval, they wanted even more model/data improvements. In particular, toll roads will have to be in the transportation model, so that prices will be in the transportation planning and the TIP.

As Mike just mentioned on vehicle speeds, ARB and EPA both wanted SCAG to look at free flow speeds greater than 55 miles per hour. For the next conformity determination, ARB and EPA also wanted: (1) a self--consistent transportation-land use interface, (2) feedback of congested speeds all the way back to trip generation, (3) inclusion of new O/D data into the next runs and new population forecasts (several million higher than the previous one, because we've been growing about 300,000 people per year over the last ten years), and (4) better quantification of TCMs.

SCAG responded to these requests/requirements with the realization that computer costs were getting out of hand. Being on a timeshare system, we had no control. So, to contain those costs, we moved the computers in-house. SCAG bought 17 IBM workstations, which required us to move the UTPS model to a TRAN PLAN mode.

In the short term, aside from putting the UTPS on TRAN PLAN, we have committed to: (1) doing the pricing in the model, (2) considering speeds greater than 55 miles per hour, (3) including new O/D data, (4) doing the interface with DRAM EMPAL and TRAN PLAN, (5) re-doing the trip generation/distribution in the models, (6) putting all general plans from the six counties and 188 cities on GIS to be used as part of DRAM EMPAL, and (7) enlarging the modeling region to include all the urban areas.

This has required a huge increase in the data/modeling budget. This fiscal year, we are spending an additional $680,000 on data and modeling. Next fiscal year, we're going to spend over $4 million on data/modeling--at least a 70 percent increase over what we would have spent without these conformity requirements.

Over the longer term, we need a more systematic and strategic approach. Instead of responding to requests for an improvement here, an improvement there, we need to take a longer range view of what is going to be required.

As Greig mentioned with the court cases, our sister agency in the Bay Area has faced some very strong legal challenges to its TIP and planning, so we're going to be subject to legal scrutiny continually.

In addition, public/interest group involvement will increase, especially in the activities of environmental agencies. Therefore, we're putting representatives on our technical committees in modeling and data to involve them from the beginning.

We need increased documentation and a strategic plan for data/modeling improvements. We intend to do that. I think we're going to be faced with similar challenges faced by stationary sources where they must do best available control technology. Transportation agencies will probably have to use best available modeling systems.

I think it's going to be a new learning experience for all of us, but a great opportunity to really do things that we haven't done for many years now.

QUESTIONS AND ANSWERS

Question from audience: (Question off mike)

Arnie Sherwood: I think the program we're committed to, costing over $4 million for next year, is designed to satisfy the immediate requirements that EPA has put on us for the next TIP and the next regional transportation plan.

But I don't see those requirements going away. There will be new requirements, and that's why we need a strategic plan for data/model improvements--why we need to get up to state-of-the-art because the courts will keep insisting on the use of best practices.

Neil Pedersen: Chris Fleet from FHWA had, I guess, the unfortunate opportunity to present the status of FHWA's negotiations with EPA on VMT monitoring requirements at the TRB Annual Meeting. For those who aren't familiar with this Clean Air Act requirement, it particularly affects those in CO nonattainment areas

with a design value of 12.5 ppm or greater.

We start, in a certain year, needing VMT estimated within 5 percent accuracy level. From there we go on a decreasing sliding scale down to within plus or minus 3 percent over the course of the next few years.

All this is fine and good if you assume 100 percent accuracy for traffic counts. But those familiar with doing traffic counts--and I'm somewhat responsible for that within our organization--know certain facts of life. For example, on urban freeways, it's virtually impossible to put out road tube counters due to unsafe conditions for individuals putting out the counting equipment. So, on urban freeways throughout the country, for the most part, we don't count except where we have permanent count stations--i.e., loop detectors within freeway pavement.

Well, the funny thing about loops detectors is, if you have stop and go traffic, they don't count correctly. So, we're getting bad counts when we have congested conditions.

Is that type of information taken into account in current VMT estimates? I'm usually happy--particularly on heavily traveled roadways--if we're getting counts on adjacent links. Or in verifying traffic counters, if we hit plus or minus 5 percent on individual counts. We'll often accept counts within plus or minus 10 percent, due to the variability in the counting equipment alone.

The biggest challenge--and this is something to think about during the workshops--is the whole management of traffic counting in terms of fundamental traffic count data relied upon for VMT estimates/model verification. Good, sound management of traffic counting will be more important for improving good estimates than arguing about whether we have a 5 percent or 3 percent accuracy requirement in our samples with EPA.

I think we, as transportation professionals, really need to emphasize this whole issue of management and quality control of the fundamental traffic data--data that we're relying on to be able to meet the expectations of the environmental agencies.

Gary Hawthorn: I remember in that very TRB session that Neil referred to back in January, MTC's Chuck Purvis made the rather pithy comment that the Clean Air Act requirement was doomed to statistical failure. So, stay tuned. There's a lot riding on it.

Question from audience: Mr. Sherwood, you discussed moving to the GIS database. Yet, you're experiencing rapid growth throughout the region. Because of this growth, will you have to keep spending at the same high rate for your data needs?

Arnie Sherwood: Right. We're intending now, with new ISTEA monies, to use a good portion for data/modeling every year.

Question from audience: While most of us are slaving away to produce all this data, can you air quality folks really put your hands on your hearts and say this kind of accuracy is needed and commensurate with the information that you have on what causes emissions and what contributes to air quality problems? It seems to me there's a linkage problem here.

If I can expand on that, I'd like to take it one step further and say now that you have emissions, what does that actually get you in terms of air quality? To take that next step to air quality, you have to consider distribution over space and time, in addition to sun vs. no sun, effects of wind currents, etc.?

Gary Hawthorn: The Clean Air Act has always been described as "technology-forcing." But the '90 Act is also "analytical methods-forcing". The requirements are out in front of the analytical/data capabilities to implement them. So there is not a logical sequence allowing sufficient time for improvements and the response to these requirements will not be as neat as everyone would like. Complicating everything further is the threat of litigation hanging over the analytical/data activities.

Michael Scheible: Realistically, we're never going to get the mobile source inventory within plus or minus 10 percent of the actual number. We're dealing now with the problem being defined probably 50 to 100 percent low for hydrocarbon and CO and probably relatively close for NOx (but there are still a lot of heavy duty vehicle emissions out there).

We're aware, after working with the transportation community, of the most uncertain areas and those where we don't have any data. We're not, at least from my perspective at CARB, looking for a VMT estimate of 5 percent and how can we improve that. Instead, we're looking at whether we have any estimate at all of high or low speeds--those things that are really emission sensitive.

We air quality folks prioritize our work just as transportation professionals do. We run each factor that might change emissions, and we say: "Well, is this a 2 percent change, a 10 percent change, a 30 percent change in emissions?"

Unfortunately, there is unlikely to be any one thing that adds 20, 25, or 30 percent change to emissions. It's going to be a whole lot of 10 percenters. So we put our effort into those, but in terms of getting a few percent

better, that's not our priority.

John Suhrbier: I wanted to pick up on the question on the linkage between transportation/air quality models/data and relate it back to VMT forecasting guidance. I spent a lot of time with transportation and air quality people. The air quality people tend to say: "Transportation data/models are really the weak link in all of this." One of the major reasons EPA is relying on HPMS data in the VMT forecast guidance section 187 work is because EPA lacks confidence in transportation model systems.

But we, as transportation people, have a tendency to say emissions models are off by a factor of 2 or 3, and then you've got the dispersion modeling. That's even worse.

My own conclusion in terms of getting on with life is to assume equality, equity, and weaknesses on both sides. There are some things that can be done quantitatively. There are some things that can be done qualitatively, as well.

In Massachusetts, I've had a chance to look at some regional modeling transport issues. The regional modeling work pretty convincingly demonstrates that Boston has a problem by itself. It's accentuated by some pollution transport, but the models certainly do not provide any evidence that there isn't an air quality problem.

So, I think, rather than debate -- it's not very constructive in my mind to debate whose models are worse, or whose models are better, but to somehow structure communication where progress can be made.

PANEL ON MANAGEMENT SYSTEMS: IMPLICATIONS FOR DATA AND COLLECTION PROCEDURES

David McElhaney, Federal Highway Administration, moderator

DATA NEEDS FOR MANAGEMENT SYSTEMS

Christopher R. Fleet, Federal Highway Administration

INTRODUCTION

The transportation planning process is being impacted in ways that have new implications for data needed to support that process. Recent legislation (i.e., the Clean Air Act Amendments of 1990 - CAAA '90; and the Intermodal Surface Transportation Efficiency Act of 1991 - ISTEA) are forcing improvements and modifications to the supporting analytical base for multimodal transportation decision-making. At the same time changing demands and needs are occurring at the State, regional, and local levels of government for improved responses to such concerns as urban congestion, assessing the complex interaction between land use development and travel, and environmental impacts of transportation decisions.

Because the substantial investment that has been made in the nation's infrastructure is susceptible to erosion if it is not managed effectively, a key element of the ISTEA is the requirement for each state to develop and maintain management systems in six specific areas. These areas are: (1) highway pavements of Federal-aid highways, (2) bridges on and off Federal-aid highways, (3) highway safety, (4) traffic congestion, (5) public transportation facilities and equipment, and (6) intermodal transportation facilities and systems. In addition the states must establish a traffic monitoring system for highways and public transportation facilities and equipment. The fundamental objective underlying these management systems is improving the efficiency of the nation's existing and future transportation systems.

ISTEA requires that regulations concerning the management systems be implemented by December 18, 1992. Much has to be done in the meantime in order to meet that date: an Advance Notice of Proposed Rule Making was published in the Federal Register June 3, 1992, and Notices of Proposed Rule Making for each system will be published in the Federal Register for review and comment; and a final regulation, taking into consideration all the comments, must be prepared and published by the December 18 date.*

ISTEA requires the states to be in the process of implementing each management system in fiscal year 1995, and they must certify before January 1, 1995 (and each subsequent year) that the management systems are, in fact, being implemented. A schedule for compliance may be established to meet the requirements for implementation through the rule-making process.

IMPLICATIONS FOR STATE AND MPO WORK PROGRAMS

ISTEA requires that any needs identified under the

* This activity and the outreach and training activities discussed later in this paper were anticipated at the time this paper was presented.

management systems must be considered in the planning and programming of transportation improvements at the state and metropolitan levels. In Transportation Management Areas (TMAs), the congestion management system (CMS) must be part of the metropolitan planning process. At least three of the systems (congestion, public transportation, and intermodal) will need to be closely coordinated with the updating of the State Implementation Plans (SIPs) in non-attainment areas. Because each state or metropolitan area is unique and has unique transportation problems, each of the management systems may be tailored to individual state or metropolitan area needs.

Since the clock is ticking toward the January 1, 1995 certification requirement, states and MPOs need to build in sufficient lead time in their work programs to scope out what is needed to develop and implement the systems. Coordination with other key planning requirements and their due dates must be considered as well. For example, states with CO nonattainment areas must update their SIPs by November this year, and states with ozone nonattainment areas must update them by November 1993. Transportation control measures (TCMs) proposed under the SIP update process will have to be closely coordinated and evaluated with transportation demand management (TDM) strategies proposed under the congestion management system.

States and MPOs will be incorporating these important work activities into their planning work programs over the next few years. Many of these activities will require data, either collected directly or obtained from secondary sources, to support them and provisions must be made to put in place data collection and monitoring procedures.

The time line in Figure 1 is a picture of the potential activities leading up to the January 1, 1995 certification. The example includes supporting activities for the congestion management system, but other systems will need similar preparation and support (except possibly those that are already under the development process such as pavement management). Also shown are some of the milestone dates for other related activities, including those supporting air quality and metropolitan planning. FHWA and FTA are sensitive to the need to coordinate as many of the various planning activities required under ISTEA as possible. Not only does it make sense for efficiency, but the effects of strategies implemented under a management system will impact proposals developed to respond to air quality problems.

Officials responsible for developing their agency's work programs will recognize that there is much to do and little time in which to do it, especially in non-attainment areas. In the example in Figure 1, for a July-to-June fiscal year, draft programs ideally need to be available for review and approval in February-March. This means the program development effort should begin in November-December, an overall time frame of seven or eight months from the initial scoping to the start of the fiscal year. In practice this time element is often much shorter.

Work activities to ensure that management systems are being implemented in fiscal year 1995, need to be in place in fiscal year 1994. If the start of the fiscal year is July 1993, then the work program development period should begin roughly November or December of this year. Preparation time for meeting the November 1993 SIP update is considerably more condensed. That work would have to be started in fiscal year 1993 work programs beginning July of this year.

OUTREACH AND OTHER RELATED ACTIVITIES

As shown in Figure 1, a substantial effort is planned at the federal level to provide information, training and technical assistance over the next two to three years. Specifically for the congestion, intermodal and public transit systems, four multi-regional meetings are being planned for June and July. Similar meetings are being planned for the safety management systems.

A series of congestion management training sessions and workshops is being planned for states, MPOs and FHWA field staffs. Two are being developed through the National Highway Institute and will be available in late summer of 1993. One will be a one-day overview for managers and the other will be a three-day workshop for technical staffs. These will coincide with the early fiscal year 1994 state and MPO work program activities and provide the technical details of assessing congestion relief strategies. To provide early discussions on congestion management, a one-day overview is planned to be available starting February 1993. This will dovetail with the development stages of fiscal year 1994 work programs. It is quite likely that these one-day sessions will be available as part of, or as add-on to, other planned meetings.

Several research efforts are shown in Figure 1. One, starting this summer, is a review and synthesis of existing congestion management activities and applications of congestion relief strategies. The results of this effort will be available by December 1992 and will provide input to the one-day overview sessions. This project is being conducted jointly by FHWA's Office of Environment and Planning and Office of Technology Applications and is the first phase of a longer term marketing program of congestion management applications.

Several recent national conferences and workshops have focused on needed analytical improvements to respond to the new demands being placed on the planning process. Integral to an improved process are the data and information needed to support it. Notable among these conferences are the Conference on Transportation, Urban Form, and the Environment (held in Irvine, California, December 1990) and the Conference on The Effects of Added Transportation Capacity (held in Bethesda, Maryland, December 1991). Major recommendations for data needs to support new initiatives were made and published in the proceedings to the Irvine Conference and proceedings are expected soon for the Bethesda Conference. It would be useful to refer to these recommendations, as they have implications for the technical direction of the process, including data needs.

This is just a sample of the activity focused on the implementation of management systems required by ISTEA. More information will be available as outreach, training, technical assistance, and research activities are developed. We view open communications as critical in implementing the management systems.

COMMON ELEMENTS AND THEMES IN THE SIX MANAGEMENT SYSTEMS

As noted earlier, ISTEA requires six management systems. While these are envisioned as separate systems or sub-systems of an overall transportation management system, there are several important elements that run throughout all six management systems:

- Cooperation—the state is the responsible agency for developing and implementing the systems. In metropolitan areas, this must be accomplished in cooperation with the MPO. Transit agencies and local governments will also need to be involved.

- Objectives—the two fundamental purposes of the management systems are to improve the efficiency of transportation systems and to protect the public and private investment made in those systems.

- Implementation—transportation needs and improvements identified as a result of a management system must be considered by the states and MPOs in their plans and programs and must be considered in making project selection decisions. Thus, the management systems themselves will not be the end products. They will provide added information for decision makers for planning and programming.

- Funding Sources—the following program or system funds may be used for developing, establishing and implementing the management systems:

  - National Highway System, Surface Transportation Program, and FHWA state Planning and Research,

  - FTA Sections 8 (planning) and 9 (capital, planning and operating); and 26 (state and national planning and research),

  - Congestion Mitigation and Air Quality Improvement Program funds may be used in non-attainment areas for congestion, transit, and intermodal management systems since these systems are likely to directly benefit air quality, and

  - Apportioned bridge funds for the bridge management system.

- Data—all management systems have common activities that require data. More discussion on these elements will follow later in this paper, but briefly they include:

  - Define and monitor the magnitude of the problems,

  - Identify transportation improvement needs,

  - Analyze alternative solutions to the problems and assess their effectiveness in solving them, and

  - Measure the effectiveness of the implemented actions.

Data requirements will vary across management systems. Some data may be useful to all systems (e.g., traffic volumes or VMT), while other data will be unique to a single system (e.g., bridge structural data). Some data will be needed for federal reporting purposes; some will be collected only for use at the state and local levels. The data and its collection and analysis should be tailored to the individual needs and objectives of the system.

There are four sources of data that, at this point, are anticipated to be used for national monitoring needs. These four could supply some state and metropolitan needs also. These sources are: (1)the

traffic monitoring system required by ISTEA, (2)the Highway Performance Monitoring System (HPMS), with possibly some modifications, (3)FTA's Section 15 reporting requirements, and (4)the National Bridge Inventory. FHWA and FTA recognize that coordination among these data sources would help improve the efficiency of data collection and use among the various management systems and we will be working toward that end.

Clearly there are many issues beyond the data considerations that need to be resolved before full implementation of the management systems. These will be addressed through the normal rule-making process and opportunities for public review and comment and our outreach activities.

DATA NEEDS FOR PAVEMENT, BRIDGE, AND SAFETY MANAGEMENT SYSTEMS

The impetus for systems or programs in these areas has developed over several years, and ISTEA reinforces the need, continuance, and (in some cases) expansion of these programs. Many of the data requirements have been, or are well on the way to being, established and are well documented through AASHTO, NCHRP, or FHWA studies or reports. While data-related issues for these systems will be addressed in the regulation development process, the focus for this paper will be on the other three management systems. This paper will only briefly touch on the highlights of the pavement, bridge, and safety management systems.

Pavement Management Systems

FHWA issued guidance in December 1991 on Pavement Design Policy. It requires that each state have, among other things, a pavement management system (PMS) operational by January 13, 1993. This PMS should be based on the concepts described in AASHTO publications including its 1985 "Guidelines on Pavement Management." While this is a requirement for states, the policy guidance recommends that local PMSs are desirable.

Most states have been developing a PMS for some time and the current policy is expected to remain in effect, although the extent of network coverage has been expanded under ISTEA to include all highways other than local roads or rural minor collectors. The rulemaking process will address the issue of expanded coverage and the phase-in period needed to incorporate the additional mileage.

AASHTO guidelines identify five data categories for a PMS:[1/]

- Inventory—facility location, functional classification, length, pavement type, etc.,
- Pavement condition—roughness, ride, distress, etc.,
- Construction and maintenance history,
- Traffic—AADT, particularly heavy truck traffic, for priority setting and to estimate loads for design purposes, and
- Cost—data for economic analysis and benefit/cost estimates.

The PMS requires many of the same data items required by HPMS for performance. The two need to be coordinated.

Bridge Management Systems

Bridge Management Systems (BMS) also have an established track record; based on a 1988 FHWA study most states had begun to organize, plan, or develop a system and progress was being made to implement them by the time the study was conducted. Another study, conducted under NCHRP, developed a model BMS[2/] and AASHTO has developed draft BMS guidance. One data "hook" for coordination is the HPMS, since bridge location is identified in the HPMS data.

Safety Management Systems

State highway safety programs can be traced as far back as the 1966 Highway Safety Act and subsequent legislation. AASHTO has produced a guide for states; and FHWA, based on a review of state practices, developed a "good practice" document. Recently states supported the need for the "good practice" document as a base for developing their systems.

1/ AASHTO, "AASHTO Guidelines for Pavement Management Systems," Washington, DC, July 1990.
2/ Transportation Research Board, "NCHRP Report No. 300, Bridge Management Systems," Washington, DC, December 1987.

DATA NEEDS FOR CONGESTION, INTERMODAL, AND PUBLIC TRANSPORTATION FACILITIES

There are several unifying elements of ISTEA (and CAAA '90) that provide compelling reasons for discussing these three management systems together:

- ISTEA Policy—development of a national intermodal transportation system with emphasis on reducing air pollution and congestion,
- Planning and program development—statewide and metropolitan plans and programs must include:
  - Reduction of congestion and methods for preventing its development where it doesn't yet exist,
  - Methods to reduce vehicle travel (especially single occupant vehicles - SOVs), and
  - Efficient use of existing facilities and improving the flow of people and goods.

Transportation Management Areas (TMAs)

The transportation planning process in areas over 200,000 population and other TMAs must include a congestion management system. In non-attainment TMAs, a project that significantly increases SOV capacity may not be funded with FHWA or FTA funds unless it is part of an approved congestion management system.

Context for Management Systems

The context for management systems is the statewide and metropolitan processes for developing plans and programs.

Elements within a Common Framework

All three systems will have elements, some common, some unique, that will fit within the same framework of activities (see Table 1):

- Identification of systems or facilities:
  - Location, extent, area of concentration, network or facilities involved, modes, transfer points, etc.
- Identification of performance measures:
  - Is performance better, worse, remaining the same over time?
  - What is the change in condition, efficiency or effectiveness of the system, or quality of service provided over time?
- Data collection and system inventories:
  - Physical condition and operating characteristics (time, cost, capacity, usage, etc.);
  - Data to track location, duration, and severity of congestion (recurring and non-recurring) and evaluate effectiveness of strategies or actions.
- Monitoring and evaluation of facility or system performance:
  - Evaluation of performance is based on and supported by the performance measures established and the data collected;
  - Methods or approaches to evaluation will be needed so problems can be identified or located and solutions recommended;
  - Measures for monitoring may be different than those needed for strategy evaluation.
- Identification of strategies or actions and their evaluation:
  - Potential effectiveness or impact of proposed strategies need to be assessed;
  - Priorities of actions and costs would be identified.
- Implementation of strategies or actions:
  - Proposed actions, responsibilities for implementation, timing, funding sources, etc.;
  - Potential problems (institutional, financial, legal) to implementation;
  - Strategies or actions become part of state and metropolitan plans and improvement programs.

Data Issues Specific to the Congestion, Public Transit, and Intermodal Management Systems

Are There Any Changes?

Indeed, a lot has changed recently in terms of the dynamics of the transportation planning process and the transportation program. At the same time, the fundamentals of transportation planning that have evolved over many years will continue to play a major role. For example:

- Measuring change—the notion that measuring the change in performance and reliability of the transportation system (something we once called "surveillance") is necessary to manage a program of improvements for that system is not new.

- Long-term issues—improved mobility and congestion relief are issues that have been around for a long time.

- Positive impacts—on the environment and economic development continue to be major considerations in the formation of plans and programs.

- Technical base—the analytical process, with a long track record, provides a technical base for decisions about enhancing the transportation system's performance and assessing the relationships between modes of travel.

Changes in the Dynamics of the Process

What has changed is the framework and dynamics within which the process is carried out:

- Program changes—legislative and program funding changes have redirected emphasis and shifted responsibilities within the context of transportation planning and programming:

  - Available funding—FHWA funds available for metropolitan planning have more than doubled from $47M to $117M annually. One percent of the funds authorized for most of the major highway programs is now set aside for metropolitan planning, up from ½ percent. HP&R Program has increased from 1½ to 2 percent of the major highway programs. National Highway System and Surface Transportation Program funds may also be used for planning. FTA funds for metropolitan planning have increased 25 percent from $35M to $44M annually. Section 9 funds are also eligible for planning.

  - Responsibilities—the MPO's authority and responsibilities for project selection have increased.

  - Statewide planning—a statewide plan and program are now required and these must be integrated with metropolitan plans and programs.

  - Air quality—the CAAA '90 and subsequent attention by the environmental community have changed the way the transportation community does business in terms of the expected analytical quality and precision of planning products. The analytical transportation planning process is being impacted in a number of ways that have implications for changes needed in travel model structure, data needed for the models, and the way in which the models are applied.

  - Travel behavior—more fundamental is our realization that we need to better understand the complex interaction among the traveler, the transportation system, and land use and form; and that this relationship must be monitored over time.

Staying with the data needs in the analytical process for the moment, Dan Brand suggests that we haven't done so well in accurately modeling land use-travel interaction so far because we have been working with "...an incomplete model of travel and land use location behavior."[3/] He suggests that we need to change our approach to travel modeling and place the

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[3/] Daniel Brand, "Research Needs for Analyzing the Impacts of Transportation Options on Urban Form and the Environment," in TRB Special Report 231, Transportation, Urban Form, and the Environment, Transportation Research Board, Washington, DC, 1991.

individual traveller (and his or her travel-related behavior) at the center of the model structure (see Figure 2, taken from Figure 1, of Brand's paper, p.103 of the Irvine Conference Proceedings).

Another issue, he says, is in dealing with what happens in practice. The problem is that the full range of costs of congestion (and making trips in that congested state) are not fully recognized or understood by the individual traveller. These costs include costs of delays, air pollution, energy consumption, etc. For the information about these costs to have any appreciable affect on travel, it must be incorporated into the travellers decision process--not an easy task, but one that is beginning to be considered through pricing strategies.

This suggests that, in addition to the more traditional transportation system and travel demand measures for monitoring the effects of strategies and actions, we need to be thinking about measuring the full range of travel costs and the relation of these costs to congestion, air pollution, and urban form.

Typical Data Items

In the meantime, what typical data should states and MPOs be considering for collection and monitoring to implement the management systems by fiscal year 1995? All three management systems will have among them one or more common components that should be considered for measuring and monitoring over time. These components are shown in Table 2, with examples of possible measurement items and the typical data that are needed to provide these measures. The components are:

- Measure—the first component is the measure itself, or "yard stick" that provides an indication of severity of congestion or condition of transit equipment, for example. The availability of the data from which these measures are derived (or the difficulty in obtaining the data) will influence the extent or quality of the measures.

The other components represent base data from which the measures are derived:

- System—the highway facilities, transit facilities, or intermodal connections in terms of such things as miles, lane miles, route miles, ton miles, etc.,

- Demand—the demand or usage of the system measured by VMT, PMT, AADT, passengers carried, or goods or people transferred,

- Time or cost—time or cost to use the system - for example - travel time, speed, transfer time of goods or people, delay or duration of congestion,

- Location or component—location, area, or class of interest of the element being measured, such as CBD, suburbs, designated area, specific network, transit route, or intermodal transfer facility, etc.

Data Sources

Both existing and new sources of data will have to be considered. A few examples of existing data sources are shown in Table 2. The transportation planning process has always relied on primary sources that are an integral component of transportation planning, as well as secondary sources that are collected under other programs or for other purposes, but are relevant to transportation planning.

New sources of data or methods of collection are likely to be necessary to support adequate management systems (and to ensure that information from the management systems is addressed in the planning process at both the metropolitan and state levels). A number of questions need to be answered first, however--among them:

- Incidents—how to monitor incidents? What are the measures to assess effects of incidents?

- Land use—what are the effects of land use alternatives and growth management strategies on travel and on reducing congestion?

- IVHS—how can the data produced by IVHS be integrated into the planning process and applied in the management systems?

The emphasis now must be on data coordination and sharing among agencies and jurisdictions and for multiple purposes:

- Efficiency and consistency—multiple uses of data, to the extent it is possible, must be considered to conserve resources and help ensure consistency between management system needs and other program needs (e.g., air quality analysis).

- Count-based travel—there is more emphasis now on developing count-based travel estimates. EPA is forcing the issue in its recent VMT Forecasting And Tracking Guidance; and VMT tracking is needed for congestion monitoring as well as for

air quality purposes. states cannot view traffic counting as one of the first activities to cut back when there is a shortage of funds.

- Link-level data—link speed information and temporal distributions of facility traffic volumes are needed for emissions modeling. This has implications for some of the same data collection procedures and analysis needed for congestion management, among them:
  - Speed inventories and estimation procedures,
  - Travel model post-processing for the MOBILE model inputs requires extensive facility-level information on regional speed/volume to develop profiles by functional class and area type.

Accuracy

Accompanying the broader range of data needs and applications is a need for greater emphasis on reasonability checking on information being produced or used within the planning process and, consequently, the management systems.

Transportation studies will need to do a good job of balancing the experience level of their analysts and sophistication (or lack of sophistication) in the models with new (and often seemingly unrealistic) demands being placed on the analytical process. Analysts (and managers) need to ask questions such as:

- How much difference does it make? What are the effects of a change in level of service or in implementing a strategy on travel and can the management system measure it?
- What is important? What is the purpose of the data being collected or being produced by an analysis? How precise and accurate does the information need to be? Do the answers need to be: quick and dirty?; $\pm$ 10%?; or bullet proof and court safe?

Frequency

Data will need to be submitted on a regular basis to FHWA and FTA, probably annually if existing sources (e.g., HPMS, Section 15) are used. Beyond this, the frequency of data collection will vary depending on the state and local needs and the management systems they establish. All systems will need data often enough to provide basic information:

- To discern changes in the component being measured,
- To supplement secondary data sources,
- Although a measure may be needed every year, some data may not be available every year and may be collected every two or three years and a measure derived in the in-between years.

SUMMARY

Requirements for management systems will make it necessary for states and MPOs to carefully review their acquisition, use, and sharing of data. Data collection is expensive, and coordination will be a key element in data-related activities. This is necessary not only for efficiency, but the effects of strategies developed under management systems will have to be evaluated for their effects under related programs, such as air quality.

Clearly much must be accomplished by U.S. DOT, as well as the states and MPOs, to meet milestone dates in establishing management systems. Substantial outreach and effort is planned over the next few years to provide assistance and training. This report includes many of the supporting activities and requirements to respond to ISTEA as they were anticipated at the time it was prepared. More information will be available as outreach, training, technical assistance, and research activities are developed; and as the various Notices of Proposed Rule Making are prepared.

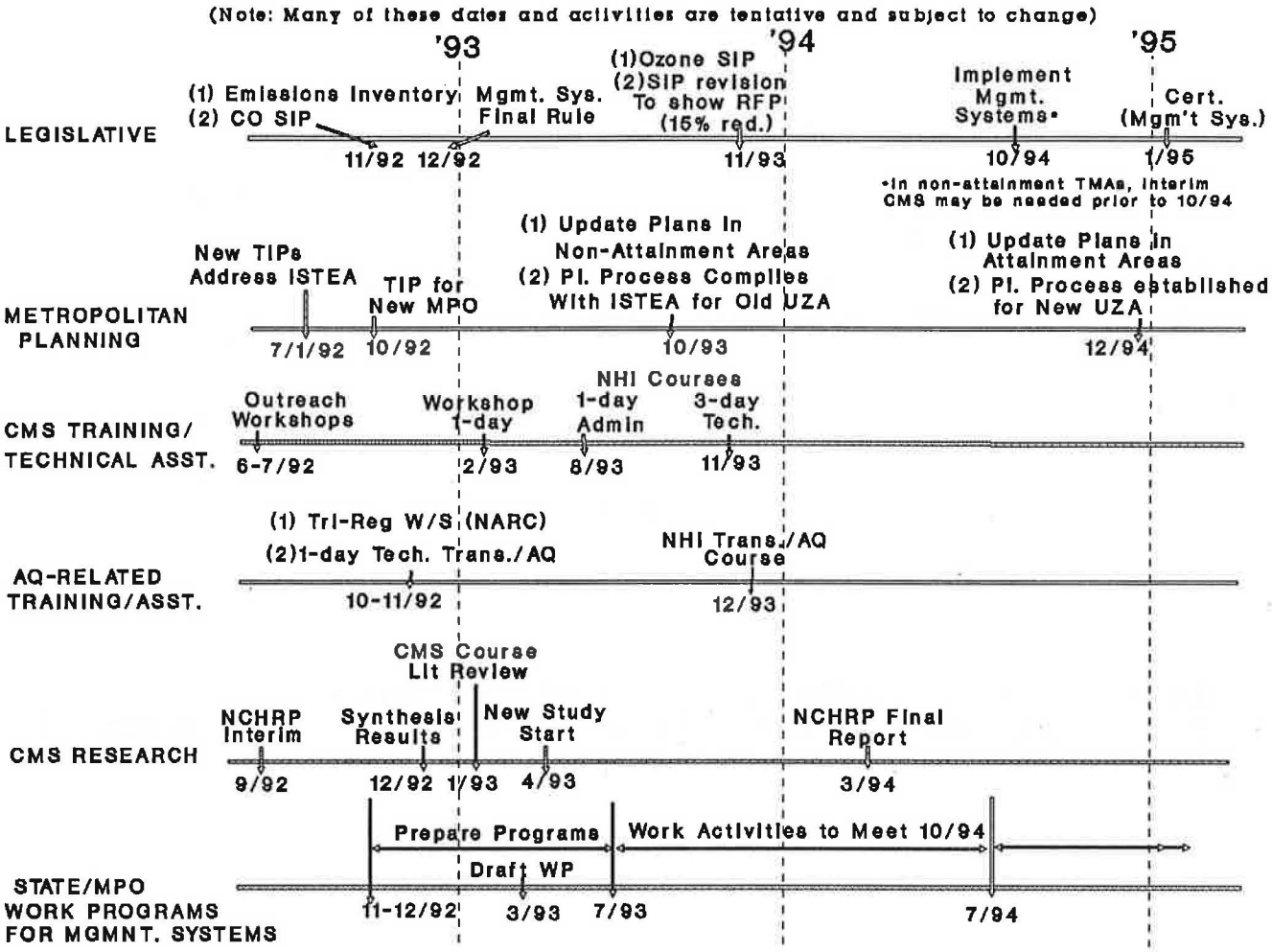

FIGURE 1 Milestone dates for selected activities supporting ISTEA.
(Note: Many of these dates and activities are tentative and subject to change.)

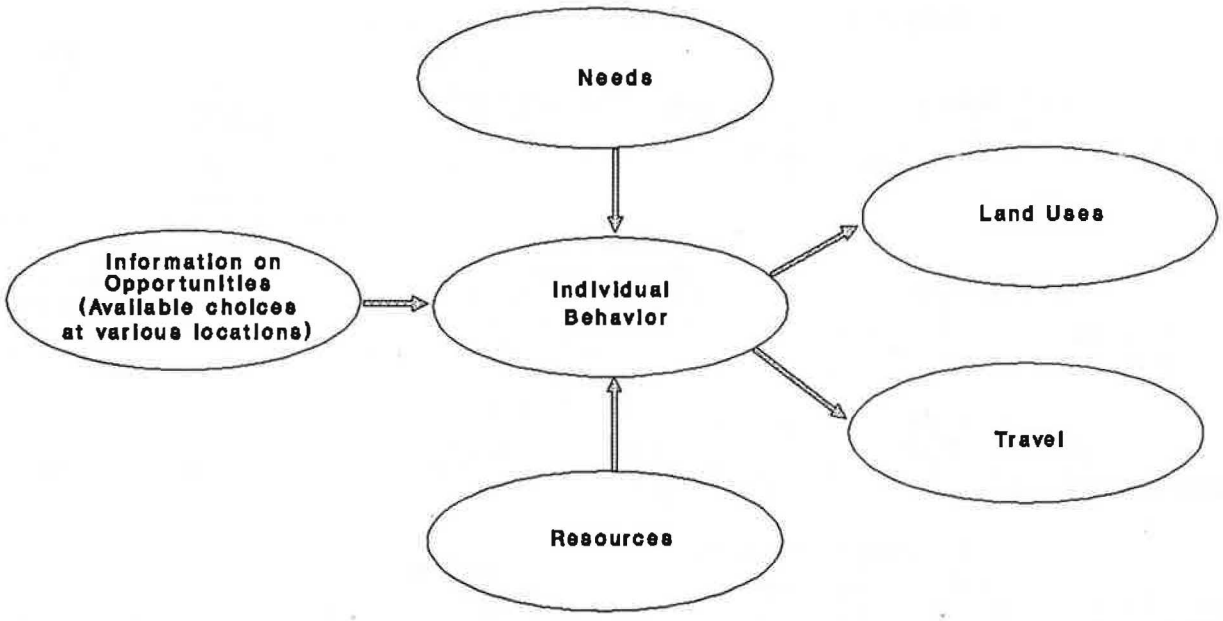

FIGURE 2 A new look at the effect of traveler behavior on land use travel interactions (from Brand, "Research Needs for Analyzing the Impacts of Transportation Options on Urban Form and the Environment," TRB Special Report 231, 1991 Figure 1).

TABLE 1 EXAMPLES OF ELEMENTS OF MANAGEMENT SYSTEM ACTIVITIES CONGESTION, TRANSIT AND INTERMODAL

ACTIVITY	ELEMENTS
Identification of Systems or Facilities	Location, extent, area of concentration, network, modes, etc. Examples: statewide, metropolitan area, corridor; public or private operators; intra- or inter-state movement of persons or goods; coastal or inland ports, rail, truck, or bus terminals.
Identification of Performance Measures	What is the condition, efficiency, or effectiveness of the system? Is performance better, worse, remaining the same? Examples: quality of service, travel time or cost, condition of facilities or equipment, cost or passengers carried per unit of service, movement of people or goods, time for intermodal transfer.
Data Collection and Systems Inventories	Physical condition and operation characteristics. Examples: time of travel, cost, capacity, usage, duration and severity of problem.
Monitoring and Evaluation of Facility or System	Evaluate performance and establish methods to locate and identify problems, and develop solutions; determine causes for inefficient movement of people or goods; monitor and evaluate effectiveness of previously implemented strategies.
Strategy Identification and Evaluation	Address current and future deficiencies; assess effectiveness of proposed strategies; set priorities; identify costs and funding sources; identify potential problems to implementation.
Implementation of Strategies or Actions	Plan for implementation; proposed actions, responsibilities for implementation, timeframe, funding sources; incorporated into plans and programs.

TABLE 2 POSSIBLE DATA FOR THREE MANAGEMENT SYSTEMS

Component	Congestion	Public Transit	Intermodal
MEASURES	LOS lane-miles>LOS "X" VMT>LOS "X" %VMT by funt. class VMT/lane-mile delay/lane mile delay/VMT delay/trip delay/vehicle delay/person delayed delay/incident delay due to construction avg. travel time/trip persons/hour on facility/ corridor persons/vehicle	riders/vehicle mile riders/vehicle hour peak load factors on-time performance cost/vehicle mile cost/rider accidents/veh. mile roads calls/veh. mile veh. hours/employee veh. miles/employee riders/employee capital replacement fund	cost/ton mile by mode cost/passenger mile by mode average value/pound (freight) on-time performance average transfer time between modes (passenger and freight) average cost due to losses or theft per trip by mode average accident cost per trip by mode
DATA: System	lane miles lane miles of HOVs capacity functional class proportion of system congested nature and location of construction underway location and duration of incidents on the system	vehicle hours vehicle miles route miles riders employees accidents useful life of assets terminals/garages equipment service hours	ton miles passenger transfer freight losses from thefts (total value) accidents useful life of assets access facilities under construction (to airports, railroads, harbors, intermodal centers)
Usage of the System or Demand	Trips VMT,DVMT total PMT & Peak ADT Period no. of vehicles using HOV lanes no. of persons using HOV lanes proportion of travel congested/delayed proportion of persons congested/delayed proportion of vehicles congested/delayed duration of peak period	passengers (total and peak period) market share	passengers freight by category-frequency and duration proportion of freight delayed proportion of passengers delayed by transfer market share

TABLE 2 POSSIBLE DATA FOR THREE MANAGEMENT SYSTEMS (continued)

Component	Congestion	Public Transit	Intermodal
Time or Cost to Use the System	person hours of delay vehicle hours of delay average speed peak period speed average travel time: peak and off-peak proportion of travel time under congestion or delayed parking cost	headway average speed wait time transfer time operating cost walking distance parking cost	transfer time-peak and off peak headway average travel time of freight during peak and off peak transfer cost
Location or Area of Interest	central city suburbs suburban fringe specific functional class coordinates for GIS	routes lines transfer points	intercity intracity international transfer points routes and lines
SOURCES OF DATA: Primary Sources	traffic counting programs travel time surveys home interview surveys employer surveys vehicle occupancy counts screen line counts cordon surveys surveys at activity centers vehicle class. counts parking inventories site impact studies computerized signal systems	on board surveys employer surveys surveys at activity centers	on board surveys employer surveys surveys at intermodal centers travel time surveys shipping surveys
Secondary Sources	Census Data system inventories HPMS	Section 15 data	census data section 15 data system inventories (harbor, airport, railroad) truck inventory and use survey

TRANSIT NEEDS FOR PLANNING PURPOSES

Ron Jensen-Fisher, Federal Transit Administration

Transit planning data needs, which represents an important building block in the data that will be required for the management systems, include data for policy, finance, and evaluation. There will be some interrelationship and overlap among three types, as well as with the management system oriented data and the specifics on condition and performance. These relationships are important as we go through.

Basically, what is being presented are two building blocks from a transit perspective--data for operations planning and data for long-range planning for transit. These represent the responsibility of the transit operator, primarily, as well as the MPO, in developing information for its own use, as well as for use by the states and the MPOs in the development of the management systems.

The first is operations planning. In general, it is a back to the basics approach, as well as an approach with some new issues that are coming up as we implement the requirements of ISTEA and the Clean Air Act. We need data for the near term management of the transit system. We need data to continually monitor transit system performance and make changes in the system in order to maximum the efficiency and effectiveness of that system. The information on performance consists of on-time performance, ridership data, fare data, costs, service, and so on.

The most problematic of these has been data on ridership. Complete data on ridership is necessary to make the adjustments in transit routes so that the services best respond to rider needs and operate efficiently. Adjustments include changes in service frequency, duration, stop location and density, route alignment, and the interaction with other routes.

It's been our experience over the last few years that operators have ceased collecting these data through sources, such as ride checks or standing load checks, which are the customary ways of tracking ridership. It's becoming more and more critical for these data to be collected and for transit operators to reinstitute continuous data collection along these lines, as well as supplementing that information with surveys, such as on-board surveys, to provide more detail information.

The 1990 Census information and the availability of the TIGER files allow route planners to now extract information on detailed socioeconomic characteristics of the ridership base, that is, the population around the transit stops. This detailed information relates to the potential transit market, which, coupled with the patronage data, already forms a strong base to make route refinements. It also allows the development of route level patronage models. The development of this kind of information provides the operator with an ability to forecast, as well as to simply respond to existing transit ridership.

Technology is also playing an increasing role in the collection of route level data. Passenger counters, automated fare collection boxes, and real time location systems through innovations, such as the advanced public transportation systems which allow voluminous amounts of data to be collected.

This is a good news, bad news situation. The good news is that more and more data are now becoming available. The bad news is that a significant effort is required to process their data so that they can be used in a meaningful way. The paradox is that effective route analysis requires a lot of data which we have the technology to capture, but which is extremely difficult to digest even with the more sophisticated data management systems that are now available.

Agencies that do collect data, that are conducting these on-board ride checks or point checks, or that have passenger counters or automated fare collection systems, collect reams of data on passenger boarding, location, on-time performance, fare payment, and then come to realize that they don't have the capability to analyze the data.

There's a clear need for methods and techniques to transform the volumes of data which are now available from the automated techniques into formats that can serve effective route planning.

The geographic information systems offer great potential to facilitate assimilation of the data, but experience in their use is limited. Transit operators should look at these techniques to develop better information.

A similar problem exists with the management of maintenance information. Systems have been created which allow for the development of considerable data on bus and rail car maintenance, that is, data on the maintenance history of specific vehicles, but so far it has not been our experience that the data have been fully utilized.

What we don't have in many of these cases is historical data for a number of years on which to compare the data that are being collected. An example illustrates this point. A number of years ago, TRB was asked to undertake an investigation of the useful life of a bus--an issue of considerable import to us in terms of our policy with respect to how we replace vehicles and in terms of providing federal support. Data were to be based on life cycle costing in order to determine the optimal time to replace a bus, but there was little historical data available at the time. So, we were unable

to get specific maintenance recommendations out of this study.

Now that maintenance management systems are becoming more available, it's likely that this kind of information will be available as the years of data become accumulated. However, the challenge remains assimilating the information and then using it in a way that makes sense.

Another important area--and this ties directly to the issue of management systems and the relationship to operations planning and management systems--is the increasing amount of assets that transit operators have accumulated over the last several years, particularly with the availability of federal assistance, but also with the growing availability of state and local assistance.

Systems have expanded, and new assets have been acquired. At the same time, there remains the enormous rehabilitation needs and the need to maintain the system that's in-place. The management system makes sense for transit operators, and it's going to be important for transit operators to participate in the development of those management systems by the creation of data on transit equipment and facilities in terms of condition, performance, and need.

The system needs to monitor the physical state of equipment and facilities, evaluate how well the system is serving the public, and identify actions to maintain the system to local standards. By identifying the condition of transit assets, adequate planning for proper maintenance and replacements can also occur.

Regarding the issue of long-range planning, it's clear that there's a continued concern about the process of developing plans for major capital investment in terms of the costs, which tend to be underestimated, and ridership, which tends to be overestimated. It's clear that there's a need for improved modeling in order to get more accurate estimates. The current state of the practice is an important place to start.

For most point models, most urbanized areas tend to use models borrowed from other cities. The borrowed models are validated on local data and adjusted, as necessary. It's becoming more and more apparent that if we're going to get accurate forecasts, we need more mode split models that are based on local behavior characteristics and more sophisticated than those in the past. While it's more time consuming and costly, using local data is the only way we can ensure that models are sensitive to local travel habits, and maybe even more important, the coding conventions behind the way the models are actually operated.

These estimation techniques also need to recognize aspects of travel demand that have not been addressed well in the past. We need larger samples of survey trip data or, at a minimum, targeted samples.

Some of the examples of the issues that the models need to be sensitive to include: 1) sensitivities to the travel characteristics of three different groups of travelers; 2) those travelers with different socioeconomic characteristics; and 3) those which receive parking subsidies. The last group is becoming more important when it comes to modeling travel to the CBD. It is becoming more and more clear as we look at this issue that parking subsidies and the whole issue of who's paying for parking on a specific trip make a much bigger difference in terms of travel behavior than I think we recognized in the past. Somebody else pays is simply the situation. Recent analysis of the nationwide personal transportation survey shows that 95 percent of those who drive to work do not pay to park. It's not quite so high in central business districts, and a lot of that is the result of increased suburbanization, but the numbers are clear and that makes a very big difference in travel behavior on the trip-to-work basis.

Traditional model estimations have not differentiated the markets because limited samples of survey information were available. This results in models that may not, for example, adequately show the correlation between parking costs and mode share because the models were based on assumptions that everyone pays for parking, which, at this point, is clearly no longer the case, if it ever was.

The problem is compounded by poor information on parking costs of people who do pay market rates. Similarly, the models may not accurately portray a particular income group's sensitivity to transit changes. With more emphasis in air quality and congestion being paid to matters, such as increases in parking costs and increases in transit services, we need to better understand the relationship of those changes in transit demand.

We also need to collect more data to accurately understand the sensitivities of the nonwork transit market, and, as the share of total travel represented by the work trip decreases over the years, this is becoming increasingly important.

The current state of the mode split models is that there's only a weak correlation between the causal variables that have been identified in transit demand in the non-work market. There is a need to examine possible other model forms, such as direct demand estimation, or again place more emphasis on market segmentation to look at this demand.

Recent research also suggests that the burden of transferring in a transit trip is much more important than our models estimate. Fixed guideway forecasts frequently indicate that as many as 80 percent of a rail

system will access the system using foot or bus. This is at variance with experience showing that 20 to 30 percent of rail patrons access rail by bus, and recent research indicates that transfer penalties could be as high as 20 minutes of in-vehicle time, which is a significant amount of sensitivity to transferring.

In order to better understand this phenomenon, we need more detailed transit networks, market segments, and information on path choice. In other words, we need better data on the way transit trips are actually made so that the models can be made sensitive to those realities.

While the data for estimation of models are important, we need better data on current transit usage to properly validate the models. The obvious question related to this is how can we have faith in our model's ability to predict the future if we cannot demonstrate and reasonably replicate what is happening now? Many transit agencies have not conducted systemwide on-bus surveys for years, or if they have, they've been done so for purposes other than model validation.

We need carefully developed surveys so that they're useful for the modeling process. They must be rich enough that they allow for model validation at a reasonable level of detail. The bottom line is that we must be able to do a validation in a more detailed way than just simply checking screen lines and systemwide totals.

With the considerable interest in fixed guideway systems, we need better data describing the patrons using existing systems. This goes back to the actual performance, validation, and evaluation issues.

What's the nature of trip making with respect to mode of access, trip purpose, time of day? These are basic modeling issues, and the data are fairly easy to get because it's much easier to collect data on a fixed guideway system than it is in a bus system.

We have some data on "park and ride" and "kiss and ride," but the remainder of the transit system has little information. We spend hundreds of millions of dollars building rail systems and then don't spend very much at all on collecting information on their actual usage.

To further enhance the credibility of modeling systems, we also need time series validation of the models. Modelers from other disciplines can't believe we rely on models that have not been validated in this way. It's clear that this is a fundamental issue.

Such data exercises are rarely done because data get lost, data are not understood, and staff turns over.

To accomplish time series validation, we need to fully document the data we collect so that it can be easily retrieved and understood and used for time series validation.

Finally, we need better accounting of the capital costs of major transit projects. Current construction costs of rail projects are compiled for each project based on bid contracts. Because each rail project has contracts containing different components, it's frequently difficult, if not impossible, to make comparisons between different projects. The result is we do not have basic costs to develop even coarse estimates of major projects, particularly for the so-called soft costs, and it is becoming clearer and clearer that this is an important issue in the cost modeling process.

The costs of preliminary engineering, final design, construction management, construction insurance, local work force, and project start-up are not easily gathered, but where we have gathered the information, it indicates that the costs are as much as 40 percent of the total project costs. That's a startling number. We need to track these costs for construction projects much more carefully.

In summary, there are two areas--operations planning and long-range planning. In the operations planning area, we need ongoing ridership data. We need to derive data to support root level patronage modeling. We need better data management techniques to take advantage of all the data we can collect from the technology that's now becoming available. We need to look at the maintenance management data that are now being collected and we also need to collect the condition data for the management systems.

On the long-range planning side, the mode split models need additional sensitivity to specific markets. We need to look at non-work travel. We need to look at validating our models, both current travel patterns on a time series basis, and we need better data on the capital costs of transit systems as they're actually constructed.

DISCUSSANTS

Edward J. Boyle, Caltrans, James Reichart, Orange County Transit Authority, and Ed Christopher, Chicago Area Transit Study

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Edward J. Boyle

Caltrans is in the process of letting contracts for the data collection and planning work needed by the state. In the contract, the state will not be specifying what kinds of data to collect. They are just interested in the results to satisfy their present needs. However, the overall systems are not defined by Caltrans. The bids are still being prepared by consultants and the contracts will be let by the end of the year.

Regarding air pollution, most traffic in the Bay area is at a slow speed, not at the over 55 mph which has shown to emit more emissions. The state will develop

an intermodal system according to the states needs. California has their own system data base for planning. It has not used the HPMS data in the past.

In California, the state is interested in all travel on air, land, and water. Caltrans is concerned with the movement of all people and goods. They not only need data on the links of transport, but they also need data on the connections. Connectors are important for all modes of travel, as well as to safety, efficiency, and economics factors. These are performance-based measures. Common denominators are required to allow evaluation between modes of travel and to compare mode equality in both performance and cost. Data needs for public transit will also be designed and carried out by the winning consultant including fixed guideway management systems.

James Reichart

Issues identified by Reichert include:

What data can we collect in the smart bus and smart car program? Vehicle location? Where are the congestion points in the system? Are rideshare matching programs needed as part of the transit information system? What is available? When will it be available? How can we access it? What information does the rider want and need to encourage their use of transit? What is a good pricing policy for the entire transportation system?

There are impacts for fitting transit into the air quality control system that will include buses and the fuel that they use.

A better job needs to be done in analyzing the data that we collect. How is it possible to make some operational decisions without the analysis of the data collected? More information is needed on mode split. Ridership is generally inflated. Better O/D data is needed and some criteria are needed to update it. Land use information is important.

What types of densities are required to make transit work? There is also a need for long-range financial planning.

Better traffic counts are needed for intersections in order to time the signals better.

Ed Christopher

The basic management system for the Chicago area is a bottom-up approach.

The CATS Policy Board represents many constituencies in the Chicago area. There are many implementing and funding agencies involved in the process. The staff of CATS is currently a group of 42 people, not the staff of 97 that CATS once employed. The staff is the travel forecasting experts of the area. They work in a participatory and conscientious process. They have years of project development and programming experience.

The data program has been developed to support the travel forecasting activities and special studies. It is a bottom-up approach through the local governments as witnessed through the operations "green light" program. It is based on a strategic regional arterial system. The process is to identify the links and then identify the problem.

Lots of data are collected in the region by different agencies and governments. All these data are not centralized or "management systemized." In order to cut down on confusion, it is necessary to be clear on who does what data collection. For the traffic congestion management system, it is necessary to publish system guidelines and definitions.

WORKSHOP REPORTS

Alvin R. Luedecke, Texas Department of Transportation, and Gordon Shunk, Texas Transportation Institute

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The workshop began with the realization that there are several management systems (ISTEA) that no one really knows exactly what they are, what they are going to be, or what the impacts are going to be.

In determining responsibility, (states/MPOs) the group realized that there was such a variety of relationships between states and MPOs (due to personnel constraints and funding constraints) that the bottom line is that it is a joint effort—a shared responsibility.

The workshop tried to stay focused on data issues as opposed to the policy issues. Data are simply the fuel for an operational administrative process. The workshop recognized that it is necessary to get proper data that will fuel the process and do it in a reliable way for decision makers that have to deal with the consequences.

The workshop focused on three management systems in ISTEA--congestion, transit, and intermodal.

Elements discussed included:

Congestion Management

- Surveys—O/D surveys, link level surveys; person vehicle trips; special generator surveys; parking supply and costs; and freight movements.

- Monitoring—time and speed performance of various facilities; physical attributes; vehicle

classification and occupancy; and time of day.

- Forecasting—projection of land use and traffic volumes.

- Survey Analysis—intersection traffic capacity; incident delays; cost-benefit analysis; and TSM measures.

Transit

- Surveys—intercity transit on-board surveys; attitudinal and population/employment within walking distance; land use density; and parking surveys.

- Monitoring—equipment inventory; ridership; vehicle ownership; comparative travel time and efficiency of service; service by modes and types; fare structure and operating costs; physical inventory—park and ride lots and special events; market share; and accidents and incidents.

- Forecast—forecast of ridership.

- Analysis—incentive programs/promotions; capital costs; safety and security; number of transfers and relative delays.

Intermodal

- Surveys—alternative modes (definition of intermodal - interfacing of various modes); varieties of modes; service area; regulating environment for each mode; commodity movement; number of terminals (train stations, ports, airports); production and consumption; network attributes.

- Monitoring—interconnection at terminals and how well they are performing and what their needs are. Market share by commodities that were being affected by those various modes; time profile—a peaking, or efficiency, or a measure of when you need to apply and mix; mode capacity.

- Forecasting—market share at each of the various modes to effect any changes on a timely basis; what the interconnection is going to be; and what the commodity movements are in the future; time and costs.

- System Analysis—comparative time and costs and the link connection between the modes; funding availability by mode either from public or private agencies.

National Highway System

- Surveys—area boundary and functional class; access control on the highway system; corridor preservation; and in urban areas parallel reliever arterials from a congestion management point-of-view.

- Monitoring—volume classification, performance volume capacity ratios; financial plan resources and innovative funding; maintenance and operation costs; revenue sources; capital costs; depreciation and interest rates.

- Forecasts—tax base trends; mode forecasts; maintenance and operation costs; congestion pricing.

HPMS

- HPMS was looked at as a national measure of how well we are doing, not necessarily one that you would use at the local level or necessarily at the state level. In Texas, they are using it with anincreased sample rate to do strategic planning which has received mixed support. No suggestions were put forth by the workshop to suggest changes or additions.

Other conclusions reached by the workshop include:

- A great deal of data coming out of congestion and intermodal systems is going to be from other sources.

- Employment data—accessing information poses a problem. Work is needed at the state level to provide a data base.

- Ability to collect data—is limited by resources both human and dollars. Both are major limitations to the development of an effective data management program.

PANEL ON DATA NEEDS FOR TRANSPORTATION POLICY, FINANCE, AND EVALUATION

Larry Hammel, New York Metropolitan Transportation Commission, moderator

DATA FOR POLICY USE: THE IMPACTS OF ISTEA ON DATA COLLECTION

Madeleine S. Bloom, Federal Highway Administration

INTRODUCTION

The transportation community, including the Federal Highway Administration (FHWA), relies on data to carry out many of its most basic functions including policy development, strategic and program planning, and program and project management. These data have been collected through a number of data systems within FHWA including the Highway Performance Monitoring System (HPMS), the Highway Statistics information programs, the National Bridge Inventory (NBI), and the Fiscal Management Information System (FMIS). In addition to these FHWA systems, states and local governments supported by organizations, such as the American Association of state Highway and Transportation Officials have developed data systems to meet their own needs.

The passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provides many challenges and requires a reevaluation of both data needs and the mechanisms for data collection. The challenge is to identify what data are needed to do policy analysis, to develop strategic plans, to develop transportation improvement programs, and to evaluate how well the program is accomplishing the objectives of ISTEA. This must be done without creating a data reporting nightmare both in terms of the number of data items and in a proliferation of data reporting systems.

This panel was charged with covering transportation policy, finance, and evaluation. Obviously, this encompasses an immense amount of territory. Moreover, by implication, it covers the decision components of the entire planning process. The central question is how we effectively incorporate the mandates of ISTEA into the state and local policy process. In some respects the policy process, given that one of its functions includes goal setting, has a role in defining the basic requirements that are to be addressed in the other panel sessions.

IMPACT OF ISTEA ON EXISTING DATA COLLECTION SYSTEMS

The ISTEA includes a number of provisions that will directly impact what data needs to be collected and how it is collected. The old Federal-aid systems are replaced by the National Highway System. A new, highly flexible program, the Surface Transportation Program (STP) is provided. For the first time a significant amount of Federal-aid highway funds can be spent on non-highway projects and on increased highway maintenance type activities.

There is a new requirement for statewide planning. Also, Metropolitan Planning Organizations are given an enhanced role in both planning and project selection. Increased coordination of highway programs with Clean Air Act requirements and transit plans and programs is required. The state must develop, establish, and implement six management systems including one for intermodal transportation facilities and systems. Under the Surface Transportation Program, project-by-project review by FHWA may be eliminated. The ISTEA also allows the comingling of Federal-aid with tolls; permits the conversion of free Federal-aid facilities to toll facilities following major reconstruction; and provides for loans reimbursed by Federal-aid from states to private toll entities. These changes will have significant implications for future data needs and collection.

National Highway System

The National Highway System (NHS) is a prime focus of interest at the national level. The need for project-level data by the FHWA will continue or even expand on this system regardless of the source of the funding, or what Federal-aid program funds an improvement. The primary source for this data is, and will continue to be, the Fiscal Management Information System (FMIS). This is the system that tracks the funding of Federal-aid projects. Since this information system is already in place, there will probably be less change for NHS than for other programs, such as the STP.

Certain inventory items will always be needed for the NHS, such as mileage, number of lanes, access control, travel, and special designations such as the national truck network or access to military facilities. Initially, as part of the functional reclassification and NHS designation process, the route log furnished by the states to provide route-specific data will include these essential items. In time, the HPMS data base will effectively cover the NHS inventory requirements.

Surface Transportation Program

Because of the shift from project level review by FHWA for some programs, such as the Surface Transportation Program (STP), project data may no longer be readily available to FHWA. A new approach will be needed to obtain the information required for reporting to the Congress for these programs. The FHWA must determine what are the minimum data requirements that will meet its needs. Reporting may be based more on where the money is spent than on the FHWA funding source. A broad picture of the use and results of the program funds are needed, rather than detailed data.

Multimodal Focus

The ISTEA has provided a substantial push to give a multimodal focus to all aspects of the Federal-aid programs. This includes the need for a multimodal focus on data collection. What data will be needed to give a multimodal focus to conditions and performance evaluation? What data will be needed to support future tools to evaluate cross-modal alternatives? Data needs will undoubtedly include more detailed information on total trip times when several modes are used for a trip, and on what modes are used in transporting commodities.

The old process had categories of funding as a guide to spending. Under the new process, different mechanisms to evaluate needs and compare alternatives among the modes will be needed. The data demands of these new mechanisms may be substantial.

At the Federal level, the new Bureau of Transportation Statistics, established by the ISTEA, is expected to serve as a clearinghouse for this type of data and as an advocate for uniformity and data quality. It will become the focus of data interpretation for all modes and will provide a resource for establishing an information base for all modes, not now available at one organizational point.

CONDITIONS AND PERFORMANCE REPORT

Data collected from the HPMS and the highway statistics reporting system are used to prepare the biennial report to Congress on the conditions and performance of the Nation's highways and bridges. The 1993 Conditions and Performance Report to the Congress will be a report not only on the conditions of the highway systems, but will include the Federal Transit Administration (FTA) report on the needs and status of transit in the nation. This report is a first step toward a truly combined report to address all surface transportation needs. Among the issues that have surfaced in our discussions with FTA on the combined report include the lack of data systems for transit comparable to the HPMS and the highway statistical reporting system, and different definitions of needs.

Use of the Highway Economic Requirements System (HERS)

For the first time in the 1993 Conditions and Performance Report to the Congress, we anticipate using a methodology that overtly applies economic procedures to estimating highway needs. This is the beginning of looking at the highway transportation picture from a broader perspective. It will do more than estimate highway needs based on engineering criteria. It will explicitly address the consideration of user costs in making highway improvement decisions.

This is only a beginning. In the future,, procedures must be developed to consider the optimum mix of modes to address transportation requirements. Tools to provide cross-modal comparisons must be developed. This also has implications for future data needs.

FINANCE

Within FHWA we have been focusing on the impact of some of these changes on the HPMS, the highway statistics reporting system, and the FMIS. The HPMS is a joint effort of the federal, state, and local governments. It provides universe data on the physical condition of the highway system including mileage, travel, accidents, land area, population, and travel activity by vehicle type.

The highway statistics reporting system relies on the states to provide data on motor fuel consumption, vehicle usage, licenses issued, and finance data by state and, in the case of finance data, by local government. The major impact of the ISTEA on this system is in the area of finance. On the revenue side of the picture, increased importance needs to be given to the collection of data on the newer revenue sources such as assessment fees and developer exactions and the changing role of the private sector in providing funding for roads. Reporting on expenditures needs to include a revised list of improvement types both to reflect changes in eligible activities under the Federal-aid program and in the kinds of activities being financed from state highway funds. The emphasis has been on construction; in the future, we will need to have better data on funding for management systems and maintenance activities.

The primary function of the FMIS is to track how money appropriated under the legislation is used. It provides us with the data we need to report on program

accomplishments, evaluate their success in meeting program objectives, and develop new policy initiatives. Historically, FMIS has relied on a project based reporting system to identify sources of funding by program and the amount of money spent on different types of improvements, such as new construction, reconstruction, and safety.

With the elimination of the requirement for project-by-project review by FHWA for activities under the STP, the ability to collect this data for some projects has been eliminated. We have developed an alternative annual report for use in monitoring spending of Federal-aid funds from the STP on improvements that are not on the NHS that is currently being reviewed by our field offices and the states.

In addition to requiring a change in the data reporting system, ISTEA also requires a change in the data items included in the FMIS to allow FHWA to assess how the funds are being spent on newly eligible activities including transit and public/private toll road facilities. We are currently working to update the FMIS to include these data items.

There is also particular interest in the following questions:

- To what extent are highway funds used for transit?
- On what functional systems or types of facilities are STP funds spent?
- Are toll facilities--new and conversions--receiving funds?
- How can we get a handle on private investment in highways?

A SEAMLESS SYSTEM—State/local data needs

Many of FHWA's data needs are also found at the state and local level. state and local governments need data to develop their own policies and programs for transportation, and to evaluate their success in meeting their surface transportation objectives. They need to maintain financial reporting systems both for their own use and to meet FHWA reporting requirements. They need data to develop transportation plans.

The ISTEA requirements for statewide intermodal planning and the development of management systems add additional data needs. One issue will be how to assure that the management systems required by ISTEA will support state and local policy, planning, and programming needs, which is their primary purpose, rather than just supporting a Washington-mandated report with no value to the local process. While some of the data to support the management systems is already being collected, there are undoubtedly large gaps in the data base needed for these kinds of activities, including data for nonhighway modes comparable to what is now available for highways, data on travel patterns, data on how modal choices are made, and data on the impact of pricing policies.

Meeting the requirements of the Clean Air Act will require states and local governments to develop innovative plans and management systems designed to reduce the impact of transportation systems on the environment. In order to develop and carry out these plans, more data is needed on the impact of various strategies on traffic congestion.

Other issues that may come to the fore include:

- New transportation technologies such as automated highways and IVHS--What data will be required to track the progress of these new technologies?
- NHS as a national truck route--How will the NHS and the existing National Truck Network be rationalized? How will we track this process? What data on heavy truck travel will be needed?
- New data technology--Will it make old data systems obsolete? What is the time horizon for the widespread use of automatic collection of pavement condition and distress data, automatic collection of traffic data, and the electronic transmission of data for immediate analysis?

POLICY APPLICATIONS—TODAY AND FUTURE

What Needs To Be Done

The surface transportation community must ensure that data will be collected as economically and efficiently as possible and that the data will be reliable. Some of the questions that need to be considered include:

- Are there overlapping data requirements that could be met with one reporting system?
- Are there existing sources for the data needed?
- When is it reasonable to try to collect universe data and when should a statistically valid sampling system be considered?

- Can the existing electronic data collection system and data bases be better integrated?

- How can disaggregated data now being collected from the states by FHWA be made more available to researchers and policy analysts? Currently, most of the data is only available in an aggregated format in Highway Statistics.

- Does there need to be standard definition of some of the terminology used to ensure that the interpretation of the data is valid? For example, the definitions for types of improvements vary from one data system to another, the term "project" has no clearly defined parameters, etc.

- How often does the data base need to be updated?

Future Federal Legislation

In view of the changes in emphasis under ISTEA, the reporting requirements for systems or programs of lesser Federal interest should be examined. How much data are required to provide the necessary program or system evaluations to the Congress and other decision makers and policy makers? What data are needed to supply the information required to determine the effects of ISTEA? Can the data be sample based? What level of statistical reliability is required?

What is ahead for future Federal legislation? How well we monitor the effects of ISTEA may well affect the course of future legislation. While the Federal role is changing, the need to monitor and track the effects of program efforts are extremely important for future legislation, including adjustments to existing legislation.

- Will surface transportation modes work closer together?

- Will they merge into a single surface transportation agency at the Federal level?

- Will there be a growth of funding? From what sources? How will the effective use of ISTEA funding flexibility affect future legislation?

- What changes will there be in fuel tax or other transportation taxes? How will use of ISTEA programs and the added flexibility of funding applications influence future tax rates and sources?

- What program performance measures will be available? The amount of dollars obligated or number of bridges rehabilitated are not enough. What did these expenditures and rehabilitated bridges do for us?

Those are some of the issues to be faced by this forum and by all leaders in the transportation field--at the Federal level, the state level, and at the local level. Increasingly, "funds utilized" is not seen as an adequate measure. The focus is now on "service delivery" which depends not only on physical capacity but also on quality of operation and level of service demand. Quality measurements typically include accessibility, reliability, safety, and congestion. Additionally, measures of economic performance, such as employment generated and contributions to productivity, are gaining in significance. The indicators for measuring ISTEA achievement must include both service oriented features, and economic efficiency and productivity measures. While today will not provide all of the answers, we hope that we will be able to suggest issues for further consideration and approaches to the solutions we are all seeking.

DATA NEEDS FOR TRANSIT POLICY, FINANCE, AND EVALUATION

Richard P. Steinmann, Federal Transit Administration

INTRODUCTION

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) presents transportation decision makers with wide-ranging new flexibility in the allocation of Federal surface transportation assistance. As a result, the analysis of transportation policy options has taken on added importance. Transportation decision makers now may allocate funds to the "best" project or program, with much less in the way of strings attached in terms of categorical program restrictions. The issue then becomes defining what is the "best" use of these flexible resources. And this is where policy analysis comes in -- to provide decision makers with information on the impacts of alternative policies, in order to allow them to make these decisions.

This paper will outline a number of areas in which improved information is needed to guide transit policy decision-making. The transit policy analyst needs information and data in at least the following five areas: 1) system condition, 2) system performance, 3) the

impact of past investments and policy choices, 4) finance and 5) a variety of strategic issues.

In the past, the transit policy analyst could focus attention on the transit aspects of each of these issue areas alone. Today, with the enhanced flexibility of funding provided by the ISTEA, and the increasing emphasis on intermodal planning and on policies which effect more than one mode, it is becoming increasingly important to view these issues in multi-modal terms.

Transit System Condition

A basic set of information for transit policy analysis is a physical inventory of the transit infrastructure. The analogy from highways is the data collected for the Highway Performance and Monitoring System (HPMS). The system is comprehensive and includes both an overall inventory as well as information from a sample of highways on the physical condition and operating performance of the highway system. A key feature of HPMS is that physical condition and operating performance are reported on the basis of consistent definitions (i.e., pavement ratings and level of service). At the present time, data on transit system condition is not as systematic.

Section 15 data, collected from each publicly-sponsored transit operator, includes counts of the number of vehicles by age and their cumulative and annual usage. In addition, it includes counts of maintenance facilities and the quantities of other physical assets, such as track and stations.

While state and local governments can use Section 15 data, supplemented by their own inventories, to track the amount of transit infrastructure in place, these data include no information on the physical condition of these assets. As noted, data on vehicle age are collected, and age is a reasonable surrogate for the condition of these vehicles (and the need for their replacement). However, for a complete picture of transit system condition, more information is needed.

For rail transit systems, the Rail Modernization Study, conducted for the Urban Mass Transportation Administration (UMTA - now Federal Transit Administration, FTA), included detailed surveys of the physical condition of these systems. These surveys were conducted on a 15 percent sample basis and were based on consistent definitions of conditions. This study thus forms a useful basis for estimating the overall condition of the rail systems.

The Rail Modernization Study surveys were conducted in 1983-84 and are clearly dated. As a result, FTA is now conducting an update of this study. New engineering inspections are not included. Rather, transit operators have been asked to provide updated estimates of the conditions of their systems based on the improvements actually made since the study surveys were first conducted. We expect the results of this analysis shortly.

This information will be available to state and local governments for their own use. However, while we find data at this level to be adequate for national policy analysis purposes, there may be a need for state and local agencies with an interest in rail modernization to conduct more detailed, or more recent, inspections of the physical conditions of the rail systems of interest. We are aware of a number of such efforts now underway.

Data for bus system conditions are not as systematic. As noted, vehicle age data are available and can be used as a surrogate for fleet conditions. We have found this to be adequate for national level policy analysis purposes. However, at the state or local level, additional detail may be useful, and actual physical inspections of vehicle conditions may be in order in certain circumstances.

Data on bus maintenance facilities are even less readily available. While Section 15 data exist on the number of such facilities, the data do not provide any information on the size or conditions of these facilities. FTA is now undertaking a study to provide additional information in this area. The study should be complete by the end of 1992. This should provide a good snap-shot picture for maintenance facilities. However, at the state and local level, additional detailed information may be useful, as would continuing collection of data in order to track facility condition over a longer period.

Transit System Performance

A second basic set of information for transit policy analysis is data on current transit system performance. Again the analogy from highways is the data collected for the Highway Performance and Monitoring System (HPMS) which includes extensive data on highway system performance in the form of data on highway level of service. Level of service for highways is well defined, the result of years of research on the relationship between traffic volume and highway physical characteristics of vehicle speed and ride quality. In addition, years of research are available on the effect of changes in traffic volume on a variety of economic and other impacts of highway travel.

Transit system performance itself has several dimensions. These include economic performance (cost, patronage, service levels and their interrelationships), service quality, and user characteristics. Each of these dimensions is discussed below.

Economic Performance

The information on transit performance which is most readily available is on economic performance.
Section 15 data are available on the amount of transit service provided (e.g., revenue vehicle miles and hours), the amount of transit service consumed (passenger miles and unlinked trips) and on the cost to provide the service. These data permit computation of a wide variety of measures of transit economic performance. In the national reporting of economic performance contained in the FTA reports to Congress required by Section 308 of Title 49, United States Code, economic performance has been defined in terms of efficiency (cost per revenue vehicle hour), effectiveness (passenger-miles per revenue vehicle hour) and cost-effectiveness (cost per passenger-mile). Many other similar measures can be calculated using Section 15 data.

While this information is readily available at the system-wide level, it is not readily available outside transit operators themselves at disaggregate levels. Recent analysis for FTA, which will be reported on in the forthcoming Section 308 report, confirms the view that there are substantial variations of economic performance between various types of transit service and that these variations are masked by use of system-level performance measurement. The FTA analysis breaks down transit services into the following types: 1) local, 2) radial, 3) express/limited, 4) crosstown, 5) feeder and 6) suburban. Other typologies may make more sense in specific local cases. The wide variation in performance between these service types suggests the need to continue efforts to look at transit economic performance more closely, and for state and local policy analysts to develop more detailed disaggregated data.

Another way to look at transit service is by the market it serves. In the forthcoming Section 308 Report, FTA identifies three primary markets for transit: 1) general mobility for residents of central cities with intensive transit systems, 2) work trips with one end in the central cities and 3) general mobility for people with limited access to automobiles. Again, there may be other ways to structure the transit market. Transit services are likely to have the same sort of variations in economic performance in serving these varied markets as they do for various service types. While it is sometimes difficult to match the service provided with the markets served, it is clear that attention to the markets served would provide a more accurate picture of transit economic performance than does analysis at the system-wide level. state and local analysts may find it useful to assess their services in market terms, and to collect the data needed to support such analyses.

Service Quality

While data on economic performance is readily available, at least at the system-wide level, much less information is available on service quality. In addition, while the analogous factor on highways is clearly defined using level of service concepts, no similar concept has the same long-standing basis in transit.

Service quality is important because it defines one of the key features of the attractiveness of transit to the potential user and thus has an effect on the amount of transit use that will be achieved by investments in transit capacity. In addition, in the absence of information on service quality, analyses of transit performance have tended to focus exclusively on economic performance, overemphasizing this aspect of performance.

The factors which go into an analysis of transit level of service include things like waiting time, ride quality, the availability of a seat, the number of transfers required, safety, and the relative travel time compared with other modes. The 1990 Nationwide Personal Transportation Study (NPTS) included a number of questions which related to the quality of transit trips taken. The forthcoming Section 308 Report relies on this information for an aggregate picture of transit service quality. However, the number of questions related to service quality is limited and the relatively small sample of transit trips means that the analysis is limited to only national level aggregation.

For analysis of transit service quality at the state or local level, data on these factors are generally available at the transit operator, sometimes on a route-level, basis. However, this data is not based on standardized definitions nor is it generally available in any more aggregated form. For analysis at the state or local level, additional data would be needed. Clearly additional work is required in the area of transit service quality, at all levels of analysis.

User Characteristics

A key issue in assessing transit performance is information on the characteristics of transit's users. This includes information on demographic characteristics (income, race/ethnic origin, age, gender, etc.), the purpose of the trip being taken, auto ownership and availability and other such factors. Information in this area helps categorize transit's users in order that the markets for transit can be better understood. In addition, such information can also be helpful in providing support for transit in terms of its social function.

For national policy analysis purposes, the 1990 NPTS

provides information on many of these demographic characteristics. The forthcoming Section 308 Report relies on NPTS for an overall picture of the transit user. Again, the size of the NPTS sample prevents its use for analysis at a lower level of aggregation. State and local analysts will require data collected at the operator level in order to provide an accurate picture of user characteristics at specific operators or for operators within a state or urbanized area as a whole. Transit operator on-board surveys can provide this information fairly readily. However, to be useful at any level of aggregation beyond a single operator, uniform definitions and, even, uniform survey questions would be useful.

Multimodal Performance

The preceding discussion has focused exclusively on the performance of transit itself. However, in the current environment of ISTEA and the Clean Air Act Amendments, urban transportation must be and is increasingly being viewed as a multimodal system. Thus, measures of performance which cross modal boundaries are becoming more useful and necessary. Transit policy analysts must be aware of highway system performance. In addition, new measures need to be developed which are multimodal in nature. FTA is now in the initial stages of investigating how a multimodal urban transportation performance monitoring system could be structured. Similar efforts should be undertaken at the state and local level to assess performance broadly and intermodally.

Investment Impacts

Transit system condition and performance relate primarily to the status of the system as it currently exists. A key aspect of transit policy analysis is estimating the impact of alternative investments and policy options. In order to do so, methods and the information needed to support them must be available which can produce reasonable estimates of these impacts. Travel demand forecasting research over the last several years has developed a wide range of models which are designed to forecast the effect of various policy and investment alternatives. Data are needed to support these models and such data are collected in support of the transportation planning process although better information is always helpful.

One area in which much more could be done is in the evaluation of previous investments and policy changes. The Department of Transportation sponsored a major study of the impacts of the Bay Area Rapid Transit System (BART) in the late 1970's. UMTA sponsored more modest analyses of the impacts of the new rail systems in Washington and Atlanta. However, these studies ended in the early 1980's. Since that time, there has been limited efforts to assess the impacts of the investments made later. In addition, the BART, Washington, and Atlanta studies were conducted fairly quickly after the opening of these systems. Thus, they focused on the early impacts of the investments. No real systematic effort has been undertaken to assess the longer term impacts of these systems.

This lack of follow-through on these impact studies is unfortunately the norm rather than the exception when it comes to the evaluation of previous transportation investments. Good investment decision making needs better information on the impact of prior investments. State and local policy analysts should consider the need for collection of such information. Issues which are addressed as a part of these analyses should include 1) quantification of the change in the transportation system due to the investment or policy change, 2) the primary impact of the investment which are the resulting changes in travel patterns (mode choice, time of day distribution of travel, etc.) and the 3) secondary effects of the investment in terms of changes in the impact of the transportation system on the urban environment (noise levels, air quality, congestion, land use patterns, etc.). Continuing efforts are needed to evaluate impacts, and additional resources applied in this area will go a long way to improving our understanding of the transportation system and the impacts on it of investment and policy alternatives.

Finance

Transportation policy analysis is increasingly becoming tied to financial questions. Issues include forecasts of the revenue generated by the sources of funding available for transit operations and capital investments as well as the availability of new financing mechanisms for transit.

The ISTEA changes to the urban transportation planning process and major transit investment criteria add further impetus to this trend. The requirements for a Transportation Improvement Program (TIP) which is financially constrained will make accurate forecasts of the availability of revenues to support the TIP all the more important. In addition, a key part of the transit major investments process is the requirement for a financial plan. The ISTEA changes to the Major Investments Criteria contained in Section 3(i) of the Federal Transit Act provide more specificity on what is required to demonstrate that the project is in fact supported by an adequate degree of local financial commitment.

In essence, transit policy analysts will be called on to make forecasts of a variety of economic conditions in a region in order to forecast revenue. Data will be needed on trends in the tax base and on the factors which affect that base. For example, if a dedicated sales tax forms the basis of a financing plan for a major investment or the TIP, the analyst must be able to make adequate forecasts of retail sales in the region on the basis of changes in population, average income, and other factors. Similarly, each revenue stream in the financial plan will have to be estimated on a similarly well-supported basis. State and local policy analysts will need data on all of those factors which have an impact on these revenue streams.

Transit finance is becoming more complicated with the introduction of a variety of innovative financing approaches. more and more operators are considering alternatives to traditional grant supported pay-as-you-go approaches. In general, these approaches involve use of borrowing to spread the capital costs over the life of the asset. Examples include use of capital leases (rather than up-front purchases) of equipment and facilities, increased use of bond financing and a variety of public-private financing including joint development. Transit policy analysts will need information on the costs and benefits of these methods in order to assess the viability of alternative financing schemes.

Strategic Issues

Transit policy analysis must be conducted with knowledge of the factors in the environment which affect transportation demand. Data is needed on a wide range of such environmental factors and trends. Suburbanization, changes in employment characteristics, improvements in telecommunications, changes in overall income patterns, the aging of the population and other demographic factors all have longer-term impacts on transportation demand. Data are needed by state and local policy analysts on these trends. Such data are generally available from sources like the decennial census. In addition, forecasts of these factors are made by a variety of analysts at the national level. State and local policy analysts need to keep up with information available on such forecasts.

A key issue in transportation policy analysis is the relationship between land use and transportation. While much has been written about these interactions, additional information about the land use impacts of transportation investments would provide analysts with a better basis on which to estimate the overall effect of a number of broader policy options.

As noted earlier, the focus of transportation planning is becoming increasingly multi-modal. Transit policy analysts will need to be more aware of trends in other modes in terms of condition, performance and system growth. Data on highway condition and performance will become an increasingly important element in understanding the effect of transit policy alternatives. In addition, the effect on the transportation system as a whole of certain highway policy alternatives, particularly those related to highway pricing and potential improvements in highway technology (such as Intelligent Vehicle Highway Systems - IVHS) will also become increasing important to transit policy analysts.

Finally, transit is being called on to deal with a number of broader societal goals, such as clean air and accessibility for disabled persons. Transit policy analysts will need information on the costs and other impacts of measures needed to meet the requirements of the Clean Air Act Amendments (such as alternative fuel vehicles) and Americans with Disabilities Act. State and local policy analysts will also need to collect data on the impact of these measures as they are implemented. Continued analysis will be needed to provide information on how to manage continued compliance with these and similar requirements.

CONCLUSION

The environment in which transit policy analysis must be conducted is becoming increasingly complex. Enhanced flexibility of funding from the Federal government, the need to meet requirements such as the Clean Air Act, and growing urban congestion require transportation decision making to be multimodal. Thus, transit policy analysis must have the data and information available to provide the basis on which to assess the impact of a broad range of transportation policy and investment alternatives. Some of these data are already available. Much more could be gathered to support these increased needs.

DISCUSSANTS

Patrick J. McCue, Florida Department of Transportation, and Ronald F. Kirby, Metropolitan Washington Council of Governments

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Patrick J. McCue

Currently, the State of Florida is gaining in population at the rate of 800 persons per day. The immigrants from other states are living all over the state. There are now 27 urbanized areas in the state. The smallest and newest is Spring Hill Lake which is located on U.S. 92. This area does not have a local government available to discuss a cooperative planning process.

In Florida, the populace travel on the Interstate system for their long distance travel. The state is spending more in adding additional lanes than it cost to build the road originally. The state now has a policy not to build any more than 10 lanes on any one corridor. This will be a lane distribution of 2-3-3-2 which is designed to serve Interstate commerce. There is a definite need to let longer trips travel at greater speeds than shorter more local trips. Therefore, with the new design, the express lanes in the center will have very few access and egress points. These express lanes can also serve as carpool lanes in mixed traffic with the longer distance traffic. There needs to be a different approach to serving travel.

There is a need to provide fast public transit alternatives, but it is difficult to provide fast transit. Regarding land use and growth management, the state now has laws in this area and local governments have developed 457 local land use plans. These are available for transportation analysis. These local land use plans will determine the eventual level of service available in that area.

Ronald F. Kirby

Local officials want and need simple measures, not confusing indexes. They understand level of service C. In fact, they invented a new level of service G which means more problems than level of service F.

Travel monitoring data are very specific. Household travel behavior and cordon courts, need to be delivered in a timely manner. These data highlight the problems. Elected officials respond to political issues. They are not like engineering officials who look for the details and specificities. Long term items are not interesting to elected officials. Resident displacement issues are very important. They are interested in development patterns.

One of the questions that continues to arise is the issue of the degree of correlation between transportation improvements and high density development. The issue that must be answered is how much development does a transportation improvement cause?

Land use forecasts are critical to the planning process. Projects will be most affected by significant land use changes. Will the system be better in the future.

There needs to be an air quality performance factor built into both land use and transportation plans. The build/no build decisions can not be determined by air quality analysis and subsequent decisions. The whole plan can only change the air quality in an area by only one percent or less.

There needs to be specific federal guidance in this area of work. Also needed are good practice manuals on how to do planning activities. These are very important, and U.S. DOT should start developing them again.

Our next year's work program will be based on ISTEA of 1991. It was enacted into law December 1992. Final approval of the work program was in March. It will take time to modify work activities and to follow the requirements of the new law. Another problem, will be the retention of staff that have had the experience and education to solve problems. Local government staff do not like the intrusion of the MPO into their perceived responsibility areas. In some cases, the MPO is not welcomed by local government officials.

Finally, there needs to be better knowledge of the interaction between transportation and land use. If transportation and land use are put together right, the need for significant expenditures could be eliminated.

In retrospect, it seems that the federal government policy in the 1980s of delegating responsibility to local governments to certify their own process has proven to be an error.

WORKSHOP REPORTS

Gloria J. Jeff, Michigan Department of Transportation, and Charles Goodman, Federal Highway Administration

Gloria J. Jeff

It's interesting that we've spent all this time talking about the data that we've collected, as opposed to deciding what is the framework in which we need to do it, and what is the importance of having an original vision, a set of goals and objectives, which then, drives what set of data becomes important.

The interesting issue is truly an agent of change that challenges us and gives us choices to make, or is it simply an affirmation of what we've always done? I think the debate over the next 18 to 24 months is going to be interesting because I think the crux of the issue is going to be are we simply doing the same things as we have always done them?

Policy, finance, and evaluation are very mushy kinds of issues in the sense that the management systems are very clear. I mean, you know what you do with bridges. You know what you do with pavement.

We found that there is really no clear division between MPOs and state DOTs. The interesting thing may well be that we have found that in ISTEA one of the changes is indeed the nature of the relationship, that there is not this rigid line of what MPOs do and what states do.

Our first key point is that the various data systems must be integrated between the states and MPOs.

The other key point is that we not only have to be

concerned about how we collect data, but how we translate data into usable statistics and in turn translate that into information. Once we have done that, it becomes important because it becomes the mechanism by which we influence decisions, inform and educate the public, and receive information from the public.

The need also exists to broaden the perspective under which we look at the data that become information and that we had to look at what are the values of the community? What is the mechanism by which we establish what those community or statewide values are?

The euphemism we are utilizing here is the "quality of life" concept. It's a shorthand for a whole range of activities. It's whether or not transportation is a utility Is it a social service, or is it an industry that is just responsible for generating profits and making money? That applies to highways, public transit, marine transit, port, rail, and intercity passenger movements. Just what is it that we're trying to do?

The final point is that it's important that we do trade-offs, that there is no single set of goals that we can all move forward to that are now, somehow or another, self-supporting, that there are trade-offs.

It may well be appropriate today, to decide that the most important decision we make is whether or not we put in an HOV lane on a freeway or add a couple of additional lanes of capacity. The trade-off that we may be making is not between transit in terms of an HOV lane and a freeway additional capacity, but rather, whether or not we're going to provide access to certain members of our society to jobs and opportunities by not dealing with the capacity issue on that particular corridor in which there is automobile movement, but rather, whether or not we provide it to an area that has not traditionally been a provider or recipient of public transportation, or for that matter, any other transport mode.

It goes to the fundamental concept that we are no longer simply dealing with those who use our system, but also with those who are impacted by the quality of our transport system and may, indeed, not be users.

We also need to, as part of the evaluation process, look at the whole question of did we obtain the objectives that we set out to do?

One of the things this industry does very, very well is spend money. You never have to worry about years of unspent obligation authority running around at the end of an authorized period. We will spend money.

The issue has now become what have we bought for the money that we have spent? That becomes a key element. Have we achieved or moved toward a particular set of objectives with the investment? Did the project that we set out to do, indeed, achieve an increase in vehicle occupancy? Did we go from 1.0 riders to 1.5 or 1.6? Were we able to improve the modal split? Were we able to reduce the actual amount of air pollution occurring in a particular area? It is something that we have not traditionally really looked at. We've said, "Did we finish the project on time, within budget?" That became our mechanism of evaluation.

We're going to have to broaden that to look at what are the impacts? What are effects? Did we get what we wanted out of it?

The question of a research agenda was discussed and the outcome included the following items.

- Incident Prediction–the statement was made that about sixty percent of the delay experienced on most urban highway systems is the result of incidents. What are the predictions of incidents? What are the characteristics associated with non-recurring incidents?

- Definition of Needs–we have done a good job of doing deficiency definitions of needs. As we begin to look at multimodal considerations, how do we define needs? It is the carrying capacity of goods or people, or is it something else?

- Surveys–how do you coordinate surveys to make sure the data are replicable and usable to multiple sources?

- Stakeholders-we can no longer simply deal with individuals the way we have always dealt with, in terms of, the "road gang", the "transit gang", and the "planning gang", but we have to expand to a new "gang." That is, the gang of folks who are impacted by the quality of the transport system that we provide, that we have to look at when we talk about the environment, not simply the physical environment. We can talk at great length about air, noise, wetlands, hazardous material sites, historical and cultural preservation activities, but if you say socioeconomic, everybody goes, "Okay. All we need to do is go to the census, and that takes care of it."

  Well, it doesn't. There are examples of where the presence of actions of a high quality transport system has a very real impact on the quality of life an individual has, and a very real impact on the values of the community in which they live.

  I'm sorry I missed the discussion earlier this week in which one of the development community's came in and chatted about the third and fourth order of development, and that it was

indeed motivated, in part, by the whole question of race, the whole concept of the white flight that took place away from many of our central cities. Transportation people cannot sit back and say, "That's not our issue." It is.

I heard a very interesting definition of what transportation was, and that definition was the whole concept that transportation is equal access to the opportunities, both financial and fiscally, of the community, city or nation within which an individual resides.

Notice, it didn't talk about movement by modes. It talked about equal access to opportunities. That's why transportation has to be concerned about the ability of people to get to jobs, to live in particular areas because transportation is a mechanism by which people have access. It doesn't matter how well educated you are. If your skills do not permit you — if you cannot take those skills and get to a place of employment, you're at a total loss to utilize those skills.

Transportation folks now have to realize that we have broadened the group of stakeholders to these individuals for whom the impact of the quality of transport systems is much more important than how many vehicles pass a particular point at any given moment.

- Environmental Survey–picking up on the environmental concept, our group talked about the need for an environmental survey and the need to put together an inventory of the physical environment. Not just those things associated with the social environment we should survey wetlands, endangered species, historical and cultural sites, hazardous material sites, and any other environmental hot spots that may take place in a community.

  Concentration of air pollution impacts, for example, associated with a transit maintenance and cleaning facility within an urbanized area need to be considered. Again, we went back to the concept that one needs to educate, and the key to education is the translation of data into information that can be communicated in a useful and effective way.

Charles Goodman

The integration of the comprehensive plan, land use forecast, and zoning issues are key in the development of forecasts. The interface between the land use plan and the TIP requires a very careful line item budget schedule. The short range element of the long range plan needs to be very carefully developed to ensure the proper timing of growth of the area. There needs to be some procedure to smooth the process between developing a long range plan and the TIP. What criteria should be used for priority setting? It is a major effort to stage the various requirements of a plan. Regional-type data are the least critical of the whole TIP development process. What is really needed is specific data for specific projects. Interim forecasts are critical for product development in the forecasting process.

One of the weakest items in the development of a financial program is determining the cost of different types of projects. Some tracking mechanism needs to be established for this purpose. A cooperative effort between MPOs to determine this may be helpful. How much do projects really cost?

Another element is the education of staff. In the planning arena, there are packaged courses that are available, but sometimes there are needs that should be satisfied that are not covered by such training courses.

There is a need for between community and intercity travel surveys, both people and goods.

A surveillance report should be developed like a report card to determine how well the plan is being achieved. There needs to be some research on land use forecasting. Alternative land use plans need to be developed along various strategies. There is a need for more household surveys as well as employer-based surveys. Hazardous materials mapping--the whole system needs to be organized around a GIS system.

PANEL ON DATA REQUIREMENTS RELATED TO LAND USE, ECONOMIC DEVELOPMENT, AND GROWTH MANAGEMENT

Robert T. Dunphy, Urban Land Institute, moderator

BUSINESS FLEES TO THE URBAN FRINGE

Christopher B. Leinberger, Robert Charles Lesser & Co.

As a direct result of the postindustrial economy that America has been creating over the past couple of decades, the locations of the best-paying new jobs are changing radically. These jobs are now overwhelmingly concentrated in obscure crossroads like King of Prussia (Philadelphia metropolitan area), New Port Beach (Los Angeles area), Tyson's Corner (Washington, D.C., area) and Schaumburg (Chicago area). These new suburbs are fourteen, forty, sixteen and twenty-five miles, respectively, from the central business district.

There are three distinct types of employment in our metropolitan areas, two generally well paying and a third almost always at the bottom of the wage scale. About one-third of metropolitan jobs are with companies that "export" goods and services outside the metro area. These are the highest-paying jobs, injecting fresh cash into the local economy. In Los Angeles, for example, these jobs are in aerospace, defense, software development, entertainment, international trade, oil refining, and a number of other industries. In Seattle, the export industries are aerospace, software development, and international trade; in Philadelphia they include pharmaceuticals, higher education, oil refining, and computer hardware development.

Export jobs in turn create demand for the second type of employment, regional-serving jobs, which include finance, real estate, utilities, the local news media and professional services of various kinds. These represent about a quarter of all jobs in most metropolitan areas and on average pay slightly less well than export jobs. It is important to note that export and regional-serving jobs tend to locate in a few concentrations, variously referred to as urban villages, edge cities, or urban cores. Most large metropolitan areas have ten to thirty urban cores, the downtown being just one of them.

The third category is local-serving jobs, representing about half of all employment and paying the least well. These jobs are located near where people live and include such occupations as schoolteacher, store clerk, police, and local professionals such as neighborhood doctors and "storefront" lawyers. Virtually every job in South Central Los Angeles is-or was-local serving. Following the Watts riots in 1965, most of the export jobs, generally in manufacturing, abandoned the area, leaving only low-wage, local-serving employment.

The export and regional-serving jobs in every metropolitan area in the country have followed the same pattern over the past twenty years. In any metro area in late twentieth-century America, if one knows the layout of the freeway system; where the existing white, upper-middle class lives and where the new white middle-income housing is; and where minority populations are concentrated, one can determine where 80 to 100 percent of the new upwardly mobile export and regional-serving jobs are located. With few exceptions, these high-paying jobs have concentrated in the predominantly white upper-middle and middle-income sections of the metropolitan region, generally on the opposite side of the metro area from the highest concentration of minority housing. Low-income residents and the new high-paying, upwardly mobile export and regional-serving jobs are now located farther apart than ever.

For example, nearly all new export and regional-serving jobs moved north of Atlanta during the 1980s; the vast majority of low-income, black neighborhoods are on the south side of town. In Dallas, nearly all new jobs have been created in the north and northwest quadrants of the metropolitan area; the black and Hispanic populations are concentrated to the east and south. In the Philadelphia metropolitan area, from 1970 to 1990 the number of export and regional-serving jobs that located in the high-income Main Line to the northwest of the city, as well as in the white middle-income areas of lower Bucks County to the northeast and New Jersey to the east, increased by more than 50 percent. The number of these types of jobs in the increasingly black and Hispanic city dropped by 15 percent over the same time period. In Los Angeles-an extremely complex metropolitan area because of its immense size (more than 14 million people) and because it has more growth paths than other metropolitan areas-nearly all new export and regional-serving jobs are created to the west, northwest and southeast during the 1980s. The largest black neighborhood, south of downtown, and the largest Hispanic concentration, the east, are located very close to the center city and quite far from the emerging new job centers in West Los Angeles, Warner Center (northeast) and Newport Beach (southeast).

The reason for this geographic shift in upwardly mobile jobs is that over the past two decades all

metropolitan jobs in the country-with Los Angeles leading the way-have been undergoing a transformation as profound as the metamorphosis of eighteenth-century trading towns into nineteenth-century industrial cities. The shape and size of our metropolitan areas have changed from what, in retrospect, looks like a relatively compact industrial city in the 1950s into the sprawling conurbations of today. The population of the Los Angeles area increased more than four times during the past fifty years, but its geographic size increased by a factor of twenty. Metropolitan Chicago's population increased by just 4 percent in the past two decades, but its size increased by 46 percent.

In the 1990s, the trend of the vast majority of the new export and regional-serving jobs moving to what will soon look like near-in suburbs appears to be ending. The few corporate relocations that have occurred in these recessionary times have been to the even more extreme fringe of our metropolitan areas, generally close to the newest housing developments. J.C. Penney, which left midtown Manhattan in 1988 for several temporary sites in near-in suburban Dallas, is now building a campus-style headquarters in Plano, Texas, as the outermost exurban edge of that metropolitan area, twenty-five miles from downtown and eight miles from its current location. U.S. Borax's headquarters (Los Angeles); IBM's software development facility (Dallas); the R&D facilities for Rohm and Haas, Sterling Drugs and SmithKline Beecham (Philadelphia); and Chryslers's new R&D facility (Detroit) have all been built in equally distant, fringe locations.

The reasons for these moves to the periphery include the need to be near mid-level employee housing during the coming decade because of the projected shortage of skilled labor once the economy revives. A second reason is that the commute for the bosses, who will probably live in the upper and upper-middle income housing areas, such as Philadelphia's Main Line or L.A.'s Newport Beach, will be against traffic, minimizing their inconvenience. A third reason for the move to the fringe is the tremendous difficulty of obtaining government approvals for the large, campus-style office and business parks in near-in suburbs.

But a fourth reason is the desire to escape the crime and the minority work force in the center city, which are now reaching the near-in suburbs as well. In Chicago, Sears is moving its merchandising division to Hoffman Estates, which is unreachable by public transit-twelve miles beyond Schaumburg and thirty-seven miles from the Sears Tower, where it is now located. Although Sears has proposed a vanpool program for employees living in the city, a number of leaders in the Chicago real estate community have privately commented that one of the primary reasons for the move is that the company wants to rid itself of its predominantly black work force in the downtown. This, the theory goes, would allow Sears to hire better-educated employees, probably predominantly white, who live near the 1.9 million square foot campus-style complex. The same motivation may have been behind the other recent corporate moves to the extreme fringe. The trend will only accelerate in Los Angeles as a result of the riots.

If, as many indicators suggest, jobs in the 1990s, particularly the high-paying ones, become available in the extreme fringe of the metropolitan area in the same proportion as they did in the near-in suburban locations over the past two decades, many inner-city residents will be too far away to commute daily to the new exurban ones. In the 1970s and 1980s the new jobs in relatively close-in suburban locations were at least within commuting distance for many city dwellers. The new relocation trend to the extreme fringe will certainly continue, and could accelerate, the post-World War II exodus of the middle class from the center cities, leaving poorer residents behind.

These trends affecting the location of export and regional-serving jobs are firmly imbedded in the economy and real estate market. Short of massive federal and state intervention in the marketplace (an unlikely event that would undoubtedly produce as many problems as it would solve), the trends must be viewed as something that can be influenced but not reversed. However, here are four ideas, tried and proved in this country and Europe, that might ameliorate some of the intended and unintended consequences of the decentralization of our metropolitan areas.

The first is to try to slow down the trend through the kind of holding action by center-city economic development agencies and public/private partnerships, working with those institutions and corporations that have a commitment to the center city. Targeting the existing concentration and export and regional-serving sections of the center city, particularly downtown, these groups must launch programs that increase job training opportunities and enhance security. A well-trained work force and freedom from fear of crime are prerequisites to maintaining the existing job base.

An example of this effort is provided by the more than twenty public/private partnerships in New York City. The Grand Central Partnership, for instance, supplements municipal services in the fifty-three-block section of Manhattan surrounding Grand Central Terminal with its own fifty-person security force, a forty-person sanitation force that sweeps the sidewalks and streets twelve hours a day, and a $2-million-a-year program for the homeless at a former Catholic boys'

school. Hundreds of these "business improvement districts" are now operating in cities throughout the country.

The second strategy is to encourage a regional approach to government, particularly toward tax-sharing. This strategy requires a recognition that the center city cannot-and should not have to-bear the cost of serving the bulk of the metropolitan area's needy. The growing fiscal and social problems of our center cities have been ignored too long by the suburban jurisdictions. Violent and property crime, homelessness, and drug trafficking know no political boundary. These problems have not been magically confined within the center city limits and have resulted in a new trend of declining property values and quality of life for close-in suburbs throughout the country. An example of the kind of tax-sharing needed can be found in the Minneapolis-St. Paul metro area, where 60 percent of new commercial property tax revenues go to the local municipality and 40 percent go to the other metro area jurisdictions.

In addition, a regional approach could allow for the establishment of an urban growth boundary around the metropolitan area, beyond which jobs and suburban housing could not go, as Portland, Oregon, and nearly every European metropolitan area have done. This would force jobs back closer to, and possibly back into, the center cities as well as protect the rural land around our metropolitan areas from sprawling development. While growth boundaries are not without flaws-they can artificially inflate lands prices and thus rents and home prices, for example-they do seem to slow lopsided growth toward predominantly white neighborhoods while maintaining the integrity of downtown.

Los Angeles has already created a de facto regional government in the form of the South Coast Air Quality Management District. This body also increasingly regulates traffic congestion, job growth, and land use. Even five years ago, regional government in the Los Angeles area was considered a fantasy. Today, most metropolitan-area leaders do not question that it is a reality. The next step would be to add social issues to the regional agenda.

A third approach is to encourage affordable and public housing in the near-in and fringe suburbs, enabling low-income residents to live closer to the new jobs. Orange County, California, has in the past required that 20 percent of all new residential projects be set aside for affordable housing. Columbia, Maryland, recently issued a taxpayer-supported bond to build low-income housing for minorities. While these measures are unlikely to be widely adopted, the business community could be a powerful ally. Many companies had a hard time filling lower-level jobs in the near-in suburbs during the 1980s, and this situation will be exacerbated in the 1990s. One promising approach is for corporations to team up with non-profit affordable-housing organizations, such as the Bridge Housing Corporation in San Francisco and Habitat for Humanity, based in Americus, Georgia. An interim measure is the organizing of carpools and setting up of vanpools to bring city residents to distant corporate jobs.

Fourth, we must improve the efficiency of central city public services. The cost of maintaining existing infrastructure and providing services in the center city is higher than the cost of building new infrastructure and providing services in the fringe suburbs, even if the exact cost of delivering social services to the needy is subtracted. The trade-off many companies face is either moving to a suburb with lower costs and fewer social problems or staying in the high-cost center city with overwhelming social problems. It is not hard to see that moving out makes more sense economically.

If present trends continue, the center city's future-and the future of many of the close-in suburbs-is likely to be similar to the present-day fate of Camden and Newark, New Jersey; of Chester, Pennsylvania; or of South Central Los Angeles. The "Camdenization" of our major cities, resulting in their being populated primarily by an underclass in an environment of hopelessness, has obviously begun. It is probable that they 1990s offer the last chance to reverse this trend, because if most of the 24 million new jobs that the Labor Department estimates will be created between 1990 and 2005 are located at the fringe of our metro areas, the downward spiral of the center cities may become irreversible.

As a nation we are used to moving away from our problems, striking out to new frontiers. If the market is allowed to take job growth to the extreme fringe of our metropolitan areas, our center cities may well require full-time military occupation. The fires in Los Angeles are a warning that an escapist strategy no longer works. The cost are too steep and the stakes are too high.

GROWTH MANAGEMENT
Douglas Porter, Growth Management Institute

Let me focus on an aspect of data that we have not really gone into very much at all and yet is probably one of the most important things that has to be done in this whole data area. That is the data management, or data handling, or communication, or intergovernmental coordination aspects of this whole data problem.

The ways that data are used and shaped within the public policy context is just as important as coming up with numbers. In fact, I would go as far as to say that data are only as good as their impacts on policies and actions.

We've discussed the changing political decision-making and there's more to that than simply producing good data. We can have all the good data in the world and it's not necessarily going to make anything happen if we don't understand how it's going to operate within a policy context. I'd like to discuss this further and point out some of the problems that I think we have before us.

Planners all over the nation are enthusiastic about ISTEA and what it promises in the way of boosting the role of planning. In general, regional organizations are starting to really grab hold of this whole area of metropolitan development and where it's going. This suggests that a new day is coming, and we can certainly hope for a more decisive formulation of metropolitan development strategies than we've seen in the last 10, 20, or 100 years, but we also know that MPOs have secured an important role in regional coordination of metropolitan development. They have certainly been acknowledged as a valuable source of basic data on population and households, employment, land use, and more importantly the forecasting mode.

At the same time, we understand that MPOs have been criticized as the weak links in the government's chain. By the way, I was struck during the day with the fact that we keep talking about links, and almost always there's another word that goes with that—weak links. We seem to have a lot of weak links, and I would suggest that it's the interaction of a whole set of systems and programs, and ideas and concepts that are the problem here more than the individual things themselves.

MPOs are highly susceptible to pressures from individual local governments to add and delete projects. They're also subject to pressures from state DOTs who control final decisions for highways and sometimes transit. We know that transportation planning is generally underfunded. It's carried out in the absence of enforceable regionwide development strategies, or regional plans. The completed plans have no force of law to compel implementation by either the state or local governments.

ISTEA may have changed some of that, and we certainly look forward to what it seems to promise in that regard. ISTEA also requires that we are going to have to change our ways of doing business a little bit in the way of data collection and handling. After 30 years of refining our methods, our procedures, and our collection and analysis of data, we know that we have data problems that simply won't go away. Three types of problems that I see with data right now are: 1) shortages of the right kind of data; 2) unsatisfactory means of defining public policy contexts for that data; and 3) shortcomings in the governance system that uses the data, and that produces plans, and that finally decides to do things.

As far as I'm concerned, ISTEA will heighten these problems and not solve them, but will make them important enough so that we actually set about doing something to solve them.

We all know that the numbers game is the thing that MPOs play best and most like to do. They like to track trends. They like to make forecasts. We also know that it's technically tricky and very difficult, and we've seen plenty of evidence of that here today.

Nevertheless, we do understand the basic importance of data collection, data management, and data forecasts as the foundations for all plans. The trends that we look at refuse to stay put, especially in rapid growth areas where forecasts and plans actually are most important. Every 10 years we get a check on where we are; a check on reality. In between, we know there are many swings and many guesses and a lot of wrong answers.

I don't need to remind you of the horror stories of where MPOs have guessed wrong. In my own recent work, I was working on a New Jersey infrastructure plan for the state, and I had to use an impact study that was done by the Rutgers Center for Policy Research. I was trying to match that up with some work that the Office of State Planning had done over the last couple of years. It was very interesting to find out that the Rutgers Center was using a set of numbers as their basic long range projection of employment and population that was a third lower than the Office of State Planning had used in its discussion of infrastructure needs. The State of New Jersey is still trying to figure out what set of numbers to use. They think they understand it's probably somewhere between the two, but they still don't know.

If we have that kind of scale of magnitude problems with an entire state, I can imagine the kinds of problems we get into in regions.

I had an opportunity to look at the growth in the Las Vegas area by looking at the projections of population there. Before the 1990 Census came out, there were four different projections that have been made fairly recent of population in the valley. The county planning department had estimated a population increase from 1980 to 1990 of 362,000. The local business group had estimated 341,000 during that same period. Two outside research firms went completely the other way and talked about 224,000 and 197,000, a difference of 110,000 from top to bottom, and the census count came right in the middle 278,000.

The county planning department was working on the assumption that the population had actually grown 30 percent more than it had. The outside research firms expected something on the order of 30 percent less than they actually got. With this kind of variation in population forecasts at the end of a census period, we've got some real problems understanding what we ought to be planning and what we ought to be building in the way of infrastructure.

We know that we have a lag in recognizing trends of five, or six, or sometimes more years, and that is particularly acute in high growth periods where we understate the trends. Of course, in low growth periods we tend to overstate them.

Then, of course, we have the problem of how we sort out growth between metropolitan areas. For example, I'll explain an incident involving WASHCOG. WASHCOG, in thinking about its employment increases in the Maryland area, decided that the employment that was expected there was going to require so much housing that much of the housing was going to have to be supplied from outside the metropolitan area and assumed that Baltimore would, probably, be that location, and that we could expect a lot more commuting from Baltimore to Washington area industries.

Baltimore, on the other hand, didn't like the idea that it was going to be a bedroom suburb for Washington and didn't figure much of that into their projections at all. So, they don't have nearly as much housing projection there as WASHCOG thinks they, probably, ought to have, and they still haven't really worked out where that housing is going to go. This kind of intra-metropolitan, or intra-MPO, problem is going to increase in the future as the MPOs grow together. There are going to be more of them having to deal with that kind of problem.

None of this deals with the spread of metro development outside the official metropolitan areas. As we all know, many of our MPOS and many of our regional agencies actually deal with a small part of the real action area for metropolitan development.

We point out that even reputable agencies sometimes miss the mark, and there are lots of hazy policy areas where their responsibilities are unclear, but the experience today, certainly, calls for more diligent tracking of the changing key variables. This will certainly call for more staff, more budget, and better access to the real numbers.

Theoretically, that might help to fix some of this problem, but there's another kind of problem which is the main thing I'm trying to get at here. That is with the public policy input. If public policy is going to shape those numbers instead of just direct trends, there are going to be some things that public policies will have to say about what those numbers should be. How we get that; where to get it; and how to evaluate it, are some key problems we have today. Regional plans, for instance, are either non-existent or are amalgams of local plans. Most metropolitan areas have no real regional development strategy, and what plans there are, are not forcible enough to significantly influence future development patterns. We all know the grand regional exercises that take place looking at this kind of pattern of development, that kind of pattern of development, the evaluations that go on, and when things get settled out they look an awful lot like what's been going on in the last five years.

That doesn't say we shouldn't go through those exercises. It does say that maybe we ought to understand a little more about what is happening and where things are likely to go.

Finally, we have a perception and not the reality that most plans are not really sound expressions of future realities at all, and that most people believe what Chris Leinberger had discussed involving market factors generally ending up overriding public policy.

We have a regional forecasting process that is frustrating, but when we look at the small area forecast or the small area numbers we find an even less satisfactory situation because we depend on policy inputs from local governments, and more particularly, on policy inputs from local plans. Unreliable they are. They really provide a frail foundation for information. Frequently, they're obsolete. They're skewed by wishful thinking. They're hampered in their implementation by local regulations. They're changed overnight to suit developer proposals.

As an example of how that can happen, a year and a half ago we did some calling around to some areas to find out what local people and MPO were doing with information flow back and forth. Aurora, Colorado was a great example because at one point the MPOs found out that it had reported it was going to have six new regional shopping centers. Aurora is a growing place, but it's not growing that fast.

The Denver black box didn't even have room to put six regional shopping centers, so somebody at the MPO level just said we're going to take three out of the six and put them in, in some fairly arbitrary way. The numbers were wrong, and the Aurora folks never did understand what that all meant for them because they never looked at the numbers that hard. Besides, the Aurora people knew that those shopping centers were all developer proposals. That is, they were things that developers had in mind that somehow found their way

into the comprehensive plan or were reported back up to COG. COG dealt with it in their way. COG never did tell Aurora how they dealt with it.

The planner, in Aurora, said that he could probably have found out those kinds of things if he'd asked, but he didn't really ask, and he didn't really understand whether they had received the numbers back or not. I'm sure they did, but this is another problem that often happens. The numbers come back. They look like numbers. They don't look like maps. Planners can't read numbers. They can only read maps. They don't understand what the implications of those things are, and they take a quick pass through the numbers. They may understand that there are some major things happening here, and they catch some major glitches that are out of control. They try to fix those. We go through a negotiation process that you're all familiar with. We try to come up with some compromise, but that doesn't mean they've really gone through the numbers in detail. It certainly doesn't mean that any public official at all bothers to look at those things.

The Aurora planner did make one suggestion. He said, "If those numbers could come back to us in map form, we might pay a lot more attention to them." That's an idea.

This leads to the next point. We have a system of intergovernmental transfer of information which has a lot of gaps, a lot of inconsistencies, and a lot of problems because we're still dealing with it at a handicraft level in almost all of our MPOS.

In most metropolitan areas, a circumstance where—and this is another aspect of that problem—local governments are free to accept or free to ignore regional forecasts. They're free to implement or resist regional plans. That's what MPOs have to deal with. Even states that require local governments to plan, and there are a bunch of those, now often don't have a system in place to coordinate those local government plans at a regional level.

The MPOs know about these problems, and they know that there are only some of the constituent local governments that are capable of competent planning or capable of interacting with regional planners in a technically sophisticated way. They certainly try to deal with it in a variety of ways.

In many cases, the data input from local governments is very sketchy, and regional inputs back to the local government actions are almost untraceable. MPOs muddle along as well as they can, and constantly consult with local planners and negotiate differences in a variety of ways. That leads to some situations which I will now quickly run through from our interviews. We've found these kinds of problems in a number of places.

First, local governments that claim the entire projection of regional growth for their own based on their great expectations of what's going to happen, and how much they're going to annex, and how much development they can expect. They're very reluctant to back down to a reasonable level.

Second, local governments that don't want the regional allocation, that actually want the down zone and want the full back—that either don't want jobs or don't want housing, and we'll argue about that.

Third, regional agencies that acquire the reputation of always being right so that local governments are almost afraid to deal with them. The regional agencies claim their numbers are the best, which they probably are. Local governments have other ideas on those numbers, and the regional agency is often not terribly interested or bothered about looking into those local differences.

Then we have regional planners who find no one to talk to at the local level because the local planners aren't interested in numbers. They don't want to look at the results and sometimes don't understand them well enough to be able to deal with them.

We have local planners and public officials who are simply overwhelmed with the amount of data that can come back out of all the computer runs. While in most jurisdictions planners will scan for the obvious glitches, they seldom reflect that output in local plans. They seldom take those numbers, go back and say well, now we've got to fix our local plan to look like these numbers. It almost never happens.

Looking ahead, we can see some more problems emerging. The concept of the jobs—housing balance idea has come up here already. I suggest to you that as that concept gets more and more applied, it's going to create more and more problems and ask for and need data. How to get information that allows matching of employment incomes to housing prices, for instance, on a small area basis, is one that comes to mind immediately, and that's a kind of data collection effort that we just don't have a good fix on now, and the whole problem, of course, of employment locational data that we've just mentioned.

How to make transportation plans that are supposed to support land use policy; how to make those operable when local governments are almost free to manage their own land use regulation the way they want to, and even in spite of their own plans, in many cases: this is California, and you have a consistency requirement. Many West Coast places do. That doesn't mean it always works that way, and, certainly, in the rest of the country, there aren't those requirements necessarily. We have all sorts of interesting problems with plans that don't look like plans when they finally get implemented and,

therefore, don't ever match up to the regional plans, the regional forecasts.

Then we have an interesting question about how we wrap the major growth management tools that are increasingly used by local governments into the whole process. Adequate facilities ordinances are one such example which often sets standards at the local level for capacities that are required before you can develop.

If those standards don't have much conformity throughout a region, they can certainly play havoc with how they fit with any kind of a transportation planning exercise. They can cause growth slowdowns and stoppages if there isn't enough capacity, and that, too, can certainly upset a lot of predictions and projections. So how do those kinds of concurrency problems at the local level, and for that matter at the state level, get translated into a transportation planning process? That's the question.

I'd like to pick up on something Neil Pedersen said, how to take the environmental concerns more seriously than we have in the past. We do have a tremendous number out there that are causing a lot of citizen action on open space and habitats for endangered species, wetlands, and certainly air quality. Air quality has been focused on very heavily. I think the other problems are equally valid. We really don't have much information in wetlands and endangered species habitats. We simply don't have much information at the region, and often at the local level, to tell us even what is there. So there isn't even much of an inventory to work from.

The Corps and EPA are working on various kinds of advanced identification projects and programs, but they haven't gone very far with those. Many local jurisdictions simply don't have that kind of data available.

To conclude my main themes, that local planners and local governments are simply not sufficiently engaged or energized in the process of transportation planning at this point. They don't have much incentive to provide good, realistic data, and often they're simply not budgeted and staffed enough to spend enough time to do it. They often don't have an easy way or don't understand how to use the output data that comes out of the transportation planning process and, therefore, that suggests a stronger type of regional coordinating role. You hate to use the word coordination because it means all things to all people. Certainly, a stronger regional direction of what goes on in a region in the way of setting standards, but also in some basic enforcement incentives to catch the attention of local officials.

Local agencies need a lot of help in making the time and staff available to do the kind of job they need to do. Unfortunately, this kind of thing tends to be one of those demands on local staff that gets a low priority. Yet, local staffs could provide a lot of help in doing much more in collecting essential data if they had the right incentives, and those incentives might have to be financial. We also need to have better data on how regional agencies and local governments interact. We spent some time talking about collecting data, looking, doing surveys, and so forth. I think there's a great deal of information we need to find out about just how this interaction works.

DISCUSSANTS

Alvin R. Luedecke, Texas Department of Transportation, and Paul Smith, City of Los Angeles

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Alvin R. Luedecke

ISTEA has created a whole new arena for states and MPOs to deal with. From Texas' standpoint, we've always worked with the MPOs to determine the demographics in urban areas. Land use has not always been presented on time in all of our 25 areas. It has not always been from the same datum, nor was there ever any obvious attention given to social issues.

More detailed land use will be necessary since the measure of the TCMs will ultimately fall in nonattainment areas and will focus not only on what the land use is for, but to what degree is land use contributing to pollution or congestion.

One example would be to look at the demographics of a particular large employer. It may be necessary to find out, in the future, is that employer supporting an active carpool program? Are they on a transit line? Are they serviced by an HOV facility, or is this one of the typical companies, in Texas, whose incentives is to provide each and every employee a parking space.

The era of economic development in the past, in the Texas DOT, has been much more reactive than proactive in supporting economic development. Until recently, our emphasis has been highways and transit. As everybody knew, roads were the source of all economic development. It was like a "field of dreams". You know, if you build it, they will come.

In recent years, at the state level, economic development has come about on an almost project-by-project basis. Because economic development is the responsibility of another state agency in Texas, our communication and coordination has not always been on target. Nor have we, from a pure transportation planning perspective, tried to develop a database to address economic development. We've always seen ourselves in a reactive mode when presented with an opportunity to develop a facility that might support major development.

As economic development strategies are formed on a state and local level, it will be important to ensure the data used to make decisions are carefully evaluated to be sure they are true and reasonable for the development that's ultimately contemplated.

What kind of database can be established to evaluate the merit of economic development proposals will probably be one of the major questions in the planning areas, especially now that transportation is multi and intermodal. When it was just highways, it was easy.

Finally, growth management. The data for this area is much the same as the data that were used to develop and prioritize programs and projects, plus a few additional measures.

The measures for growth management will also be based on density, congestion, facility development, land use, and economic development. The measures will have to be statistically valid in order to be used in support of decisions that may seem counter to those in a position to benefit from growth in a particular area. Growth management will certainly be an emotional issue — that is fair game. Whatever data are developed and used must be strong enough to stand up in court or even harder, the scrutiny of public perception.

To summarize, in years to come, these three categories of data will be the basis of a considerable number of major decisions at the local, state, and national levels. While much of it is probably already gathered at some level, I don't know that it is statistically valid everywhere or universally defined, so that it is usable in the various agencies that will need it.

In Texas, we're aware that we have a long way to go. The money, personnel, and resources necessary to address all current and expected data needs must be provided at all levels similar to what ISTEA has done for the MPOs through allocation of PL funds.

In support of the MPOs, Texas received its allocation of PL funds and in past years has always matched, the old match was 15 percent now 20 percent, with in-kind services of our planning staffs in the districts and in the headquarters. This year, we're going to match it with a cash match of state funds and take our in-kind match in other ways. This has provided roughly $2.7 million more for the MPOs.

Paul Smith

The Office of Legislative Analysts is a body that supports policy analysis for the Los Angeles City Council. We're engaged in their budget and their IGR, staff their committees, and help them in any way we can in grappling with some of these larger issues.

This is the context in which Los Angeles finds itself in the regional planning and regulatory context. We have the AQMD engaged in the long-term planning and air quality planning for the region. They have structured 38 local government local control measures, of which 23 are transportation oriented.

Another is Southern California Association of Governments (SCAG). Of those local government control measures from the AQMD, SCAG is responsible for 22 of them. Transportation implementation is handled by LACTC and the RTD which will be merging. It will be MTA for Los Angeles. It will be a mega-agency. They are also responsible for the congestion management plan for this area, at least, in Los Angeles County.

It surprises me how this messy milieu of regulatory agencies mirrors the way the city is handling itself. We respond to the AQMD through our environmental affairs department, through our planning department, CMP through the DOT department. As these agencies interact or don't interact, it's mirrored in the larger context. Are the AQMD, SCAG, LACTC interacting in a meaningful way? Possibly, maybe not to our best advantage.

There is one footnote that I always like to express. It is that the citizens of Los Angeles County have indebted themselves to a tune of $183 billion over the next 30 years, to put in transit development. How this money will be spent, how we go about this 30-year plan will, in large measure, be determined by the work that you people do. The information that you gather, disseminate, transmit to MPOs, local governments, and regional agencies will have great impact on the expenditure of those monies.

These will illustrate the predicament of local governments. October (1991), one of our council members visited my boss's office. He said, "Well, you know, we have a trip reduction ordinance coming up before my committee. We have an air quality element that's being prepared, and we have a clean air plan, which will be the accompaniment document to the air quality element. However, I need some answers. I need some data to feed my decision-making process."

He stated what information he wanted us to give him. What were the air quality benefits? What were the mobility benefits of each one of these local government control measures? If you have seen air quality plans, you are aware that they're all disparate little individual action items that local governments can take off a menu and implement.

He then inquiried about the cost to the city to do this? What is the cost to the regulated community? That's a good question. What is the cost effectiveness? It's getting a little more difficult. Competitive

disadvantage; if we do this, how is that going to affect our business community? For instance, if we put in regulations on special events centers, how will that affect Disney and Dodgers Stadium and those kinds of decisions?

The larger question is do we implement as a locality these strategies on a local level, or do we say, "Let's do it on a regional basis?" Do we get more bang out of a regional rule than we do at local rule? That's a good question, too. Then, we talked for a little bit longer, and he said, "Well, how about fair share? What are the fair share questions? How much do we do against some other localities, sub-regional groups". As he's leaving, he says, "Oh, by the way, give me the job impacts. Give me the socioeconomic statistics. I said, "Well, there's a model out there that the AQMD uses and they pump all this information into it, and they supposedly give you information relative to job impacts." As we begin thinking about this, he comes back, and he says, "Oh, there's one last thing. What is this notion of expeditious implementation? Can you help me with that? Oh, by the way, throw in reasonable further progress". We began trying to collect these data, but we essentially could not answer those questions. For a local government official to make some crucial decisions on limited resources — and you know what limited resources are — we couldn't give them basic jurisdictional information to help them make those decisions; those policy decisions. We have talked about policy decisions here. We are talking about what drives it; the data or the policy?

The essential question that was trying to be asked was, what was the biggest bang for my buck? What will give it to me? What they're asking is, what will this measure buy? What are the trade-offs? Who benefits? Who is hurt? Who pays? What they are really seeking is some type of prioritization of alternatives, and that was a difficult, difficult task. One, I'm sorry to say, we couldn't respond to at this particular time.

Secondly, TCM working group is a group of local jurisdictions and private sector folks looking at transportation control measures, trying to make them more compact, simplified. Again, the whole notion of quantification and enforceability, those numbers are not available. You can't pick and choose and simplify if you don't know what results will come from the actions that you take.

Thirdly, we had a recent disturbance in L.A. that focused a lot of attention on urban communities. The question of social equity in transportation has been recently refocused. Are we putting our transportation systems in the communities that benefit most? Those questions have to be addressed, and you should be addressing them.

I have my wish list. One surrounds the notion of--is it more art than science out there today? I could almost wish we could stop the world and get off for a while and let the science catch up with the art. Let you guys come back with some stunning, brilliant analysis of the competing demands that are out there.

In your data collection, in your data distribution, think of the local official, who makes those crucial decisions.

Bridge the gap between the technician and the local politician. Be concise, readable. Represent real world concerns and economics that are out there, the fragileness of the local economies.

GIS has been discussed here. I'm very fond of that kind of representation of data. I think that would have a great impact on local decision makers. You can see it. You can feel it. You can almost taste it. If it's out there, it's in color, it's on a screen, and you have someone competent who can interpret it for them, it is probably remarkable.

I just want to underscore the idea of cooperation, cooperation, cooperation. This region is over layered with governance, and do they all talk? Yes. Do they talk well? I don't know.

Data have to be reliable. You have to have confidence in it. I cannot overly express the need for confidence in the data that's generated on the local level. Do they look at it and throw it in the wastepaper basket and say, "Oh, it's another MPO survey?"

Lastly, in an earlier discussion, someone said we need a quality of life index. Are our regions relatively better or less well off? Is there a discomfort index that can be developed? I throw that out to you to challenge you.

WORKSHOP REPORTS

Elaine Murakami, Puget Sound Regional Council, and Jack Butler, Florida Department of Transportation

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Elaine Murakami

Eighteen people participated in the Workshop Land on Use, Economic Development, and Growth Management. There were two state DOT representatives, 12 from MPOs or COGS, and four others, including the Urban Land Institute and the Growth Management Institute.

The MPOs varied in size from 75,000 population to over three million population, and they also varied in their responsibilities. Some were very active with census activities, and others had less responsibility in that area. About half of the MPOs prepared their own population, employment, and land use forecasts, and the other half used forecasts from other agencies. One agency was required to use the state population forecasts, and

another MPO said that they would never just take the state forecasts, and that their approach was to work directly with the state to come up with mutually agreeable forecast numbers.

The planning horizon for most MPOs was 20 to 30 years. The frequency of the population and employment forecasts range from every two years to once every 10 years, but I would say that most range somewhere between two and four years.

The current practice in terms of population and land use forecasts was that these numbers were prepared first, and then they were fed into the travel demand models. I think we need to be moving toward a more cyclical approach where these two are integrated, but the current practice I could summarize in two ways.

There was a comprehensive plan examination and review with local staff people on the realistic expectations of these comprehensive plans being realized. The first approach was using Delphi-like methods where they would work directly with local staffs and come to some agreement.

The second approach was that regional councils prepared control totals for the area using economic or demographic trends and forecasts. These regional totals were allocated to sub-areas, and those sub-area numbers were reviewed with locals in an iterative process to adjust the figures within those areas.

There was a lot of discussion early on that there wasn't much understanding or knowledge about the interrelationship between land use and transportation.

Al Luedecke made some reference to "field of dreams". He said that sometimes we think about "if you build it, they will come." A Maryland State DOT person said this was sort of the way that people had been speaking about transportation facilities, at least, in their state.

Another theory we have heard related to transportation facilities is opposite of that. If you don't build it, they won't come, but what was actually happening was not only these two options, but these other two options. One of them, if you build it they might not come, was discussed in terms of both highways and rail systems and Texas highways as an example. The other one was if you don't build it, they'll come and the Tysons Corner example was used for this example. From all of what we learned, there wasn't very much knowledge about what these interrelationships were. We have to decide what are we going to do about this lack of knowledge.

The workshop began with a brainstorming session where we thought of many ideas about land use, and growth management, and economic data development. Then we grouped those ideas into more generic, descriptive categories. We identified the major gaps and the greatest need for improvement. The items that were seen as not as difficult, although there might be a need for ongoing effort, were given a lot lower priority then the higher priority items that we came up with.

The most important item was in the systems analysis area. It was very difficult to prioritize these because they were all very important. We decided that synthesizing data from multiple sources would be a useful way of looking at the data. Not only was this going to be important from the technical aspect, but it was also going to be an important product for informing elected officials and the public. This also came up in the administrative issues part of the discussion.

There were three other items that were almost the same priority level as this one. Those were to revise old and to develop new methods in forecasting, impact analysis, and cost benefit analysis. This will also be related back to the forecasting issue.

We said we needed data to know more about data compatibility and reliability. This was really important when we are trying to build integrated data sets where you might have data from one source like wetlands data and a highway network from another source. You need to know what the accuracy and the reliability of each of those data sets are when you start to compare them against each other.

One of the examples that I brought up from the growth management side was a lot of the wetlands mapping is being compared against parcel databases to determine whether people can build on their specific piece of property. The accuracy issue is very critical in those examples.

Finally, we said that the current GIS in transportation was inadequate and needed further development. This is one area where the federal agencies could take a role in working with the software developers in explaining that there really was a market for these. There are many MPOs and state agencies that could use this project if it could meet our needs a little better. One of the gaps we saw in GIS was this dynamic segmentation problem.

In administration, the biggest problem was that we needed to increase the coordination and cooperation for data access. This crossed all different boundaries. We saw there could be a role for states in helping local governments get access to state data sets outside -- not just DOT, but outside of DOT, also federal agencies, and also to improve the data sharing between the MPOs and local governments.

We set a slightly lower priority for three other items. This was informing elected officials and the public. During the workshop, we talked about education. We talked about educating elected officials and the public,

and I don't think that's what we're trying to do. We're trying to inform them. Part of informing might be that we all, as staff, need to have better communications skills, and we did talk about improving our communication, not only with the elected officials and the public, but also with the people who were asking to provide us data for use in feeding the land use and transportation modeling. This was a problem sometimes when we asked people for data. They didn't understand how that data were going to be used, or what the value was because we didn't communicate enough with them.

We also thought that staff training was very important. We need training in how to increase public participation. We also need training in the areas of technical work in terms of modeling and GIS.

In the forecast, this was sort of a sleeper — not forecasting was the sleeper, but we talked about forecast evaluation. Most MPOs felt that they didn't have the time to sit back and evaluate how well their models predicted 1990 using the 1970 and 1980 information, but this was really something that was very important.

There could be a role for the federal agencies in helping us do this. We recommended taking a sample of certain areas and seeing where different models performed well, forecasted accurately, and those areas that didn't perform well. Then try to assess what went into the models, what were the major gaps, and then see how to revise our methods so that we can improve our forecasting.

The other things that came up were that we would be required or asked to perform multiple forecasts, but there won't be just one forecast. There will be alternative forecasts, i.e., showing different development patterns. This is the current trends forecast, but given growth management requirements, requirements for high residential zoning, higher residential densities, and employment densities by zoning, that this is an alternative forecast using those assumptions.

We also need to adjust our forecast to incorporate these changes, and this is related to the monitoring. It also goes back into the forecast evaluation component.

We also need to recalibrate our base year data. This is going to be a lot of work in the near term because of the availability of 1990 census data.

In terms of surveys, we saw that overall these were very expensive, and that's why they weren't done too frequently. They tended to be irregular.

In terms of what our workshop was tasked with, the biggest gap was in an actual physical inventory of land and this was not something that the MPOs actually wanted to get, but they were largely relying on other agencies like departments of natural resources and forest areas. The different issues of endangered species also came up.

The other topics that the other groups discussed were how travel characteristics and travel behavior were changing over time, and how this related to land. We also discussed facility performance.

Finally, in monitoring, we saw that the biggest gap in this area was in goods movement. We need more employment and other economic indicators. Some agencies have been successful in working with their state files, and other agencies are running into a lot of red tape. Some areas are using private data sources like Dunn & Bradstreet's and other areas are having to go out and do their own employment inventories.

We need some basic information about transportation system usage. There was quite a bit of discussion that the traffic data on the highways had a lot of error, and we question its statistical reliability.

Going back to our initial question, what would the impact be between the land use and transportation and how would this feed into our forecast?

In this area, particularly, people felt they were doing a lot already, and these are the "C" categories where these were ongoing efforts. It wasn't that they weren't needed any more, it was just that there was a good base for those already.

Jack Butler

State departments of transportation have traditionally had almost no direct role in the topic of this session. At most, state DOTs have provided general transportation planning technical support and highway/traffic data. It would also be fair to say that state DOTs are aware of the reactive and proactive economic development effects of transportation improvements, although few states have specific programs for making transportation improvements to create economic opportunities.

This history was well demonstrated by the virtually complete absence of state DOT representatives at the session, which consisted mainly of regional agency (MPO and COG) staff. It was also well demonstrated that the presently limited state DOT role must be greatly expanded if the requirements of ISTEA are to be met.

The expanded state role is primarily one of providing increased leadership for setting data and method standards. There are three basic areas in which state DOTs, working individually or together, must expand their activities:

- Data sharing between state and regional agencies
    - *Serve as facilitators for getting information from other state agencies to the MPOs and COGs doing transportation planning.* For example, local agencies need population, employment, and

construction data from which forecasts may be made. These data are usually collected or projected by state Departments of Commerce or Labor.

- *Help affected agencies set data coding and file exchange format standards.* The increasingly large amounts of data required to meet planning quality standards mandate the use of automated data processing methods. However, no standards exist which would allow data from different sources to be readily combined. For example, each county often has its own format for maintaining property records, with the result that regional agencies cannot readily combine information on existing land use from their member counties.

- *Create a statewide forum or mechanism for data sharing between MPOS.* A recently published study showed that acceptable results can be obtained from statewide or even national data defaults for such characteristics as trip generation. It will be cost effective for state and regional agencies to pool their resources so that statewide estimates for appropriate input data can be readily devised; e.g., vehicle occupancy, peak season identification, etc. Each state DOT may want to consider formally recognizing input default values so that the results of all in-state MPOs may be combined in a statewide transportation planning effort.

- Establishment of methodology standards

  - *Describe and teach standard surveying methods.* As the ultimate goal is a coordinated state transportation planning effort, the input data upon which the effort is founded must be consistently gathered and reported. A frequently noted need was the establishment of a method for deriving input traffic data, such as how to do seasonal and axle adjustments to base counts. In air quality non-attainment areas, local and regional governments may be called upon to conduct new types of surveys; e.g., travel time studies. The state DOT should set up a program for defining standard methods and teaching these methods to regional and local planning staffs. In some instances, metropolitan areas in the state may be the source of such training.

  - *Establish standard traffic modelling methods.* Just as the input data must be collected or derived on a common basis, so must the use of that data be standardized. Agencies that perform the traffic modelling function may need assistance in increasing the detail of those models, or in improving calibration methods to include travel speeds. The states, MPOS, and FHWA should cooperate on meeting this need.

  - *Create a means to conduct intermodal cost/benefit analyses.* ISTEA requires the state and MPOs to make project selections from a multi-modal mix of alternatives. The states should work with FHWA and FTA to define a standard means for making such selections on a common basis for all modal impacts.

  - *Define and use standard transportation performance measures.* Intermodal planning will also require post-implementation evaluation of improvements. Common and comparable performance measures will allow same-basis evaluation of all types of improvements.

- Establishing GIS-T standards

One common item was mentioned in every presentation made during the first day: geographic information systems will be THE tool for combining data from multiple sources and on differing topics into a single presentation. However, there currently is no standard means for representing and storing these data in a GIS. Indeed, there is not even one GIS on the market today that can do the broad range of tasks needed for multimodal transportation planning.

It is the belief of the session attendees that the needed GIS will not be quickly provided by software/hardware vendors through the normally diffuse market for such systems. Accordingly, it is strongly recommended that the MPOs, states, and FHWA quickly work together to define a standard GIS-Transportation specification that can be provided to vendors.

Transportation Data Implications of the Clean Air Act of 1990

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Transportation Data Implications of the Clean Air Act of 1990

Introduction

Transportation data and analysis methodologies have remained relatively static for over 10 years. The Clean Air Act Amendments for 1990, however, have significant and analytical implications for the transportation profession. The most fundamental conclusion is that existing data and analytical capabilities in many urban areas will not satisfy the requirements of the new Clean Air Act. Improvements are needed in the state-of-transportation practice.

This paper examines:

- The preparation of mobile source emission inventories;
- A summary of other Clean Air Act requirements having important transportation data and analysis implications;
- The transportation-related variables that are important in influencing mobile source emissions; and
- Implications for transportation practice and research.

The observations presented for purposes of this workshop are very much from an air quality perspective. It is important to note, though, that very similar conclusions are reached by examining the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. For example, the analysis required to support ISTEA's congestion management and intermodal freight movements also will require a restructuring of transportation data and analysis procedures.

Mobile Source Emission Inventories

The development of mobile source emission inventories too often has been regarded as a relatively routine procedure. Under the new Clean Air Act, however, the preparation of these inventories is not so simple anymore. In many cases, a mobile source inventory may be required that is temporally distributed over a 24-hour period and spatially distributed over a geographic grid. In some areas of the country, these inventories also will have to be developed on a multi-state basis; and in some cases, it may even be desirable to develop a multi-day inventory in order to analyze multi-day air pollution episodes.

Figure 1 is a highly simplified representation of the Motor Vehicle Emissions Model (MOVEM) which is part of a larger Emissions Modeling System covering stationary, area, mobile, and biogenic sources that is being developed by Radian Corporation for the four-state (Wisconsin, Illinois, Indiana and Michigan) Lake Michigan Ozone Study. More detailed representations of the spatial and non-spatial transportation data portions of this system are

provided in Figures 2 and 3 respectively.[1] The underlying computational capabilities are provided by a combination of the geographic information system, ARCINFO and the Statistical Analysis System, SAS. Multiple traffic data sources are incorporated and merged including:

- Urban area highway networks;
- State highway networks;
- Highway Performance Monitoring System (HPMS);
- Traffic counts; and
- Estimates of intrazonal trips.

The system builds off U.S. Census TIGER/Line data files and utilizes Feature Classification Codes. Data are structured by state, area type, and highway functional classification incorporating a hierarchical structure of assumptions and default values.

The Lake Michigan Ozone Study and its associated Emissions Modeling System represent a new generation of analytical capability that integrates a variety of transportation and emissions data. It is illustrative of what new integrated transportation air quality models may look like in coming years.

■ Other Clean Air Act Transportation Analysis Requirements

In addition to providing for enhanced procedures for preparing both base and future year mobile source emission inventories, the Clean Air Act of 1990 also contains a number of other important transportation-related data and analysis requirements. The 1990 Amendments address air toxics, acid rain and stratospheric ozone as well as mobile sources. The contribution of mobile sources to the carbon monoxide and atmospheric ozone nonattainment problems, though, represents a central thrust of the legislation, with major new or enhanced provisions affecting motor vehicles, fuels and transportation control measures. The key feature of the new law is that it classifies CO and ozone nonattainment areas into different levels of severity. For ozone there are five categories; for CO, there are two classes. The deadline for ozone nonattainment various from three years for marginal areas to 20 years for extreme areas. The boundaries of serious and above ozone nonattainment areas must include the entire metropolitan statistical area or the consolidated metropolitan statistical area.

A major new requirement of the Act is the specification of incremental as well as a final attainment schedule. For all but marginal ozone areas, there must be a total net reduction of 15 percent in VOC emissions during the first 6 years and 3 percent per year thereafter. The

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1/ Bruckman, Leonard with Edmund Dickson, "Development of Transportation Data for Use in Photochemical Grid Modeling," Radian Corporation, paper presented at the 85th Annual Meeting of the Air and Waste Management Association, Kansas City, MO, June 1992.

implication of these changes is that transportation emissions estimates must be produced on an annual basis as well as for a horizon year that may differ from that typically used in standard transportation studies. The analyses and their underlying data also must cover a geographic area that in most cases is larger than that now covered by the typical urban transportation study.

Transportation programs may be particularly affected by changes in the Act regarding the conformity of transportation and air quality actions. Conformity requirements are now defined in considerable detail, with a shift from the conformity of a project to a conformity of "purpose" or emissions. The total emissions from a regional transportation plan and program must now be consistent with the emissions estimate contained in the State Implementation Plan's projection and schedule. This, in effect, places a cap on total mobile source emissions, creating the concept of an area wide emissions budget. It also emphasizes emissions from transportation programs rather then emissions just from individual projects. The cost and time required to prepare a legally defensible conformity analysis will almost certainly be considerably larger than what normally has been spent on conformity determinations in the past.

Section 187 of the Clean Air Act adds a new requirement to forecast and monitor vehicle miles of travel for certain carbon monoxide nonattainment areas. If actual VMT proves to be higher than forecast, then prespecified contingency measures must be implemented. The Federal Highway Administration's Highway Performance Monitoring System (HPMS) will be used as the source of the annual VMT monitoring data. Steps will have to be taken to insure that the HPMS data are statistically significant on an urban area as well as a state basis, and also to adjust the HPMS monitored data to correspond to the same geographic boundaries as the air quality nonattainment area. Travel forecasts from a network-based transportation demand modeling system can still be used to develop annual forecasts of vehicle miles of travel. These forecasts, however, must be calibrated to the HPMS data so that the respective numbers are consistent.

Requirements regarding transportation control measures generally are regarded as being strengthened in the new Clean Air Act, consistent with the overall emphasis on mobile sources. Sixteen separate transportation control measures are listed in Section 108(f), as summarized in Figure 4. Estimates of the effect of TCMs on trip generation, trip distribution, modal split and vehicle miles of travel will have to be integrated into the travel demand forecasts that are now being developed for urban areas.

In ozone areas classified as serious or above, employers with 100 or more employees are required to implement trip reduction programs designed to reduce commute-related vehicle miles of travel by raising average vehicle occupancy for employee work trips at least 25 percent above the area average. This establishes requirements for determining appropriate vehicle occupancy rates for both base and future year conditions, for identifying applicable employment sites, and for evaluating the effectiveness of implemented employer transportation management programs.

A central thrust of the 1990 Clean Air Act Amendments is the emphasis on market-based principals of economic incentives and disincentives. Concepts based on emission fees and emission trading are encouraged. With respect to transportation, this creates opportunities for innovative forms of economic pricing covering parking and other possible transportation

fees. For example employer provided free parking could be replaced with an equivalent transportation allowance that could then be applied by an employee to any mode of travel. The challenge for transportation analysts is to include the effects of pricing and related policies in their evaluation of air quality and other transportation measures.

The new Clean Air Act also specifies that emissions resulting from growth in vehicle miles of travel or in vehicle trips must be offset. This again places an emphasis on estimating emissions rather than just travel, utilizing a consistent set of highway functional classification definitions, and developing reliable annual estimates for variables such as population, employment, vehicle trips, VMT and associated emissions.

In summary, the 1990 Amendments to the Clean Air Act do far more than just define another round of air quality planning; they re-certify the important interrelationships between highway transportation and air quality. In addition to defining a set of actions and requirements aimed at reducing mobile source emissions, more than 10 provisions of the new Clean Air Act have important transportation data and analysis implications. This is true when these provisions are considered individually; it is especially the case when these provisions are considered in combination. State Departments of Transportation and urban area Metropolitan Planning Organizations will have to determine how well prepared they are to meet these new and demanding requirements.

■ Important Variables Affecting Highway Vehicle Emissions

Transportation variables affecting emissions are not necessarily the same ones that currently receive most emphasis in travel demand model systems. Rather than looking primarily at vehicle miles of travel as often was done in the past, emphasis increasingly is being given to variable such as the number of trips, trip length, vehicle speed, vehicle acceleration, driving cycle, and even the length of time between vehicle trips. Many current studies also are calling into question the validity of mobile source emission models, concluding that existing estimates may be under estimating actual emissions by a factor of two to three, if not higher.[2]

The following factors, as examples, are important in estimating transportation-related emissions:

- Ozone violations typically occur in the summer and carbon monoxide violations normally occur in the winter. Transportation conditions vary by time of year but normally are modeled for an average day that may be more representative of the spring or fall seasons than of actual ozone or carbon monoxide violation characteristics.

- Emissions vary in a non-linear matter with vehicle speed. It has long been recognized that emissions increase rapidly with operating speeds below 20 miles per hour. It has only recently been recognized that there also may be a significant increase in emissions

2/ Fujita, Eric with B. Croes, C. Bennett, D. Lawson, F. Larmann, and H. Main, "Comparison of Emission Inventory and Ambient Concentration Ratios of CO, NMOG, and NO_x in California's South Coast Air Basin," California Air Resources Board and Sonoma Technology, Inc., Journal of the Air and Waste Management Association, Vol. 42, No. 3, March 1992.

with operating speeds above about 50 miles per hour. Many transportation data sets however, do not capture the true magnitude of these high end vehicle speeds.

- Exhaust emissions can be classified as to whether they are cold start, hot start or hot stabilized. Cold start trip end emissions unfortunately are not uniformly distributed over the entire length of a trip as implied by a uniform grams per mile figure, but typically occur at the start of a trip. Consequently, cold start emissions are important in determining the emission reduction benefits of such measures as peak-and-ride lots. For trips under seven miles in length under typical summer conditions, these cold start or trip end emissions may exceed running or hot stabilized exhaust emissions in magnitude.

- Vehicle acceleration and operating mode are important in determining emission characteristics, but typically are not treated directly. In addition there is an increasing concern that high acceleration emissions may be under represented in the Federal Test Procedure and therefore also under represented in EPA's MOBILE model.

- Evaporative emissions are being increasingly recognized as having been underestimated in the past. Hydrocarbon evaporative emissions may exceed exhaust emissions in magnitude in many cases. Evaporative emissions include temperature induced evaporation of fuel when the engine is not running, commonly referred to as diurnal losses. They also include hot soak evaporation occurring at the end of a vehicle trip, resting losses and refueling losses.

- The classification of vehicles that is important for emission estimation purposes is not the same as is normally used by transportation agencies. In many studies, a difficulty has been encountered in converting from one vehicle classification scheme to an emissions-based vehicle classification scheme. Vehicle characteristics that are important for emission purposes include fuel type, vehicle age, and the accumulated travel mileage.

If transportation data and analysis systems are to be improved for purposes of estimating emissions, than it is important that improved data be collected on those variables that air quality studies are showing are important in determining mobile source emissions.

Conclusions

Achieving the full requirements of the new Clean Air Act (as well as the requirements of ISTEA) implies what some may consider to be an ideal set of data and analysis requirements. Others, however, consider these to be a minimum set of requirements in order to legally satisfy these two new significant pieces of transportation legislation.

Is it really necessary to change anything? How are priorities established? Unfortunately, the answers to these questions are very context specific, depending both on the existing capabilities of an urban area and the nonattainment air quality status of that area.

It is important to note, though, that the number of Clean Air Act-based lawsuits has increased significantly in recent years. The continued threat of these lawsuits in the future is likely to have the effect of encouraging agencies to improve both their data and analysis methodologies.

In general, there are two simultaneous needs. First, there is an immediate need to improve the current state-of-the-practice, doing the best practical job possible today. Second and in parallel, there is a need to improve the current state-of-the-art of data and analytical capabilities, undertaking a significant longer-range program of research advances. This research program then can be used to help establish priorities for nearer term data and methodological improvements.

An interesting question in this context is what does the next generation of travel demand forecasting procedures look like. Given the high level of investment in today's standard four-step modeling approach, is it sufficient to just make incremental improvements to the existing model structure? While numerous small scale data collection efforts and model enhancements certainly should be undertaken in the short term to improve the four-step modeling process, fundamentally a whole new generation of travel surveys and analytical capabilities needs to be developed over the next decade. These desired improvements include:

- An expanded range of policy sensitivity, especially to travel demand management measures and intermodal characteristics;
- The explicit consideration of feedback including revised estimates of travel time on other aspects of travel behavior including trip generation and automobile ownership, with the increasing use of simultaneous as opposed to sequential choice structured models becoming more prevalent;
- Use of geographic information systems as an integrating foundation or platform for travel demand model systems;
- Disaggregate individual household and market-based forecasting methods as opposed to current aggregate zonal approaches;
- The use of incremental pivot point and related sketch planning methodologies;
- Direct integration with roadway and other management information systems; and
- The use of trip-based emissions and energy forecasts.

In summary, responding to the data and analysis requirements of the new Clean Air Act presents an unparalleled opportunity for change. While the many immediate challenges of the new Clean Air Act can at times appear overwhelming, the requirements of the Act, taken both individually and in combination, help to define a new generation of data and analysis requirements towards which the transportation profession should be moving.

Figure 1. Lake Michigan Ozone Study Motor Vehicle Emissions Model

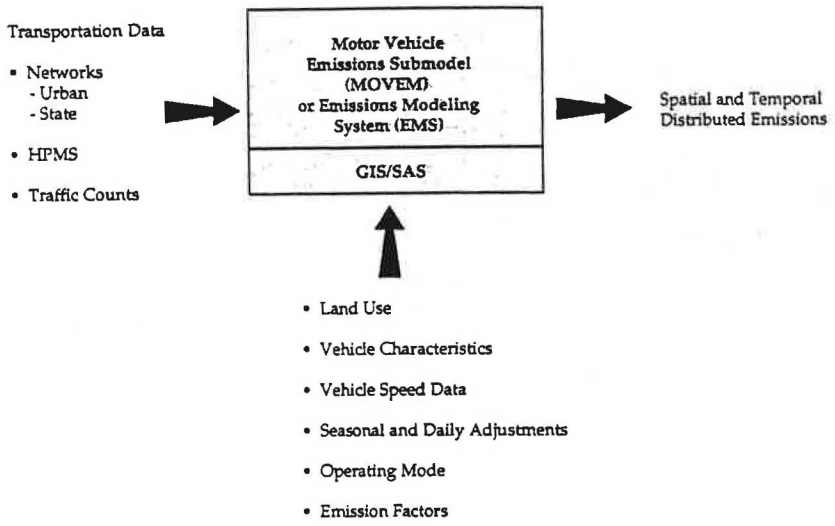
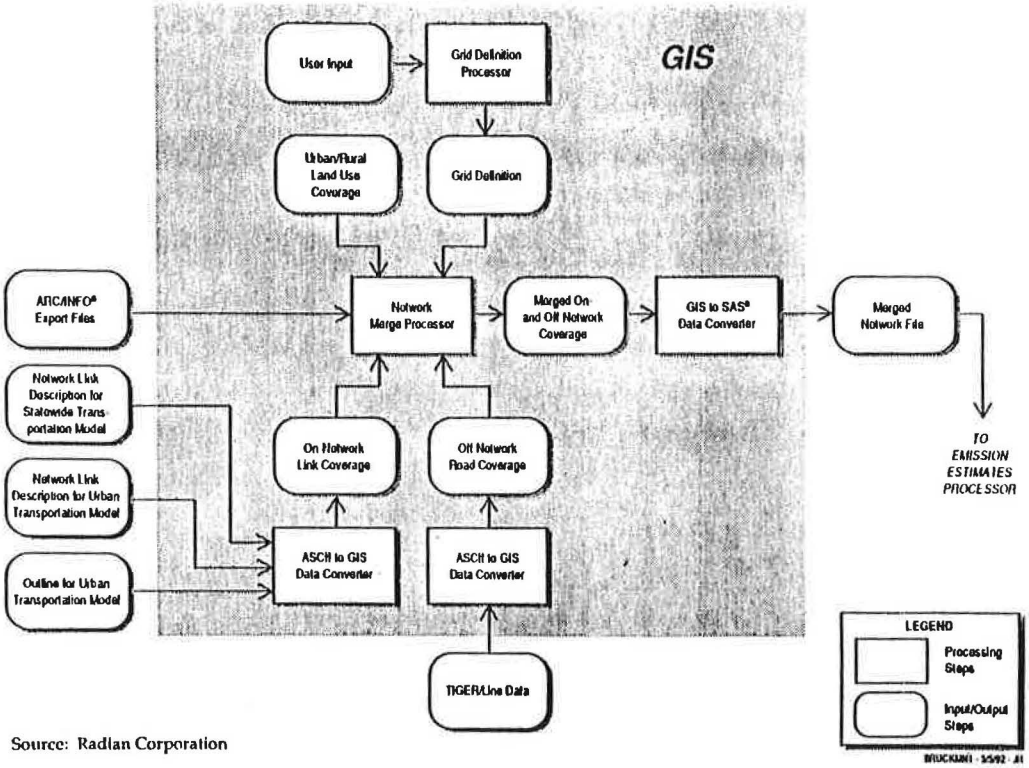
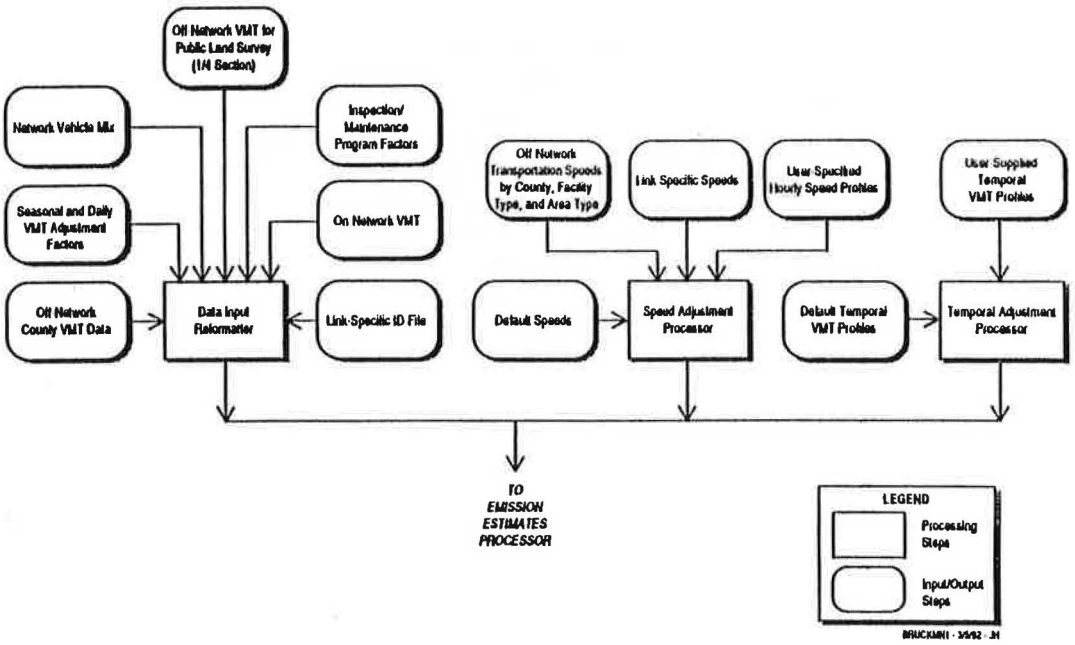


Figure 2. Preparation of LMOS Spatial Transportation Data



Source: Radian Corporation

Figure 3. Preparation of LMOS Non-Spatial Transportation Data



Source: Radian Corporation

Figure 4. Available Transportation Control Measures

Trip Reduction Ordinances
Employer-Based Transportation Management Programs
Work Schedule Changes
Area-wide Rideshare Incentives
Improved Public Transit
High Occupancy Vehicle Lanes
Traffic Flow Improvements
Parking Management
Park-and-Ride/Fringe Parking
Bicycle and Pedestrian Programs
Special Events
Vehicle Use Limitations/Restrictions
Activity Centers
Accelerated Retirement of Vehicles
Extended Vehicle Idling
Extreme Low-Temperature Cold Starts

Clean Air Act Transportation Analysis Requirements

- Emissions Inventory
  - Base Year
  - Future Year
- Projecting Regional VMT
- Effectiveness
  - Transportation Control Measures
  - Pricing and Market-Based Economic Incentives
- Employer Trip Reduction Programs

Clean Air Act Transportation Analysis Requirements (continued)

- Emissions Resulting from Growth in VMT or Vehicle Trips
- Monitoring
  - VMT
  - Emissions
  - Congestion
  - Vehicle Occupancy Rates
- Conformity

CAA Conformity Provision

- Emissions from MPO-adopted regional transportation plans and transportation improvement programs must be consistent with S.I.P. mobile source emissions estimate.

- *Key Changes*
  - A Cap on Total Mobile Source Emissions
  - Program- rather than Project-Based

CAA Available Transportation Control Measures

- Improve Public Transit
- High Occupancy Vehicle Lanes
- Employer-Based Transportation Programs
- Trip-Reduction Ordinances
- Traffic Flow Improvements
- Park-and-Ride/Fringe Parking
- Restrict Vehicle Use in Downtown Areas
- Areawide Ridesharing Incentives

CAA Available Transportation Control Measures (continued)

- Bicycle and Pedestrian Facilities and Lanes (3)
- Control of Extended Vehicle Idling
- Reduce Extreme Cold Start Emissions
- Flexible Work Schedules
- Programs for Large Activity Centers and Special Events
- Voluntary Removal of Pre-1980 Vehicles
- (Pricing and Economic Incentives)

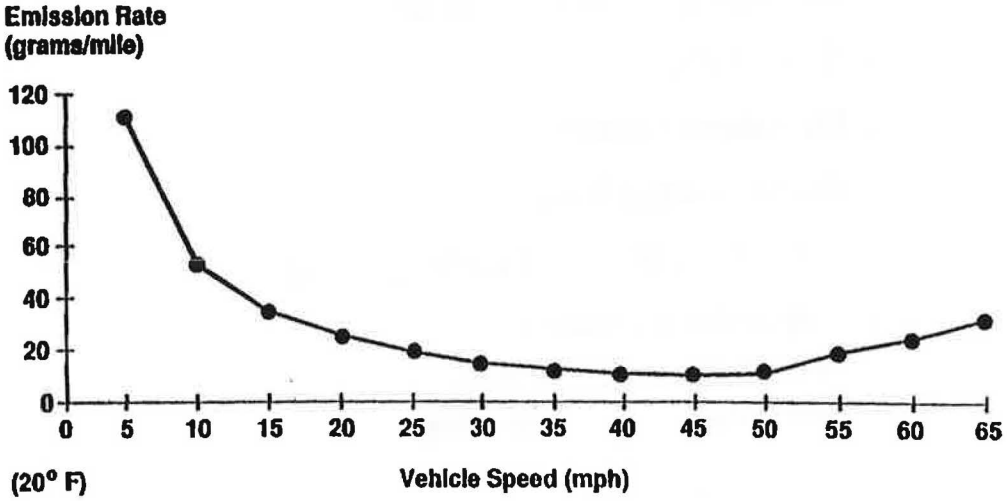
Important Highway Vehicle Emissions Variables

- Month or Season (Temperature)
- Time of Day
- Geographic Location
- Vehicle Miles of Travel
- Cold vs. Hot Start vs. Running (Stabilized)
- Evaporative Emissions
  - Hot Soak
  - Resting
  - Running
  - Refueling

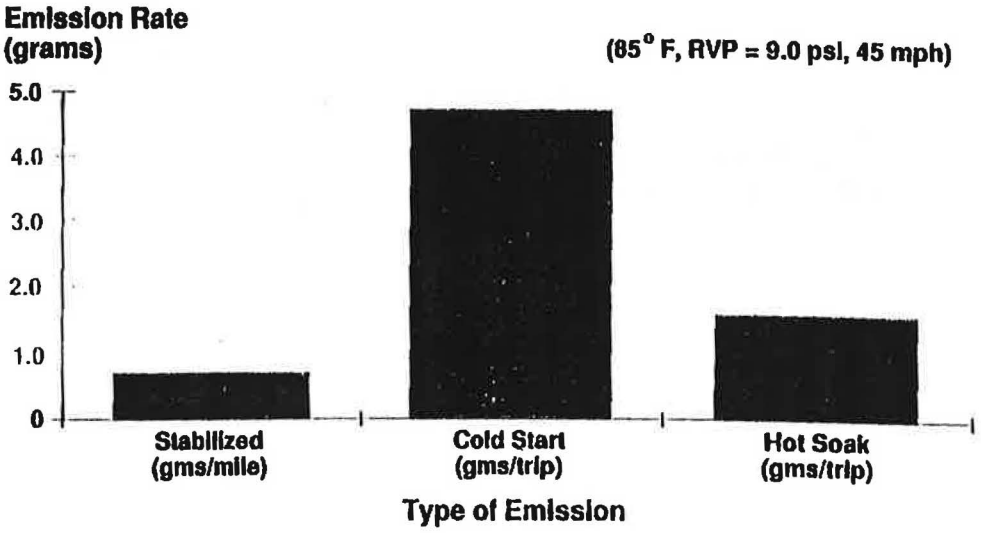
Important Highway Vehicle Emissions Variables (continued)

- Vehicle Speed
- Vehicle Acceleration, Deceleration, Operating Condition
- Vehicle Characteristics
  - Type
  - Fuel Type
  - Age
  - Maintenance
  - Mileage Accumulation
- Use Pattern of Vehicle (Diurnal Evaporative Emissions)

Variation of CO Emissions with Vehicle Speed



Variation in HC Emissions — Trip End vs. Stabilized Operation



Issues Requiring Enhanced Modeling

- Congestion Management
- Air Quality Management
- Downtown Revitalization
- Suburban Development Patterns
- Growth Management
- Airport Access
- Inter-Modal Freight Movements and Coordination
- Housing Location/Price

"States" of Transportation Practice

The Next Generation of Travel Demand Forecasting

- Expanded Range of Policy Sensitivity
- Explicit Consideration of Feedback on Travel Behavior; Simultaneous vs. Sequential Choice
- Integration with Geographic Information Systems (GIS)
- Disaggregate Individual Household, and Market Segment Based Forecasting vs. Aggregate Zonal Approaches
- A Decrease in Standardization
- Trip-Based Emissions and Energy Forecasts vs. Link or Traffic Volume-Based

STATE OF CALIFORNIA

PETE WILSON, Governo

AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

Attachment 3

May 21, 1992

To Interested Parties:

Notification of Workshop to Discuss New Speed Correction Factors Developed for EMFAC

As many of you are aware, the Air Resources Board (ARB) staff is continuously evaluating and improving the methods and data used to estimate emissions from stationary and mobile sources in California. The purpose of this letter is to inform you of an important change we have recently made to the methodology of estimating emissions from on-road motor vehicles. The change is in the speed correction factors which are used by the computer model, EMFAC, in developing emission factors. We believe the change is significant enough to warrant immediate incorporation into emissions analyses done by the transportation planning agencies, and have scheduled a public workshop to discuss the impacts of the change.

Background

EMFAC is the ARB's computer model for estimating emission factors for on-road motor vehicles in the California fleet. These factors are combined with vehicle population and usage data to estimate the total vehicular emissions throughout the state.

EMFAC starts with base emission rates derived from dynamometer tests of a cross section of the fleet in accordance with the federal test procedure (FTP) cycle. EMFAC then adjusts these rates to reflect different modes, temperatures, and speeds encountered outside the FTP. These adjustments are made through correction factors. Data for the correction factors are derived from separate, non-FTP, tests such as high and low temperature tests and high and low speed tests.

Speed correction factors (SCFs) are applied to all vehicle classes and technology groups. The speed correction factors are essentially a set of multipliers that are applied to the "baseline" FTP running exhaust emission rate, whose average speed is 16 mph, to estimate the emission rates at other speeds.

The change in SCFs is being made to three vehicle classes (light-duty autos, light-duty trucks and medium-duty trucks) and to one technology group (catalyst). Catalyst vehicles comprised 77 percent of the fleet for these three vehicle classes in 1987. That percentage increases to 99 percent by the year 2000 due to attrition of the non-catalyst vehicles. The SCFs used for the other

vehicle classes and technology groups will remain unchanged. The change affects only exhaust emissions.

Basis of Change

This change primarily involves a change in the methodology of modeling speed correction factors.

EMFAC7EP is the version of EMFAC that is currently in the public domain. In that version, low and intermediate SCF regression equations from the federal emission factor model (MOBILE4) were combined with ARB high speed equations. For this new, interim version of EMFAC, referred to as E7EPSCF, the actual federal SCF data have been integrated with ARB high speed data. Integrating these different data bases necessitated a change in the regression analyses.

The new regression analyses yield much simpler SCF equations for catalyst-equipped, light-duty autos (LDAs), light-duty trucks (LDTs) and medium-duty trucks (MDTs) than are used in EMFAC7EP. All non-catalyst LDAs, LDTs and MDTs will continue to be modeled in E7EPSCF as currently done in EMFAC7EP.

Effect of New SCFs

Figures 1 through 3 compare the emission rates in grams per mile for LDA catalyst vehicles for the old and new speed correction curves at speeds 5 through 65 miles per hour. These figures are for calendar year 1987. The old speed correction factors show a decrease in emissions of organic gases and carbon monoxide between average speeds of 30 and 55 mph, and of oxides of nitrogen between 30 and 45 mph. The new factors show gradual increases in organic gases beginning at about 35 mph and in carbon monoxide beginning at about 40 mph, and a steep increase in oxides of nitrogen beginning at about 20 mph. Also significant are the increased emission rates at the very low (5 and 10 mph) and high (50 to 65 mph) average speeds.

Figures 4 through 6 show the same curves for calendar year 2000. Table 1 shows the emission factor values that are plotted in Figures 1 through 6.

The overall effect is an increase in the emissions of organic gases, carbon monoxide and oxides of nitrogen. Because the SCFs apply to past as well as future calendar years, all years will see an increase although the magnitude will vary. Figures 7 through 9 show the effect on LDAs in the South Coast Air Basin by process (mode) for calendar year 1987. These figures show an increase in organic gases and carbon monoxide for all three modes: running exhaust and cold and hot start exhaust. For oxides of nitrogen, running exhaust increases while cold and hot starts decrease.

Figures 10 through 12 compare the emissions over time. Four years are shown: 1987, 1990, 2000 and 2010. These figures show a substantial increase in emissions for LDAs for all years due to the use of the new SCFs. The general

downward trend in emissions between 1987 and 2010, which is attributed to new regulations and turnover in the vehicle fleet, occurs with both the old and new SCFs.

Significance of Change

The new speed correction factors will be incorporated into EMFAC7F, scheduled for release this fall. EMFAC7F will also include other changes, such as the benefits of the clean fuels regulations (oxygenates and phase 2 gasoline) recently adopted by the ARB.

However, because of the implications of changes to speed correction factors for conformity analyses required by the federal Clean Air Act, we are releasing the interim version of EMFAC today. A number of transportation planning agencies will be utilizing EMFAC over the next several months in emissions analyses for transportation improvement programs (TIPs). Transportation project consultants also rely on EMFAC for project-level analyses. The ARB believes it is essential that both system and project analyses reflect current improvements in motor vehicle emissions estimates.

Use of the interim EMFAC, E7EPSCF, is in full accord with Clean Air Act requirements that transportation plans and programs be "consistent with the most recent estimates of mobile source emissions." More importantly, agencies which are planning major investments of public funds in the state's transportation systems will be better prepared to evaluate whether currently envisioned transportation improvement programs will contribute to air quality improvement. The new factors may alternately validate current directions or cause planners to reconsider them; the new factors are potentially that significant.

Purpose of Workshop

Because of the importance of the new SCFs, the ARB staff wishes to provide an opportunity to discuss the full details and impacts of the changes. Therefore, we have scheduled a workshop to facilitate a greater exchange of information than possible in this letter and to respond to questions. The date, time and location of the workshop are shown below.

Date: June 25, 1992

Time: 10 am - 3 pm

Location: State Personnel Board
801 Capitol Mall, Room 150
Sacramento, California

If you have questions about the development of the new speed correction factors, please contact Jeff Long at (818) 450-6140. If you have questions regarding the workshop or the impact of the new speed correction factors on the emission inventory, please contact Bob Effa at (916) 323-4950. For assistance with conformity issues, please contact Doug Thompson at (916) 322-7062.

Sincerely,

Michael H. Scheible
Deputy Executive Officer

Enclosures

FIGURE 1

COMPARISON OF SPEED CORRECTION CURVES

TOG (CY=1987, LDA-CAT)

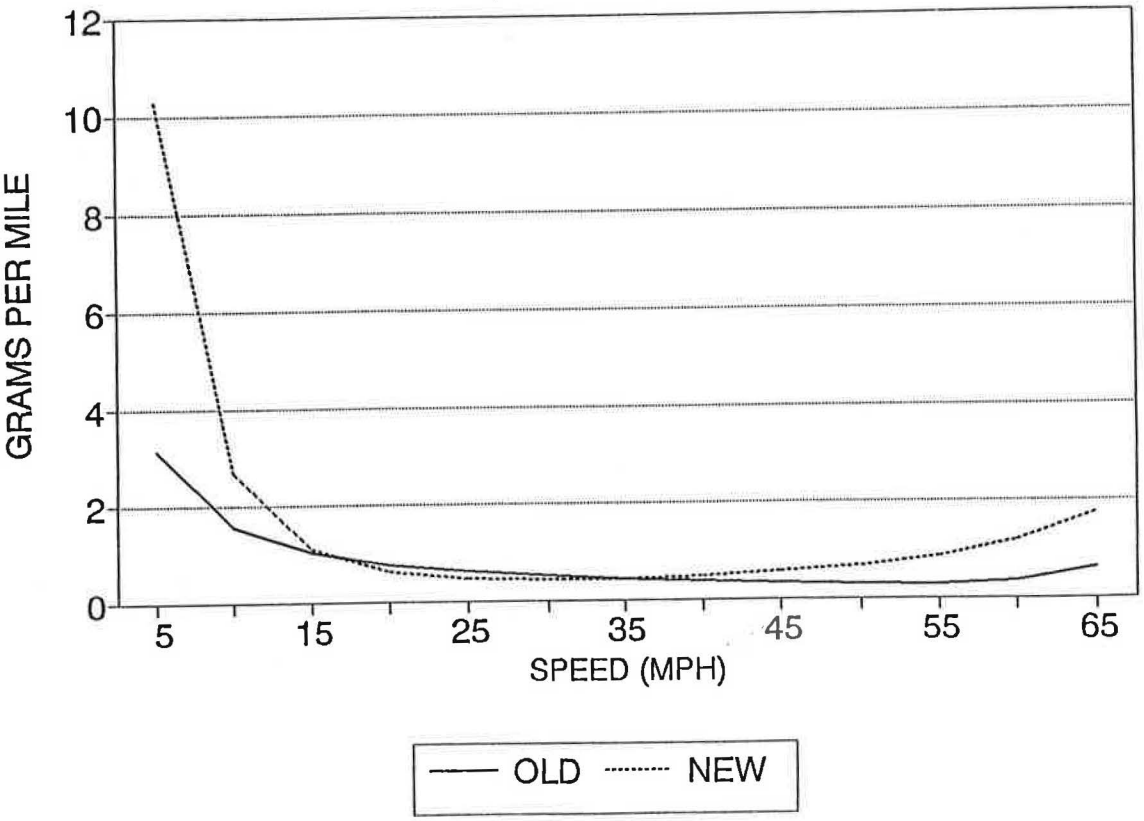


FIGURE 2

COMPARISON OF SPEED CORRECTION CURVES

CO (CY=1987, LDA-CAT)

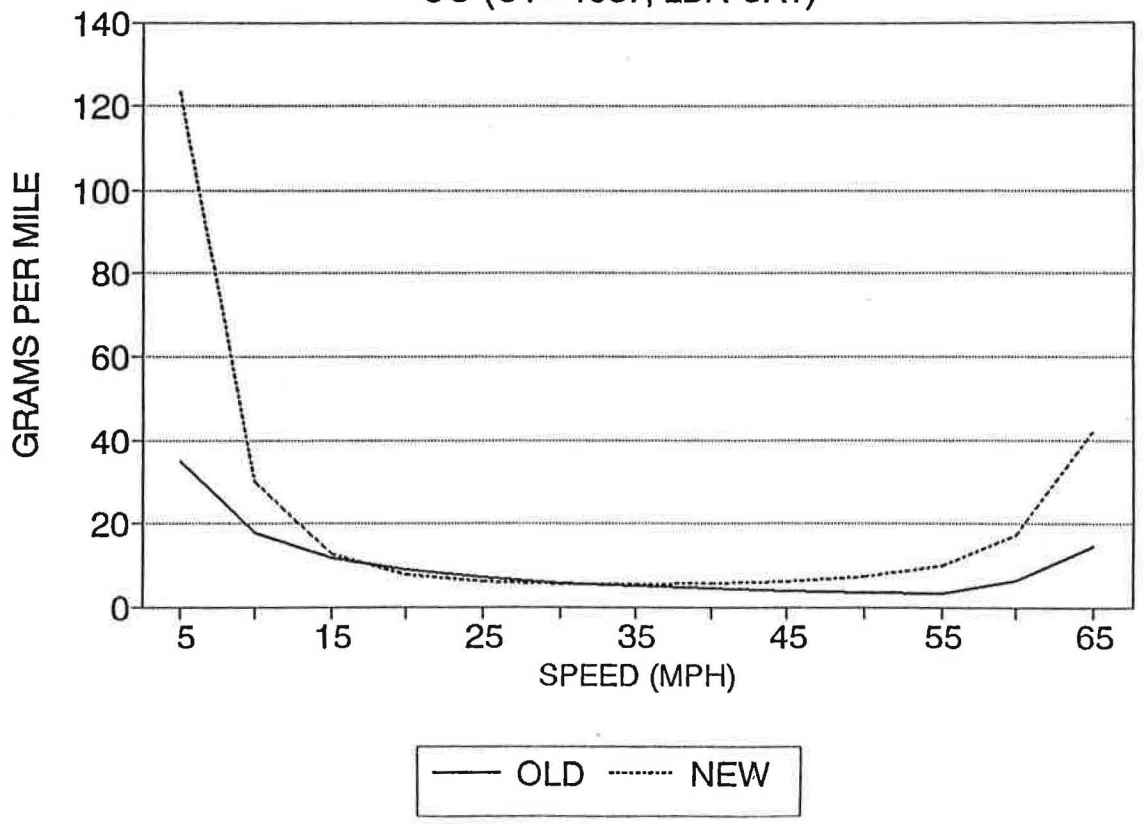


FIGURE 3

COMPARISON OF SPEED CORRECTION CURVES

NOX (CY=1987, LDA-CAT)

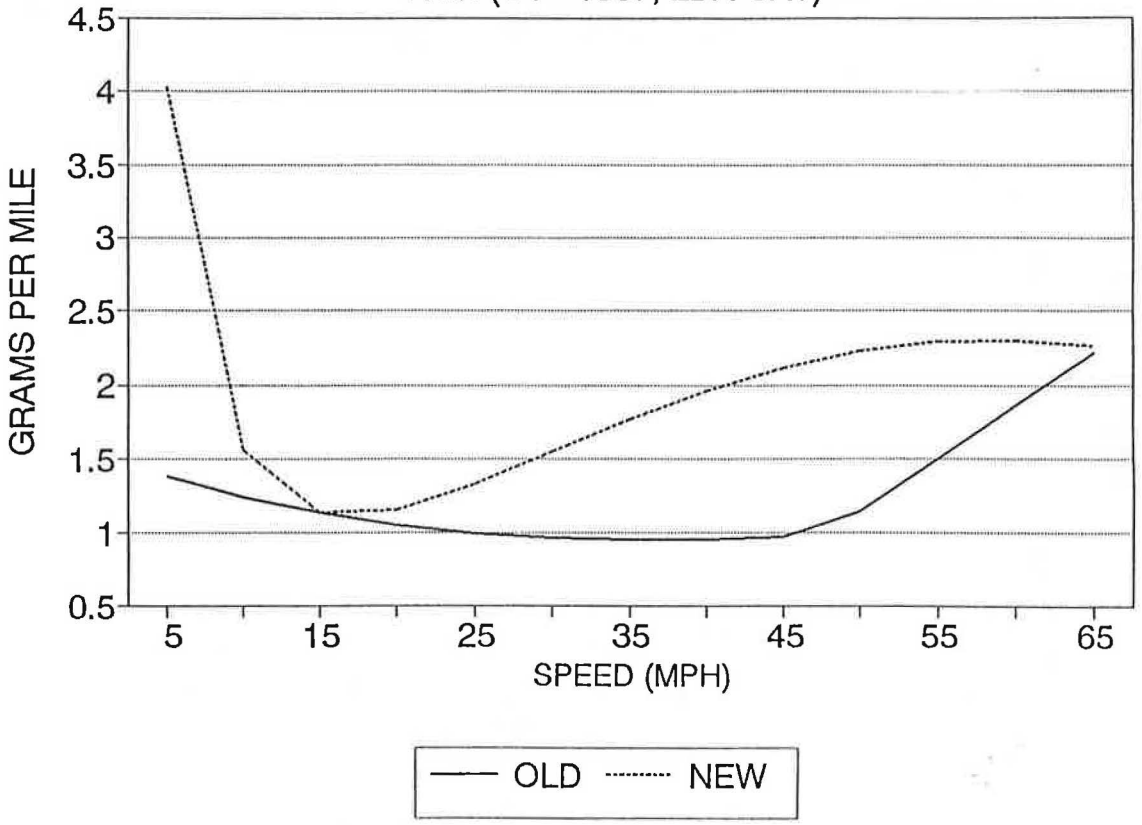


FIGURE 4

COMPARISON OF SPEED CORRECTION CURVES

TOG (CY=2000, LDA-CAT)

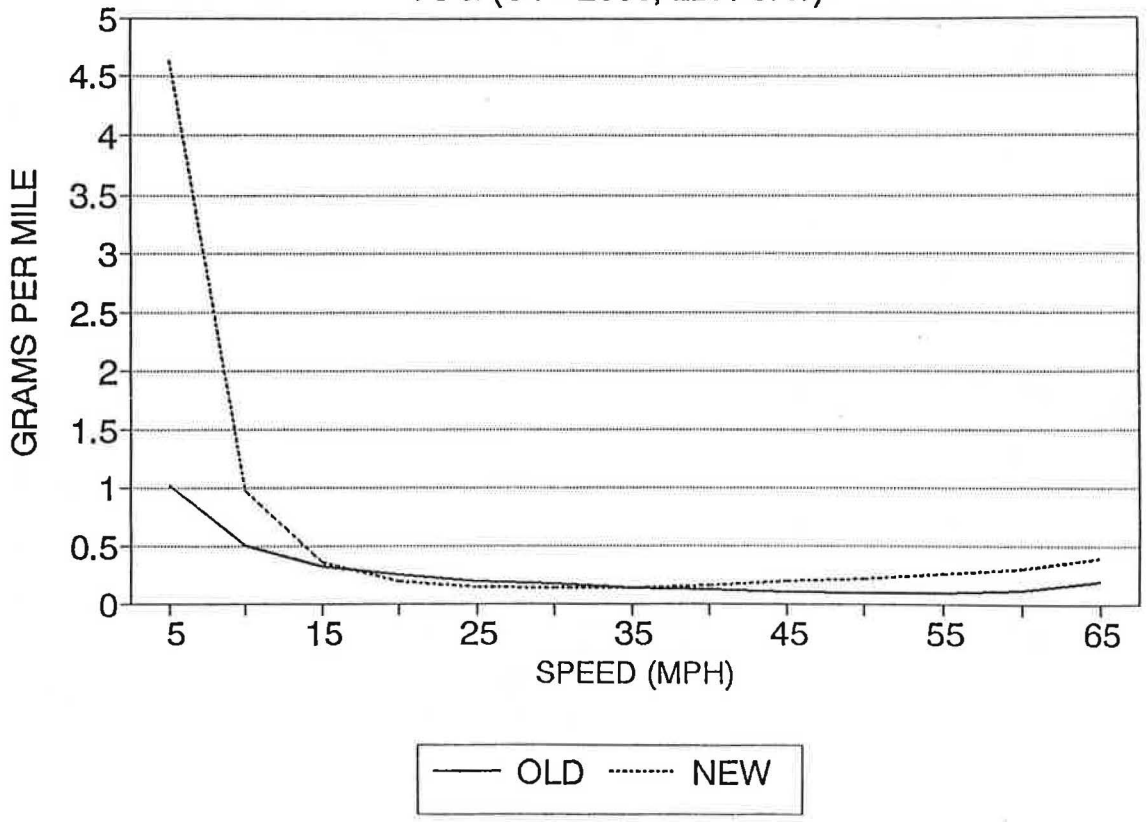


FIGURE 5

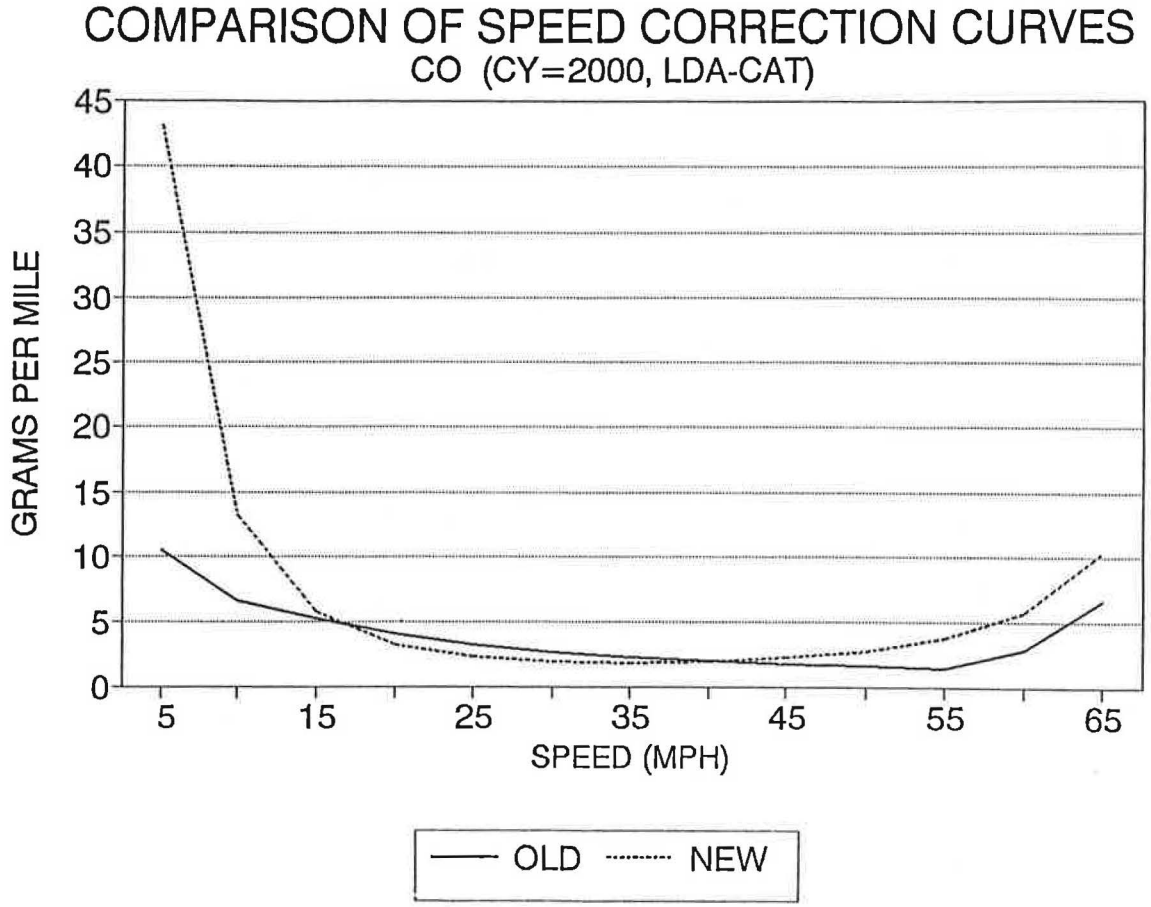


FIGURE 6

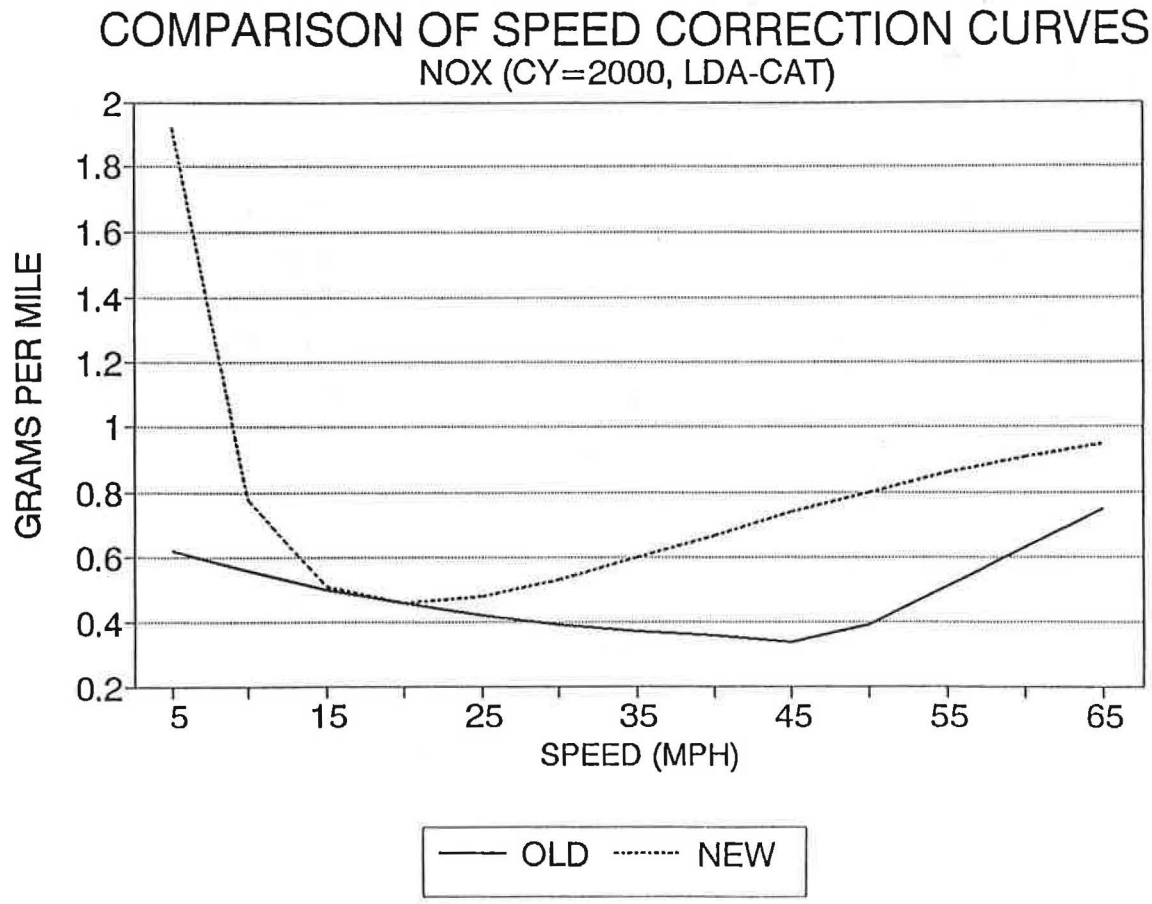


TABLE 1

COMPARISON OF OLD AND NEW SPEED CORRECTION FACTORS
(EMISSION FACTORS IN GRAMS/MILE FOR CATALYST-EQUIPPED LIGHT DUTY AUTOS)

		SPEED (MPH)											
		5	10	15	20	25	30	35	40	45	50	55	60	65
YR 1987														
TOG	OLD	3.14	1.56	1.03	0.77	0.62	0.51	0.44	0.39	0.34	0.31	0.28	0.37	0.62
TOG	NEW	10.29	2.68	1.10	0.64	0.48	0.44	0.45	0.49	0.57	0.69	0.88	1.18	1.76
CO	OLD	34.83	17.57	11.81	8.87	7.10	5.92	5.07	4.44	3.94	3.55	3.23	6.30	14.41
CO	NEW	123.42	29.93	12.55	7.70	6.05	5.52	5.47	5.67	6.16	7.23	9.80	16.88	42.40
NOX	OLD	1.38	1.24	1.13	1.05	0.99	0.96	0.95	0.95	0.97	1.14	1.50	1.86	2.22
NOX	NEW	4.02	1.56	1.13	1.15	1.33	1.55	1.77	1.96	2.11	2.23	2.29	2.30	2.26
YR 2000														
TOG	OLD	1.02	0.51	0.33	0.25	0.20	0.17	0.14	0.13	0.11	0.10	0.09	0.12	0.20
TOG	NEW	4.64	0.98	0.36	0.20	0.15	0.14	0.14	0.16	0.19	0.22	0.26	0.31	0.40
CO	OLD	10.52	6.55	5.23	4.05	3.24	2.70	2.31	2.02	1.80	1.62	1.47	2.88	6.58
CO	NEW	43.17	13.29	5.78	3.29	2.32	1.94	1.84	1.93	2.21	2.75	3.75	5.71	10.32
NOX	OLD	0.62	0.56	0.50	0.46	0.42	0.39	0.37	0.36	0.34	0.39	0.51	0.63	0.75
NOX	NEW	1.92	0.78	0.51	0.46	0.48	0.53	0.60	0.67	0.74	0.80	0.86	0.91	0.95

FIGURE 7

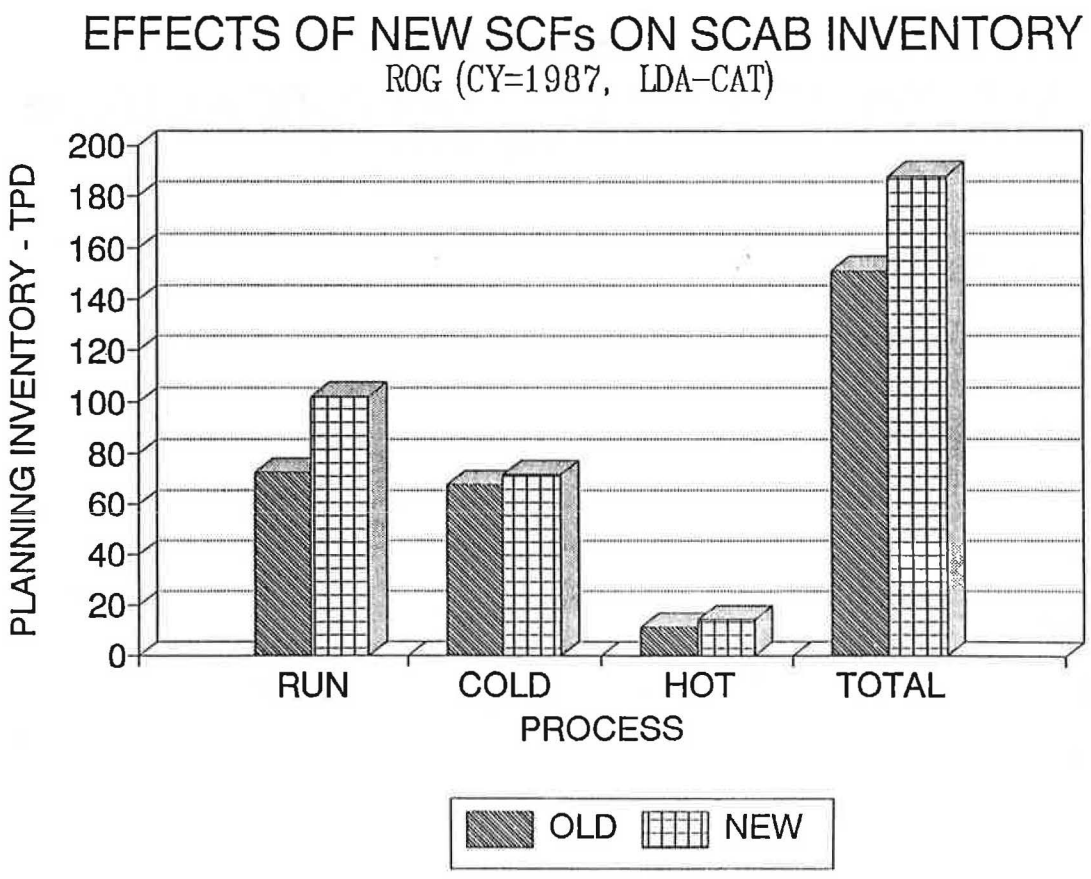


FIGURE 8

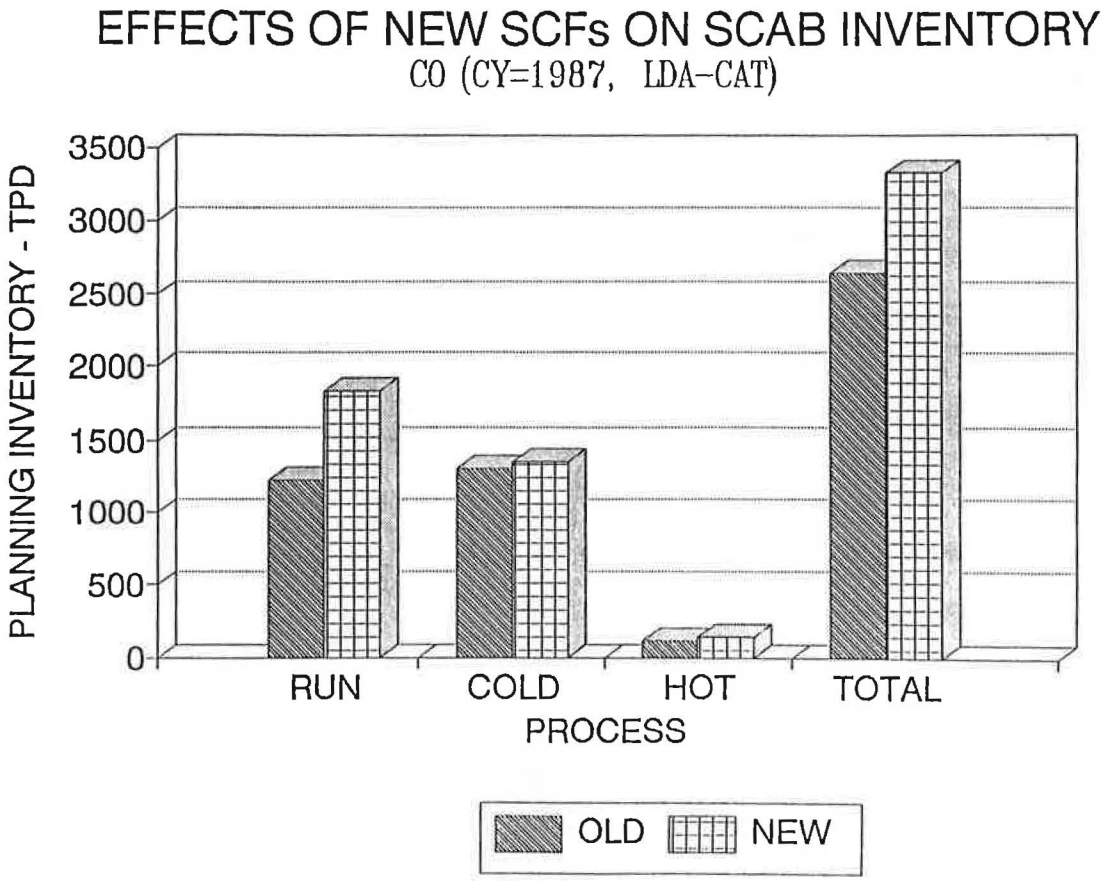


FIGURE 9

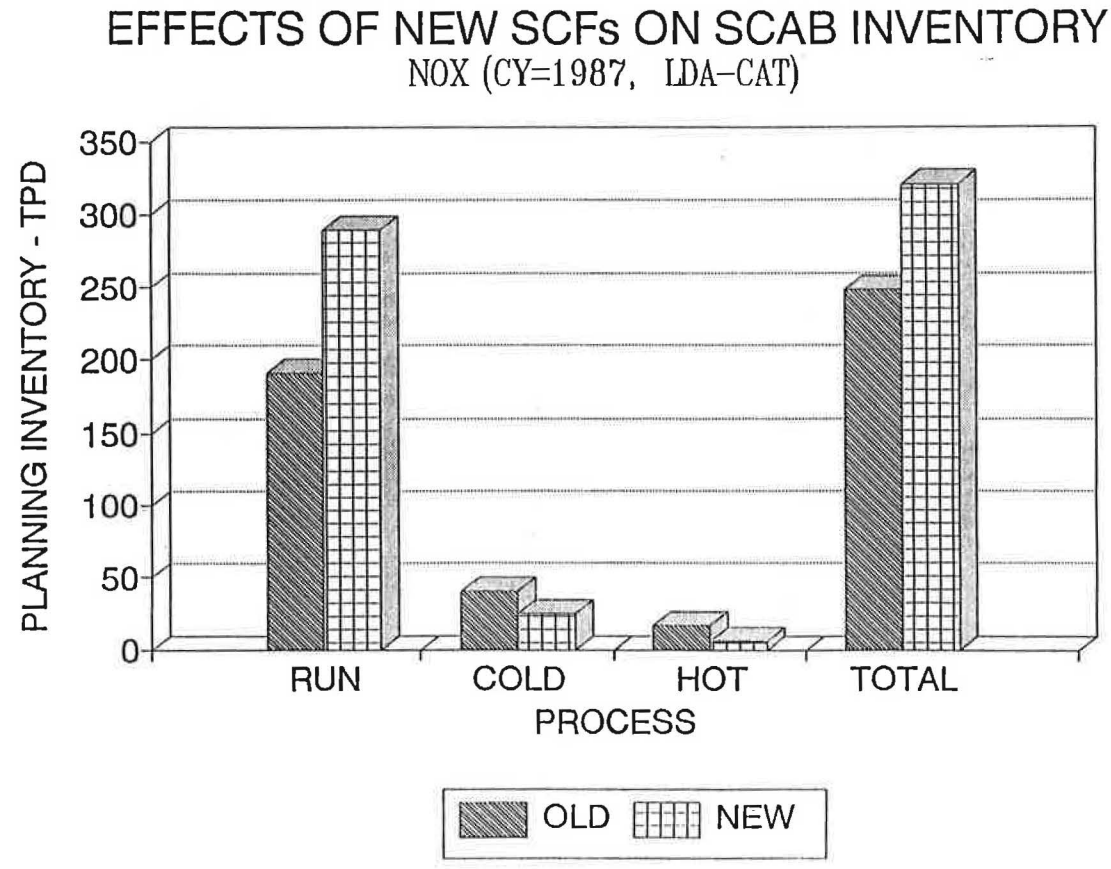


FIGURE 10

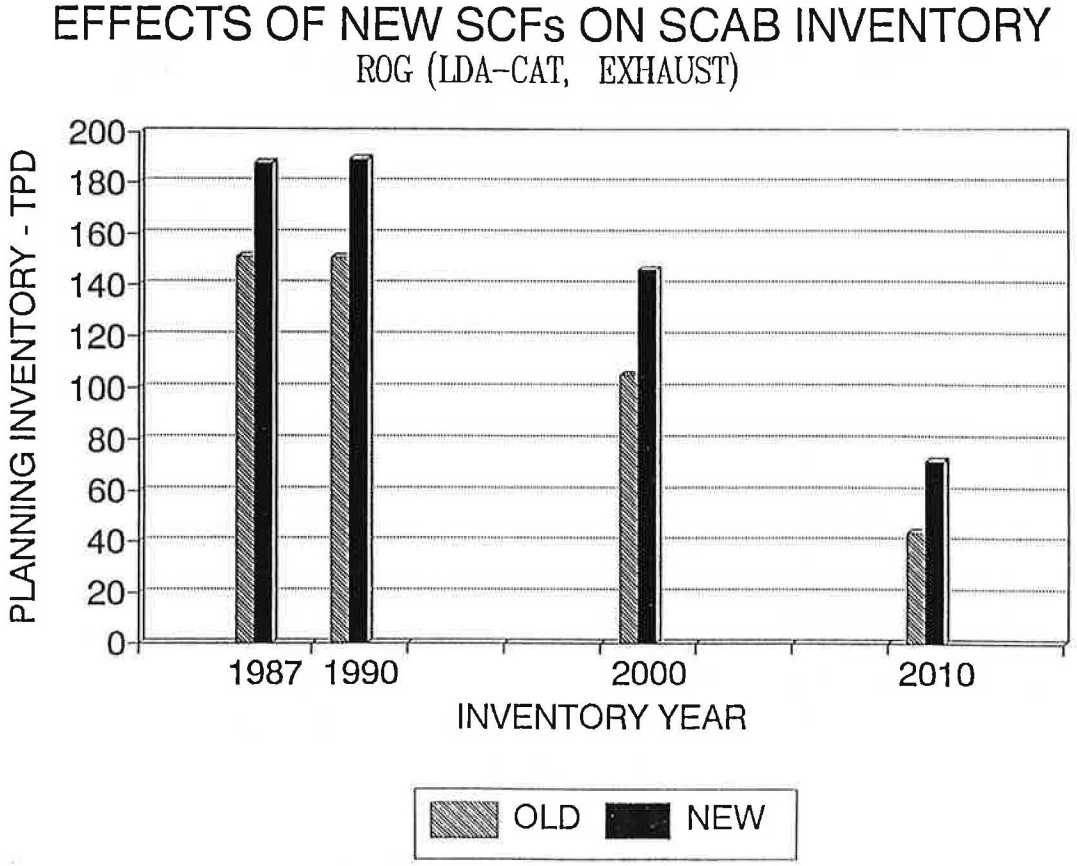


FIGURE 11

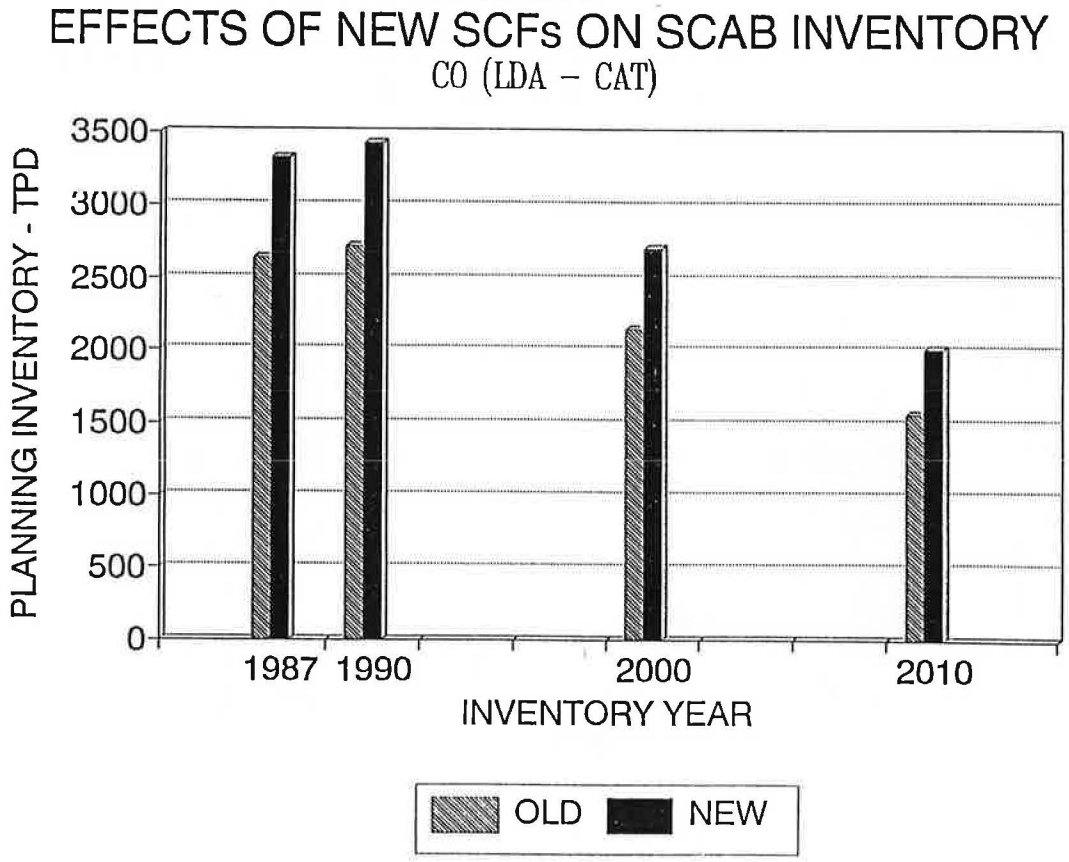
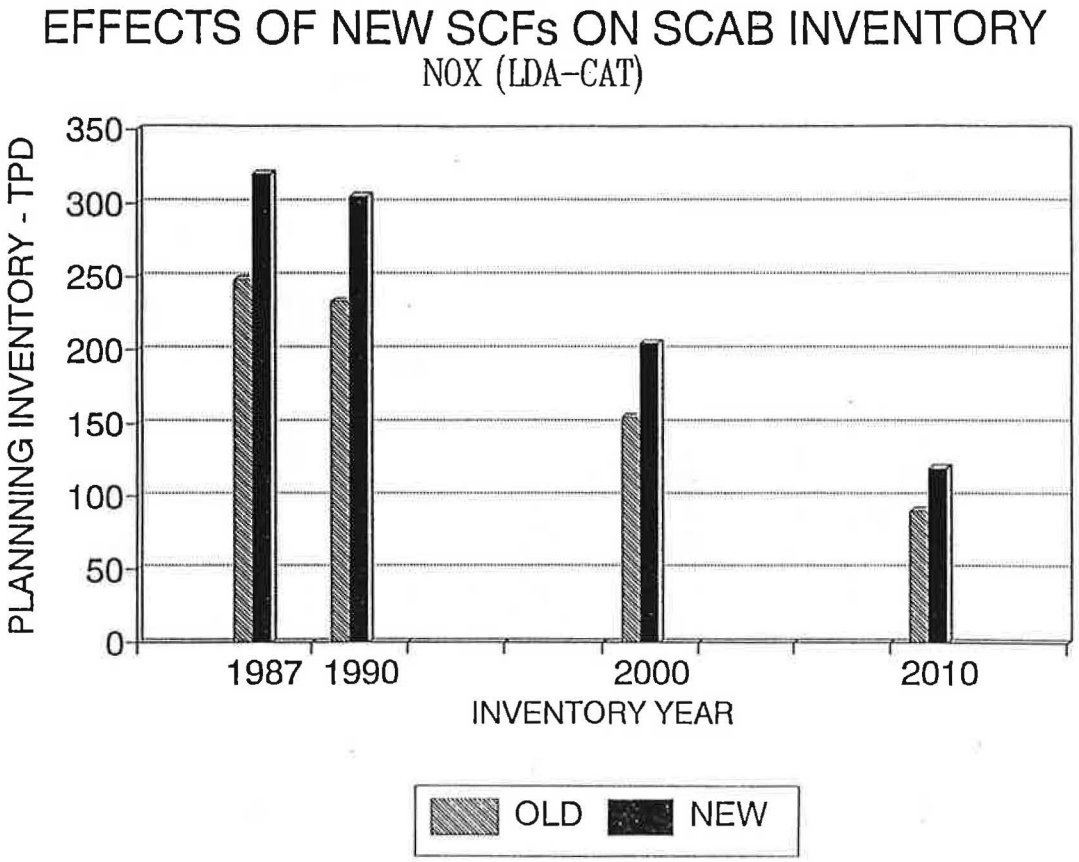
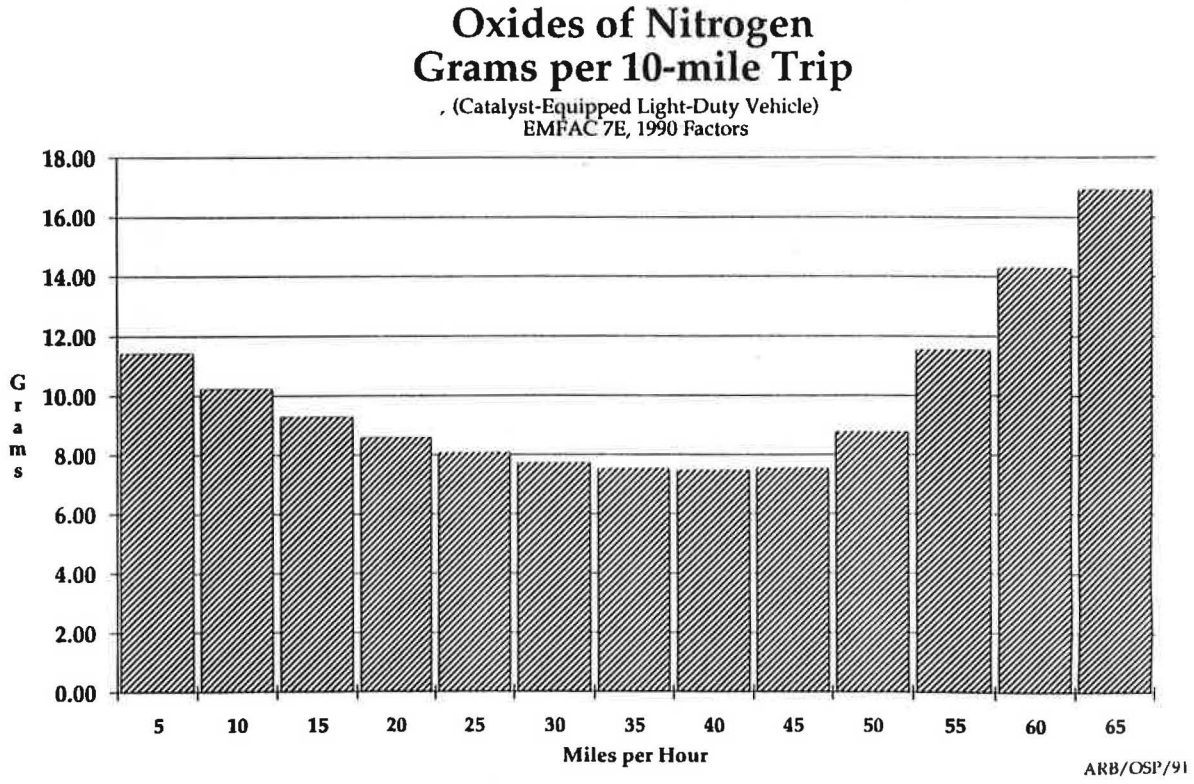


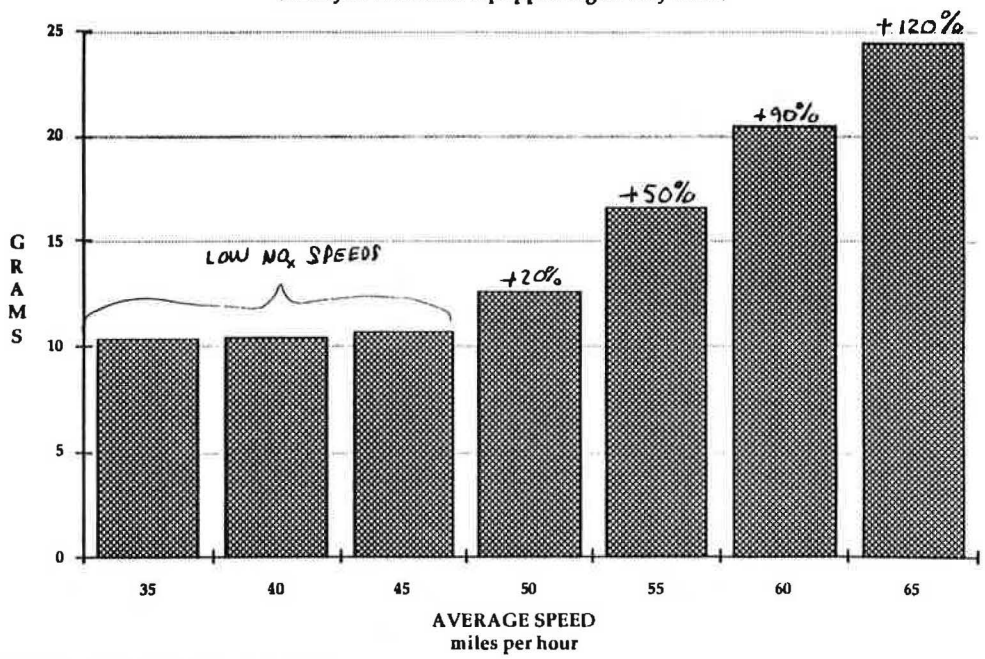
FIGURE 12


EFFECTS OF NEW SCFs ON SCAB INVENTORY
NOX (LDA-CAT)
PLANNING INVENTORY - TPD
350
300
250
200
150
100
50
0
1987
1990
2000
2010
INVENTORY YEAR
OLD
NEW


Oxides of Nitrogen
Grams per 10-mile Trip
(Catalyst-Equipped Light-Duty Vehicle)
EMFAC 7E, 1990 Factors
Grams
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
5
10
15
20
25
30
35
40
45
50
55
60
65
Miles per Hour
ARB/OSP/91

OXIDES OF NITROGEN (NOx) EMISSIONS BY SPEED CATEGORY 10 MILE TRIP

(Catalytic Converter Equipped Light Duty Auto)

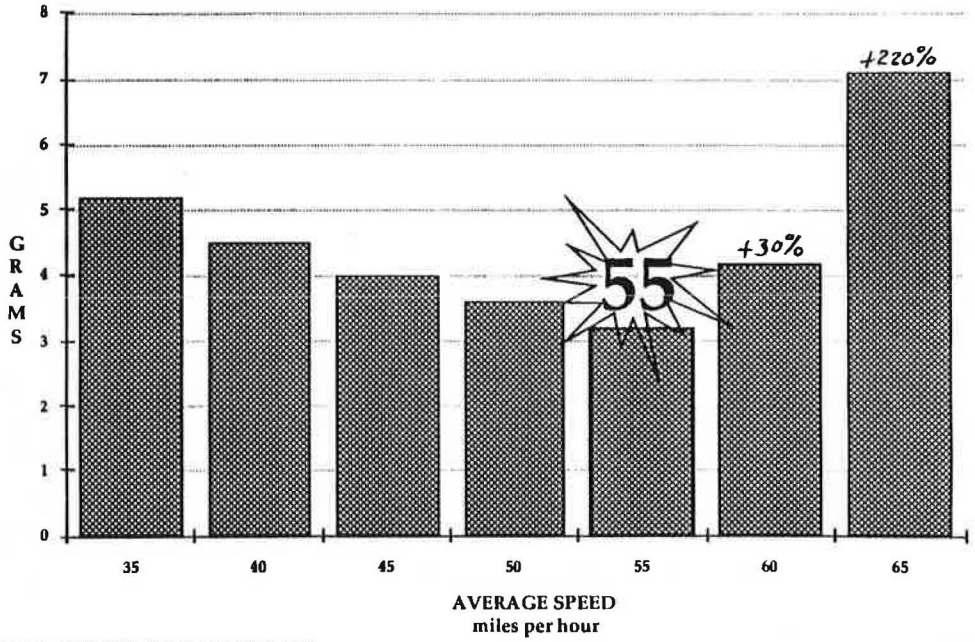


EMISSION FACTORS FROM DRAFT - EMFAC 7E

ARB/OSP/4-90

TOTAL ORGANIC GASES EMISSIONS BY SPEED CATEGORY 10 MILE TRIP

(Catalytic Converter Equipped Light Duty Auto)



EMISSION FACTORS FROM DRAFT EMFAC 7E

ARB/OSP/4-90