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COMPREHENSIVE DATA RESEARCH PROGRAM-TRACK D
TRAVEL MODEL IMPROVEMENT PROGRAM (TMIP)

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COMPREHENSIVE DATA RESEARCH PROGRAM--TRACK D
Travel Model Improvement Program (TMIP)

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OVERVIEW

A long-term research program was initiated recently focusing on improving transportation data collection, analysis and use. Two major areas of research are being targeted: improving data collection methods to support States and metropolitan planning organizations (MPOs) to better respond to the Internodal Surface Transportation and Efficiency Act (ISTEA) and the Clean Air Act Amendments of 1990 (CAAA'90); and data needs for travel model improvement and development efforts. A framework for a multi-year program has been developed and several "quick-start" projects are due for completion early this year. These projects feed in to a "white paper" addressing: (1)current data collection practices and capabilities of States and MPOs to support travel modeling, (2)near and long-term trends in data collection practice, (3)gaps between current practice and state-of-the-art, (4)data needs to support contemporary and emerging model systems, (5)emerging technologies for data collection, (6)recommendations for research over the long term, and (7)proposals for filling in the details of a long-term research program.

The Travel Model Imurovement Program (TMIP)--The TMIP was established in 1992 to improve existing models and develop new analytical procedures for travel forecasting to overcome the limitations and deficiencies of models currently available to States and MPOs. Current models are not well suited to analyzing contemporary issues such as assessing congestion management and mobility enhancement strategies, analyzing transportation control measures, evaluating multi modal alternatives and major transportation investments, and the effects of alternative development patterns on travel. Both near- and long-term research under TMIP will provide practitioners with better transportation planning tools.

Within the Travel Model Improvement Program (TMIP) there are five "tracks" or emphasis areas of research and development. Track A is oriented to outreach consisting of training, technical assistance, research coordination, and a clearing house function. Tracks B and C center on near- and longer-term improvements to the analytical travel forecasting process. Track E is focused on improving land use models and the ability to quantify the relationship between land use activity and travel. The purpose of Track D is to identify, design, and develop improved data collection procedures that will meet transportation decision makers' current and future needs. Data to support activities in the other tracks is included within the scope of Track D.

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To help guide the overall direction of the TMIP a review panel was established that includes representatives of the States, MPOs, transit agencies, the private sector, environmental **groups,** and universities. This review panel meets twice a year to review the status of the program and offer recommendations for continued activities. Additional detail on the TMIP can be found in the TMIP Brochure and various other TMIP publications.

NEEDED RESEARCH ON DATA-BACKGROUND

There are two major areas of research that have been targeted: (1)data needs, collection methods, and analyses for the transportation program applications of States and regional planning agencies, and (2)data to support model improvements and development in Tracks B and C.

In the first case, state-of-the-art data collection methods are being assessed and guidance developed to assist transportation planning agencies in developing the data necessary support **metropolitan transportation** planning and to apply current travel forecasting models. Timely data and information is needed by decision-makers to assist them in carrying out the transportation programs in their areas. As new travel forecasting methods and technology become available, data to support them will be needed by transportation agencies that plan to apply these new methods. Long-range data needs must be anticipated.

The other major area of research determines data needed to support travel model improvement and development efforts. The research will identify where, when, and how the desired data should be obtained and the level of precision and degree of detail or disaggregation needed. Shortcomings of current data and existing sources will be identified, and actions to improve the quality of data from those sources will be determined. Potential new data sources will be examined to provide more accurate and detailed information that will complement and enhance current sources.

Mission--The mission of Track D is to develop and improve methods for data collection, acquisition, and use that support contemporary and future model calibration, validation, and application by States and metropolitan planning organizations (MPOs), and others with direct interest in travel surveys. These methods should accommodate, and be compatible with, the shifts in model development occurring today (e.g., activity-based, non-motorized travel, transportation/land use interaction, stated preference, and GIS).

A Question of Scone--A major consideration early in the development of the Track D Program was how broad the scope of the program should be (i.e., what is the definition of data?). Should the program center on travel model improvements, and on data needs of traditional transportation planning programs (e.g., demand, supply, performance, and evaluation), or should it be broader? Metropolitan transportation planning scope and flexibility are much greater today than in the past. Current and emerging issues shaping the planning process will require information and analytical ability in areas as diverse as economic growth, quality of life, cross-modal trade-offs, societal costs, **environmental justice, etc.** Planners will have **to** respond **to these issues** and data and analytical methods will be needed to do this. The consensus of the TMIP **Review Panel** meeting in January 1995 was to focus for the time being on data for travel models, then re-visit this question at a later time. **The current focus of Track D research is on data to support travel demand analysis and evaluation and the assessment of performance of the transportation system.**

STATUS OF TRACK D

Over the past year feedback on a proposed program has been obtained from a variety sources: discussions at TRB, research recommendations from the household travel survey conference (March 12-15, i 995), discussions at the 5th Applications Conference in Seattle in April, 1995, TMIP I and II Conferences in August 1994 and December 1995, comments by TMIP Review Panel members, and in other forums. These sources have provided some excellent initial recommended research projects for consideration.

In addition to these sources, the development of a comprehensive research program has been guided by the general recognition that there needs to be a focal point to: (1)coordinate and monitor on-going research on data, and (2)a means to identify and initiate new data-related research.

Since the initial concept of a Track D was presented to the TMIP Review Panel in January 1995, and subsequently discussed at meetings in August and December 1995, there have been three major accomplishments: (1)five early "quick start" projects have been initiated, with reports available in the summer of 1996; (2)a framework for Track-D was established; and (3)considerable coordination has been accomplished.

Overall Framework for Track D

Figure 1 is a general picture of the program as it is structured to date, including the first of a "second wave" of high-priority projects funded in FY 1996. The three new projects on non-response and small-area guidance are listed in Appendix A. The activities in the grey boxes define Track D efforts.

To structure a long-term research program, it was apparent that we first needed to assess and answer the following questions:

1) where is data collection practice today and, from a cross-section of recent data collection activities, what are the States and MPOs, and others, doing?

2) given the state-of-the-practice, where is the state-of-the-art today and where is it likely to be heading in the future? and

3) given the answers to these questions, along with input from practitioners and researchers, what should a comprehensive, long-term research program look like to advance both the state-of-the-practice and the state-of-the-art?

TMIP--TRACK D (DATA) PROGRAM

FY'95 | FY'96 | FY'97 | FY'98

TRACK B
(Current Procedures)

- *New Survey Manual* (FY'95–FY'96)
- New Methods-Applications (FY'97–FY'98)

TRACK A
(Outreach)

- *Travel Survey Course*
- *Survey CD*

TRACK D
(Data)

Quick Start Projects
-Scan of Recent Surveys
-Portland Case Study
-Scan of Data Research
-Synth of Conf. Research

- Detail Recommen.
- Identify Priorities
- Propose Program

- Monitor Progress,
- Update Program
- Coordinate, etc.

- Update Survey Manual

- *Assess SOP Vs. SOA*
("White Paper")
- *"Straw" Program*

Guidance on Non-Response
Initiate High-Priority Projects:
Case Study on NR
Guidance for Smaller Areas

- *Related Activity / Coordination*

KEY:
Italics= Underway
Italics = Draft in Review

The answers to these questions will lay the foundation for the longer-term, more substantial research to come. This near-term research focuses on assessing current activity, assimilating current knowledge, and pulling together existing material on surveys and data collection methods and activities. Careful consideration is given to existing, on-going work, and to the relation of that work to the program objectives of Track D. For example, recommendations from recent research, conferences, papers, etc. are synthesized. Current and recent data collection activity by practitioners is summarized. Other research is assessed for its relevance to Track D (see Appendix A for a listing of current USDOT research related to data collection and use in transportation planning). Comments and ideas from practitioners and experts in the field have been solicited and incorporated in these early efforts.

"Quick Start" Projects and First Year Work (FY 1995)--To assist FHWA and FTA with compiling and reviewing relevant information, Cambridge Systematics, Inc. was engaged to conduct the initial projects under Track D. These projects have the objective of providing immediate assistance to States and MPOs, as well as setting the direction for a longer term research program. The following paragraphs detail these early projects.*

1) Scan of Recent Travel Surveys

Status: Final report; availability: summer 1996.

This scan provides a baseline of current activity (1990-l 995) against which future expected data collection and needed improvements to methods can be assessed. Information based on contacts with 5 1 metropolitan planning organizations (MPOs) revealed that since 1990 there were 42 household travel surveys conducted, including 4 statewide travel surveys. Thirteen of these are activity-based household surveys. In contrast, in the decade prior to 1990, 22 household travel surveys were conducted. While most of the surveys in the '90s have been carried out by larger metropolitan areas, 20 percent of the 38 MPO surveys were conducted by areas under 750,000 population.

Pertinent information on these surveys includes:

- location
- dates of the survey(s)
- agency/contact
- type of survey(s)
- purpose of the survey(s)--household, external, visitor, transit, workplace, etc.
- sample size
- some measure of "success" (e.g., response rates)
- cost
- any other comments relevant to the survey(s)

* For information about obtaining a copy of the reports from these projects, see last page of this paper.

The conclusions drawn in this report provide a setting for current travel survey activity across the U.S. It is clear that shifts are taking place toward activity-based and stated preference questions, and to a limited extent, longitudinal type surveys. Methodologies today routinely include CATI/CAPI and GIS, but the incorporation of the full capabilities of advancing technology have not yet been realized.

It is anticipated that this report will be distributed as a companion document to the Travel Survey Manual (see Project #6) now under final review. Information in this Scan will be periodically updated. USDOT requests feedback from MPO, State, transit operators, and others to help keep the information current.

2) Scan of Recent Data Research

Status: second draft being reviewed; availability: Fall 1996

This is a listing, description, and assessment (of its relevance and relationship to Track D) of current, and planned, research. This listing covers surveys in their broadest definition (e.g., traditional household surveys, data from supplemental sources, road-side surveys, vehicle occupancy, on-board transit, unobtrusive methods, new data sources and needs, etc.) and what their products are expected to be/have been. Implications for the Track D program are explicitly considered. Observations in the report about current research and future research needs cover such topics as: GIS, use of Census data, computer-assisted surveying, intelligent transportation systems, and multimedia/virtual reality.

Based on this scan, the majority of recent data-related research is oriented to the development of new approaches to travel demand modeling rather than directly to improving data collection methods and procedures. The majority of this travel demand research points to new travel models that are much more data intensive than today's four-step model systems, implying more and/or better data to support such improvements as stated preference and activity-based modeling, and micro simulation. This is coming at a time when States and MPOs are facing significant budget and staffing limitations, leading to a need for more cost-effective data collection methods. It is clear that a program of data collection and survey research needs to be closely coordinated with the research in other tracks of TMIP and with other on-going travel model research.

Several related research activities currently underway, were considered in this scan:

NCHRP 8-32(5) -- "Multi modal Transportation Planning Data"
NCHRP 25-7 -- "Transportation Data and Modeling Procedures for Air Quality Emissions Estimates"
NCHRP 20-5 -- "Methods for Household Travel Surveys"
Effect of a Continuous Count Census on Transportation Planning
development of a freight modeling handbook (FHWA)*

performance measures and other data for advanced congestion management applications (FHWA)*
assessment of collection techniques for travel times/speeds (FHWA)*
case studies of methods for collecting vehicle occupancy data (FHWA)*
research being conducted under Track B (near-term)**
research being conducted under Track C (TRANSIMS)**

3) Synthesis of Conference Data Research Recommendations

Status: first draft in review; availability: this document is intended for internal use and limited distribution to researchers. It will not be widely available.

Several conferences in recent years have produced recommendations for improvements to, and research for, data collection and use in State and regional transportation programs. Other sources of research recommendations needed to be accessed and evaluated. A synthesis of pertinent recommendations for research was compiled from the proceedings of 22 conferences held within the last five years and having potentially important implications for transportation data collection. This resulted in 153 individual recommendations that were entered into a computerized data base. An assessment of the relevance and usefulness of these research recommendations to Track D is included, with categorization and prioritization (e.g., basic vs. applied; and near-term vs. long-term; or urgently needed vs. needed, but not necessary, etc.). Approximately half of the recommendations are directly related to the TMIP, with two-thirds of these having some potential relevance to Track D. See Appendix B for representative recommendations from these conferences. Among the conferences and other research "sources" that are included in the synthesis are:

A) Conferences:

Transnortation. Urban Form. and the Environment, Beckman Center, Irvine, CA, December 9-12, 1990 (TRB Special Report 23 I).
National Conference on Transportation Environmental Research Needs, Denver, CO, November 13-15, 1991.
The Effects of Added Transnortation Capacity, Bethesda, MD, December 16-l 7, 1991 (TMIP Report #DOT-T-94-12).
Transnortation Data Needs: Programs for a New Era -- Implications for State DOTS and MPOs, Irvine, CA, May 1992 (Transportation Research Circular No. 407, April 1993).
Transportation Planning. Programming. and Finance, Seattle, WA, July 19-22,1992.
U.S. Conference on Panels for Transportation Planning, Lake Arrowhead, CA, October, 1992, (selected papers from this conference are forthcoming in a publication edited by Thomas Golob, Lyn Long, and Ryuichi Kitamura).

* See Appendix A for more information on these projects
** See TMIP reports for more information on these projects

<u>NCHRP Workshop to identify a multi vear research agenda for consideration under the NCHRP</u>, Irvine, CA, November l-3,1993 (recommendations being implemented under NCHRP 8-32).
<u>National Conference on Decennial Census Data for Transportation Planning</u>, Irvine, CA, March 13-16, 1994.
<u>Travel Model Improvement Program Workshop,</u> Fort Worth, TX, August 14-17, 1994.

B) Other Sources:

<u>Identification of Transnortation Planning Data Reauirements in Federal Legislation</u>, TMIP Report No. DOT-T-94-2 1, July 1994.
<u>Punet Sound Transportation Panel -- Four Waves: and other research reports resulting from the Pueet Sound panel</u> (presented at the Travel Model Improvement Program Workshop, Fort Worth, TX, August 14-17, 1994).
<u>Stated Preference Methods: **Applications** in Land Use. Transportation Planning and Environmental Economics -- Short Course</u>, Portland State University, Portland, OR, December 12-16, 1994.

4) Data Collection in the Portland, Oregon Metropolitan Area

*Status: second draft reviewed, in final preparation for publication; **availability: summer 1996.***

Portland, Oregon has emerged as one of several good examples of contemporary, modern-day data collection. The travel surveys conducted in the region were designed to support advanced travel modeling, including activity-based forecasting. The Portland survey instrument includes multi-day activity diaries, in-home and out-of-home activities, full week coverage, transit usage, and all household members. Trip ends are geocoded to x-y coordinates for application within a GIS environment. In addition, there is close coordination and integration with other relevant databases (such as land use, parking, building permits).

This case study describes the entire data collection program for transportation planning and chronicles the steps and decisions that entered into achieving the current data collection activity in the Portland, Oregon region. The material is suitable for distribution to other practitioners as a stand-alone-document. In addition, portions of the material will be incorporated into the new travel survey course currently being developed and into other media oriented to data collection methods.

This document should be useful to States and MPOs considering data collection activities to support contemporary transportation planning processes. It contains much of the Portland "experience" to assist other practitioners in developing their data collection program. A number of lessons and recommendations are drawn from this experience.

5) An Assessment of Emerging Data Collection Practices to Support State and Regional Transportation Planning (White Paper)

Status: draft in review; availability: summer 1996, limited distribution.

This "white paper" is a statement of contemporary conditions and prospects of the data requirements for State and regional transportation programs in the context of research objectives of Track D. It is based on the review and assessment in the previous four Tasks, current knowledge of the contractor, current wisdom and views of the transportation planning community, on-going contacts and discussions' between the contractor and practitioners/clients, discussions with DOT staff, and other sources. This paper includes such topics as:

recommendations for, and an approach to, the development of a more complete research program

recommendations for DOT-sponsored research vs. research more appropriate for other agencies

an assessment of what is needed for both near-term and long-term research to improve data collection practice

While the paper does not contain the details of a comprehensive research program, it does provide the foundation upon which a program of research activities can be developed. This paper will be a valuable resource document for the "next steps" in the Track D program.

6) Travel Survey Manual and NHI Course

Status: (1)Survey Manual in final preparation for printing; availability: Spring-Summer 1996; (2) NHI Course under development; availability: fall 1996

A major initiative started early in 1995 is the development of a new travel survey manual. Over 20 years have elapsed since the last definitive guidance was produced for States, MPOs, and others to use in considering, designing and implementing travel surveys. This new manual provides extensive guidance for developing and implementing the seven most common types of travel surveys: household travel and activity, vehicle intercept and external station, transit on-board, commercial vehicle, workplace and establishment, special generator, and parking. Contemporary and future models require more detailed information than ever before on travel characteristics and on peoples' travel choices. In addition, travel surveys have become much more complex than in the past; reflecting such things as declining respondent cooperation, increasing analytical demands, and new survey technologies. The manual addresses these and many other important considerations in travel surveys.

A companion effort to the Survey Manual is the development of a new NH1 Course based on the material in the manual.

It is anticipated that both the Survey Manual and the NHI Course will be made available through electronic form, with improved user guides, hyper media, additional video and using other latest electronic technology and capability.

7) Improved Decision Support

The complex dynamics of intergovernmental coordination and decision-making are making the need for improved techniques in information management more imperative than ever. A major initiative in Track D begun in 1995 is to help make state-of-the-art technology available to the transportation planning process for improved decision support. Included in the first year is a synthesis and assessment of the state-of-the-practice of information technologies by the Oak Ridge National Labs. Subsequent work will focus on adapting this technology to the transportation planning process and the needs of metropolitan transportation programs. Status: ***Oak Ridge report completed availability: limited availability Spring 1996***

The second phase of the initiative includes a cooperative study with the National Association of Regional Councils (NARC) and their Association of Metropolitan Planning Organizations (AMPO), to identify where specific elements of MPO activities and decision-making could be better supported with technology. A panel of representatives from MPOs, academia, and affiliate organizations such as AASHTO are guiding the study and its three phase interview structure of selected MPOs The study is designed to produce findings, including: a clear definition of problems in existing MPO practice; opportunities for alleviating problems with information technology; the potential for near term deployment of such technology among MPOs; and a set of prioritized "next" steps, both for FHWA, NARC and the transportation planning community at-large. ***Status: the first phase of MPO Interviews has been completed, and the second is underway; availability: The Report from the Phase I interviews, identifying problems and barriers in MPO activities will be available Spring of 1996. The final study report will be available late summer of 1996.***

OTHER ACTIVITY

Relation to Other Tracks -- In all the Track D research there must be a direct tie to the other Tracks. New model data needs identified in Track C work must be coordinated with the stream of research in Track D. New data collection and analysis methods developed in Track D will be distributed, applied and supported through Track A. Data collection technology applications will be conducted in Track B.

Census Data--A major consideration for transportation planning programs is the format and content of the year 2000 Census and the effects of proposed changes on transportation planning programs. States and MPOs have relied heavily in the past on the census data (particularly the special Census Transportation Planning Package--CTPP, as well as the public use micro data set--PUMS). Often local data collection activities have been scheduled and coordinated with the decennial censuses, integrating the data from each to support planning. With increases in the cost of travel surveys, reliance by States and MPOs on secondary data sources is critical. Results of studies of the effects of the continuous Census and other proposals on local data programs and travel forecasting methods will be considered in the Track D Program. A "plan of action" is a proposed product of the upcoming second national Census Data Conference in April this year. This will be closely reviewed for relevance to Track D work.

Other Activity (Track D-related)--Track D represents a focused effort on data collection and survey method research within TMIP. There are many other data-related research activities underway that support the overall effort to develop improved survey methods for States and MPOs A list of selected USDOT research activities, with their current status, is included in Appendix A to this paper. The objectives and products from these projects will be considered when a final program is proposed for Track D. The relationship of Track D to other research activity will be a continuing consideration.

NEXT STEPS

FY 1996--The general effort in FY'96 is aimed at developing a program to identify limitations and attributes of current methodologies that have not yet been widely applied. These procedures would be tested through case studies, before/after studies, etc. Quick turn-around guidance and answers to difficult questions would be available from these studies. At the same time, longer-range data needs will need to be identified, both from the testing of current procedures in Track B and from early products of the new modeling procedures research in Track C.

New methods of data collection and analysis will need to be developed and tested. New data items may need to be identified. Recommendations for a comprehensive data collection program for States and MPOs to support metropolitan transportation planning may be a product.

FY 1997 and beyond--Leading from research in the first two years, new procedures and new survey designs will be under development and testing starting in FY'97.

Preliminary Listing of High Priority Research--Appendix B contains a description ofresearch that represents a synthesis of the highest priority projects identified so far from a variety of sources:

Household Survey Conference
TMIP I and II Conferences in 1994 and 1995
backlogged projects from FHWA and FTA annual research programs
results of the "quick start" project

This list is preliminary, intended to provide a starting point for discussion, and eventually leading to more complete project descriptions. It is anticipated that these projects will be presented to the TMIP review Panel in the summer 1996 and presented in other forums for review, comment, and modification. More complete project statements will need to be drafted. Comments on this list are welcome.

Open Process. Outreach. and Obtaining: Views and Input--Input from practitioners and researchers will be continually sought throughout the Track D Program. Experts in the field will be contacted for recommendations about the direction of this research. The Track D Program is taking a proactive, open process, approach to obtaining this input. Research recommendations produced at the national conference on household travel surveys in March 1995 is being integrated into the Track D program. Discussions at the Transportation Planning Applications Conference in April 1995 provide additional input. Recommendations from researchers and practitioners at the two recent TMIP conferences is being used. Opportunities such as these at other conferences and forums will be made to solicit comment and provide information on the Track D Program. A "straw" program will be provided to the TMIP Review Panel at their next meeting in the summer of 1996.

As the Track D Program takes shape, a focused, invitation-only workshop may be considered to further define projects and develop the detail necessary to feed into project statements-of-work. A focused review panel may be the most effective way to accomplish this.

Track D Review Panel--A standing review panel, similar to the TMIP Review Panel, but focused on data, is being considered to help guide Track D over the long term. Members might be representatives from among the following:

- the TMIP Review Panel
- the Household Survey Conference Steering Committee
- the Census Conference Steering Committee
- practitioners
- researchers

It is likely the panel will be asked to provide external guidance to Track D efforts, provide input to and assist in developing project statements, review products of Track D research, and other on-going functions that will help guide the Track D program. Comments on the feasibility of such a panel are welcome.

FOR MORE INFORMATION

This program will undergo continual update and change. Information will be available through our outreach program, the TMIP Web site (http://tmip.tamu.edu), or by contacting anyone on the TMIP Project staff at:.

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APPENDIX A

Travel Model Improvement Program (TMIP)

SYNOPSIS OF SELECTED DATA TRACK D-RELATED RESEARCH

Metropolitan Planning Division. FHWA (HEP-20)*
Intermodal and Statewide Programs Division. (HEP-10)*
Office of Highway Information Management, FHWA (HPM)*
Office of Planning. Innovation & Analvsis. FTA (TPL)*

January 18, 1996

[NOTE: This is a listing of selected Track D-related research projects currently underway. The list is not exhaustive. The purpose is to provide an indication of the type of work being conducted under other programs that will be coordinated with Track D.]

Travel Surveys

TITLE: **Analysis of Longitudinal Data from the** Puget **Sound Transportation Panel**
DESCRIP:
1. Clean and rectify 4 years of data from the Puget Sound Transportation Panel.
2. Establish weights for all years.
3. Create inventory of PSTP analyses and uses.
4. Examine mode use and transitions.
5. Examine activity and time use transitions.

STATUS: Completion expected by March '96, several papers to be presented at TRB' 96. Final reports will be released on Travel Survey CD-ROM.
METHOD: Contract: Battelle with Penn State University (HPM)*

TITLE: **Testing Household Travel/Activity Survey Methods**
DESCRIP: Increase pre-test of NCTCOG household survey with two specific tests: (1)telephone vs. mail-back retrieval and (2)booklet vs. single sheet format of diaries. Examine response rates, respondent burden (length of time on telephone), trip reporting rates.
STATUS: Final report available digitally through BTS and via TMIP CD-ROM.
METHOD: Contractor: NCTCOG via Fed-Aid, with AMPG (HPM)

TITLE: **GPS for Household Travel Surveys**
DESCRIP: Develop specifications for user-friendly, mailable unit that can be sent to "average" persons for tracking personal vehicle travel and to compare results to traditional self-reported travel using a diary. Compare trip length (distance and time), establish measures of roadway functional class, travel speed.
STATUS: Hardware and software tests underway; field testing to begin in late summer '96. Expected completion Feb '97.
METHOD: Contractor: Battelle, with subs ETAK and CSI (HPM)

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*(HEP/TPL/HPM) denotes DOT office participating in project

TITLE: **Synthesis Projects on Non-Response and Panel** Surveys
DESCRIP: There will be two separate products from this project. The first will be a document on reporting non-response, and methods to reduce non-response in household travel surveys. The second document will be a primer on panel (longitudinal) surveys and how they can be used in transportation research. The third document will focus on adjusting for non-response.
STATUS: Underway.
METHOD: Contractor: Battelle, with NORC (HPM)

System Performance

TITLE: Case Study of CMS Data Collection: Develop a **"Travel Time Data Collection Source Book"** (Follow-on to TSC research on best methods of travel time data collection by HPM)
DESCRIP: Travel time as a performance measure for evaluating mobility-increasing strategies & **transportation** system operation, and for calibrating travel forecasting models.
STATUS: Draft report
METHOD: Contract with Volpe Transportation Systems Center (HEP)

TITLE: **Improved Vehicle Occupancy Data Collection**
DESCRIP: Develop case studies in assessing a wide range of methods for monitoring corridor-wide, multimodal vehicle occupancy; study sites: Chicago, Baltimore, Louisville, Albany.
STATUS: Multimodal data collection is now underway and the final report **is due** later this year.
METHOD: Contract with Battelle (HPM/HEP)

TITLE: **GPS Demonstration for Travel Time Data Collection**
DESCRIP: Demonstrate application of recent advances in GPS technology to permit cost-effective travel time data collection and development of methods to support time-based performance measures
STATUS: Starting (follow-on to GPS work started by HPM--see above)
METHOD: Contract with Battelle (HEP)

TITLE: **Congestion Management System Application Testing**
DESCRIP: Assessment of TRANSIMS micro-simulation data as a source for performance measures to support a metropolitan area's CMS
STATUS: Model testing underway.
METHOD: Fed-Aid through TXDOT to NCTCOG (HEP)

TITLE: **Congestion Management System Application Testing**
DESCRIP: Development of methods, hardware and software to coordinate data collected by the Automated Traffic Control System (ATMS) with the performance measures needed for the region's CMS
STATUS: starting
METHOD: Fed-Aid through Washington State DOT to Puget Sound Regional Council (HEP)

TITLE: **Urban Traffic Monitoring Scan**
DESCRIP: Investigate how traffic monitoring programs are operating in urban areas, report on fmdings, develop case studies. Results to be included in TRB Paper.
STATUS: Detailed survey complete and selections for follow up interviews underway.
METHOD: Volpe Transportation Systems Center (HPM)

TITLE: **Characteristics of Urban Freight Systems (CUFS)**
DESCRIP: Will provide a database that summarizes the characteristics of urban freight transportation systems as reported in literature or collected by local/regional planning agencies, State DOTs, and transportation operators. Second phase may involve collecting additional data
STATUS: Report in draft. Final report available in Iate summer '96.
METHOD: Contract: University of Tennessee (HEP- 10)

Travel Demand

TITLE: **Data Analysis and Policy Implementation for TDM Strategies (support testing of AMOS Model)**
DESCRIP: Develop a better understanding of relation between HI-I activity and travel behavior and to study the influence of TCMs on policy measures.
STATUS: Final report
METHOD: Federal-Aid through DC. Dept of Public Works and WASHCOG (HEP)

TITLE: **Development of Notebook Computer Software to Collect Trip Generation at Intermodal Passenger and Freight Facilities**
DESCRIP: Development of software to run on notebook or hand-held computers to collect trip generation and other transportation data at intermodal facilities such as airports, seaports, and rail terminals.
STA TUS: Phase **I** and draft report complete.
METHOD: Small Business Innovation Research Program

Other

TITLE: **Improved Decision Support-Computer-Aided Technologies and Tools Used in Decision-Making, Training, and Presentation**
DESCRIP: With NARC and task force of representatives from AMPO, TRB, AASHTO, etc. -- define existing practice, and identify opportunities for enhancing and improving practice with recent advances iu high technology (e.g.,hypermedia, distance learning, etc.); assess the potential and implications for incorporating technology in the planning process in the near term.
STATUS: Underway
METHOD: Cooperative Agreement with NARC

TITLE: **Comprehensive Intermodal Visual Database**
DESCRIP: Collection and aggregation of current intermodal freight transportation data from throughout the U.S. into one broad-based visual database. Database will include visual images and other computer graphics and images, narrative project descriptions, data related to intermodal facilities, county-to-county movements by mode and commodity type using CD-ROM, hyper-media, and multimedia technologies.
STATUS: Phase I and feasibility report complete. Phase II starting.
METHOD: Small Business Innovation Research Program

DESIGNING A METROPOLITAN TRANSPORTATION DATA CLEARINGHOUSE

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Presented at
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CONTEXT OF DATA NEEDS FOR METROPOLITAN WASHINGTON

The Metropolitan Washington Council of Governments (COG) is the Washington, D.C. area's regional organization of local governments. The COG region includes Washington, D.C., and surrounding suburb in the States of Maryland and Virginia (see Figure 1), a total of 18 local or state governments. The Transportation Planning Board (TPB) at COG is the officially designated metropolitan planning organization (MPO) for the region. Like many such organizations, COG and TPB undertake a number of activities relating to the creation of metropolitan long-range transportation plans and programs. Among these activities are demographic forecasting, travel forecasting, air quality analysis (mobile source emissions and emissions mitigation), and congestion management.

Data needs associated with major regional planning and programming activities are significant. A first example is demographic forecasting, including population totals, number of households, and employment totals. These are handled at COG within a formal regional Cooperative Forecasting process, relying on the most recently available U.S. Census information, on national economic trends, and on information and staff expertise from the participating jurisdictions of the region.

These demographic forecasts provide major input to the region's travel forecasting process. Our agency has long been charged with creating regional transportation long-range plans and short- to medium-range programs. Analysts model current and future travel loads on the region's transportation systems a four-step[2] computer modeling process,[3] supplemented by other techniques. The model is calibrated to current conditions (conditions for a recent year for which information is available, information such as population and employment figures, traffic counts, and transit ridership). Then changes or assumptions are introduced to the regional travel forecasting computer model based on projected demographic changes, and/or based on proposed additions or changes to the region's transportation network. With these changes as input assumptions, future traffic and transit loads are forecast.

The scale of the Washington region, its modeling process, and its analysis needs is considerable. The

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2 The four steps are: tip generation, trip distribution, mode split, and route assignment. COG/TPB, however, employs a modeling process that elaborates upon those four steps with feedback loops and other enhancements.

3 COG/TPB utilizes MINUTP, one of several commercially available transportation forecasting software packages for microcomputers.

region's population of 3.7 million in 1990 (in an area of over 3,000 square miles) is projected to grow to 5.1 million by the year 2020.[4] Our current regional model has over 1,400 zones and over 22,000 highway links; an enhanced model currently under development which will increase the number of zones and links significantly (because of an increase in the geographical area covered). It is estimated that, on a daily basis, there are over 12 million vehicle trips in the Washington region traveling over 96 million vehicle miles.[5] These large numbers mean that data tiles covering the region can grow to vast sizes, necessitating efforts to systematically store these data and make them available to and manipulatable by regional analysts.

FEDERAL REQUIREMENTS AND THE REGIONAL TRANSPORTATION DATA CLEARINGHOUSE

The federal Clean Air Act Amendments (CAAA) of 1990 and ISTEA in 1991 placed upon metropolitan planning organizations a number of new or expanded requirements. First among these were additions to the air quality planning process. These laws and subsequent federal regulations specified that proposed plans and programs in nonattainment metropolitan areas (areas that did not meet national ambient air quality standards) must be analyzed, and it must be shown that these plans and programs do not worsen air quality overall. This is often referred to as the "conformity" process, since regional transportation plans and programs must conform to "State Implementation Plans" for air quality. Analysts rely on the regional transportation computer model output to use, in turn as input to an air quality model (the federally-mandated MOBILE model). If plans or programs show a worsening of air quality, and thus do not "conform", one common recourse is for the region to analyze and adopt transportation control measures (ICMs) These are additional program elements, often of a travel demand management nature, which are projected to make positive air quality contributions to offset negative air quality impacts from other transportation projects (such as roadway expansions). Example TCMs include carpool and vanpool promotion, transit fare subsidies, parking restrictions or surcharges, or similar activities aimed at reducing single occupant automobile commuting.

ISTEA also instituted requirements for congestion management systems (CMSs) This necessitated a

4 Source: *Growth Trends to 2020: Cooperative Forecasting in the Washington Region,* Metropolitan Washington Council of Governments, Washington, D. C., Summer 1995.

'Source: Metropolitan Washington Council of Governments 1995 air quality conformity model runs. Note that these numbers are approximate because of some differences between the coverage of the regional model and the official boundaries of the COG/TPB planning area.

systematic analysis of congestion, and called for the design of strategies to preserve the infrastructure and to arrange for its more efficient use. Furthermore, for metropolitan areas which did not attain federal ambient air quality standards, no project that would expand single-occupant vehicle highway capacity would be eligible for federal funding unless its planning was a product of a CMS; and all reasonable congestion management strategies must be incorporated into such a project.

The Washington regional CMS has been proposed and envisioned as an information processing system to support decision making. The first major step in the CMS process is to identity and monitor congestion, both currently existing and anticipated to occur in the future. The second step is to evaluate the effectiveness of a number of transportation alternatives or strategies that might alleviate that congestion. Finally, after strategies are implemented, the CMS is to go back and examine what has been implemented, to see how successful the strategies were in alleviating congestion. If implemented strategies have not proved to be successful, new or additional solutions will have to be explored.

ISTEA specified a number of categories of congestion management strategies to be considered by the CMS. These include capital or construction actions such as new transit facilities, intersection improvements, or the construction of new high-occupancy vehicle (HOV) systems. They include non-construction solutions such as travel demand management programs. Also to be examined are changes such as new technologies (“ITS” --intelligent transportation systems), transit operational or fare changes, congestion pricing/tolls, and the use of non-motorized means of transportation.

NEW PROCESSES, NEW TECHNIQUES

The requirements of the Clean Air Act Amendments and ISTEA created new and expanded tasks for metropolitan planning organizations such as COG/TPB. They included, for example, air quality and emissions impacts estimation, forecasting use of non-automobile modes of transportation (e.g., bicycling, pedestrians), and “feedback” effects of how changes in the regions transportation systems might affect land use and development. All of these transportation modeling and travel forecasting activities had a common dependency upon accurate and precise transportation systems usage data, the kind of data frequently collected and compiled by state and local transportation agencies.

Most regional travel forecasting and transportation planning activities have their foundation in the travel forecasting computer model. This model shows the overall effects of sets of proposed transportation improvements from the region’s annual transportation improvement programs (TIPS) and regional long-range transportation plans (updated once every three years). The new federal requirements, however, created forecast demands outside the scope and capabilities of the traditional travel forecasting model. This led to the use of supplementary techniques, supplementary computer models, professional judgment, and sketch planning for estimating impacts to and from the region's transportation system. These supplementary techniques made new and additional demands for data and analysis, answered in part by the development of the Regional Transportation Data Clearinghouse.

The ISTEA era has been a challenging period. Requirements were increased and delved into brand-new areas for metropolitan planning organizations (e.g., traffic operations analyses, congestion pricing analyses); deadlines were short. Techniques for analyzing many of the required CMS strategies were not in hand, and had to be developed on the fly. This was an era of calibrating new models or recalibrating old ones, thus calling for data to feed these models.

WANTED: DATA

Although there is a wide variety of data that might be used in the Congestion Management System or the regional planning process, there are a few types of data that analysts might consider to be basic "staples". They include:

- Traffic volumes, preferably by direction and by time of day (at least for a statistically expandable sample of the region's highways);
- Traffic speeds (average running speeds), convertible to travel time and delay;
- Vehicle classifications to help determine the proportion of automobiles, trucks, buses, etc., in the traffic mix;
- Vehicle occupancy, important because of ISTEA's emphasis on reducing reliance on single occupant vehicles and to monitor person travel as opposed to or in addition to only vehicle travel; and
- Transit ridership or modal shares, again to reflect total person travel in addition to vehicle

travel.[6]

These data represent the initial priorities for entry into the Regional Transportation Data Clearinghouse. Other types of data will be added in the future when feasible.

REGIONAL DATA SOURCES

COG and TPB are not builders, implementers, or owners oftransportation systems. COG/TPB does not have internally or independently-produced funds for what might be termed "routine" data collection activities, such as traffic and transit counts. Thus the traditional arrangement in the Washington region has been and continues to be to rely upon state and local departments or agencies of transportation, regional transit providers, and other transportation providers, to share data they have collected as part of their own monitoring processes.

COG/TPB has supplemented these agency data sources with special or occasional data collection activities of its own, concentrating on types not generally covered by other entities. These types of data include person and vehicle movement counts at defined cordon lines, vehicle occupancy counts, surveys of household travel characteristics, and special modal studies such as of freight movement or bicycling.

CREATING THE REGIONAL TRANSPORTATION DATA CLEARINGHOUSE

The major concept behind the Regional Transportation Data Clearinghouse was to compile in a central place existing transportation systems usage data, data that, for the most part, was assumed to be collected routinely by the region's departments of transportation and other transportation agencies. Furthermore, it was envisioned to format these data to be compatible with and comparable to data from COG/TPB data collection activities as well as COG/TPB's travel forecasting and analysis activities.

6 ***Source F.Y. I995 Congestion Management System Annual Reportfor the Washington Region,*** Metropolitan Washington Count Governments, Washington, D.C., September 1995.

From the outset, the Regional Transportation Data Clearinghouse was envisioned to reside on a GIS. COG/TPB developed a GIS for regional planning applications, and simultaneously began development of a Regional Transportation Data Clearinghouse as a part of that GIS. The GIS utilizes Oracle database software and ESRI ArcInfo and ArcView software, and resides onaworkstation computer'@ contrastedwith a desktop "P.C." microcomputer). Analysts access the GIS through an agency-wide local area network (LAN) of computers.

DATABASE PREPARATION

COG/TPB staff contacted the transportation agencies of the region, seeking the transportation systems usage data those agencies had collected, compiled, or stored. Staff concentrated on getting data from those agencies for the following types of highways: freeways, parkways, toll facilities, and other principal arterials. In addition to average annualized daily traffic counts (AADTs) or average annualized weekday traffic counts (AAWTs), staff sought other demand information that agencies responsible for roadways might have on hand, including peak hour directional volumes, vehicle occupancy, and vehicle classification counts.

In preparation for organizing these data, staff also assembled information on roadway characteristics, including number of lanes, interchanges, signalized intersections, variable message signs, truck weigh stations, toll plazas, automatic traffic recorder locations, National Highway System (NHS) status, and political boundary information. The information was stored in personal computer (PC-compatible) tiles (Lotus l-2-3 .WKl format) for later application in Oracle and ArcView.

The next step was to link these data files by means of a common identifier field into the GIS. Analysts geo-referenced the files to the transportation networks of the state departments of transportation and the regional travel forecasting computer model by route name and link identifier.' Furthermore, this project relied on a previously completed project to interrelate the regional travel forecasting computer model network with the U. S . Census TIGER line files, providing precise longitude/latitude information for each node in the system, as well as the ability to produce maps with realistic shapes and geographic

'An IBM RS6000 Engineering Work Station, capable of supporting multiple GIS/Oracle users simultaneously.

8 Each link in the regional travel forecasting computer model is a line connecting two "nodes"; this line represents a link of the regional transportation system. Each node for the entire metropolitan area has a unique node number. The combination of these two numbers (e.g., 12506-12507) provides the unique name/link identifier for the purposes of the model and the GIS.

features from the GIS.

OBTAINING DATA PROM OUTSIDE AGENCIES

Bringing in data from outside agencies was, in no way an exaggeration, a giant task. The region's transportation agencies were of great help in providing access to historical data. But data were stored in a variety of formats, which took analysts an unanticipated length of time to reformat into a single overall arrangement. These various formats included:

- Data on PC spreadsheets such as Lotus l-2-3;
- Data on hard copy only, in an individual format (e.g., a single intersection traffic and turning movement count submitted by a private entity as a required part of a land development proposal);
- Summary data on hard copy only, often from a mainframe computer application. There has been discussion of automatic and/or electronic transfer of data from these agencies to COG/TPB, but, up to now, it has been deemed not feasible by these agencies to reprogram mainframes to do so;
- Data from other management information systems-type applications, frequently for transit data. Again, there have been discussion of but, up to now, no attempts at electronic transfer of data from these agencies to COG/TPB.

Regardless of the originating agency format, analysts incorporated data, often having to keypunch the data, into COG/TPB's own PC spreadsheet format. Up to the time of this writing, COG/TPB staff has concentrated on highway data, and will leave integration of transit and other data for the future.

INCORPORATINGNON-HIGHWAY DATA AND DATA PROM COG/TPB'S OWN STUDIES

COG/TPB's policy and technical review committees have expressed desires to broaden the scope of the Clearinghouse to include more than just highway traffic counts. This includes data on transit ridership, bicycling and walking, and accidents/incidents, even though these data do not yet have a tine-tuned place in the regional travel forecasting computer model. Putting these data on the GIS will help planners analyze intermodal effects. The GIS allows expedient side-by-side analysis of traditional traffic counts with information and forecasts from the regional MINUTP model, and display of these on attractive GIS-based maps.

Analysts also will be incorporating data from COG/TPB's own data collection activities. These include aerial photography surveys of highways, traffic counts at defined cordon lines, average vehicle occupancy studies, transit usage studies, highway speed and delay studies, home interview surveys of household travel characteristics, parking studies, truck travel studies, bicycle travel studies, surveys of travel to and from workplaces, surveys of visitor and tourist travel, taxi user surveys, and land use studies. Note that a basic issue here is that some of these data are link-based (such as a count of the number of vehicles on North Capitol Street between G and H Streets), with others are origin-destination based (such as the number of trucks traveling to Bethesda from outside the region on a daily basis); the analyst must decide upon and go through a process of assigning origin-destination data to links. Overall, the heterogeneity of these studies imply a complex process of reformatting of the data generated in these studies into a Regional Transportation Data Clearinghouse-compatible format, and will be an ongoing task for the foreseeable future.

EXAMPLES FROM THE REGIONAL TRANSPORTATION DATA CLEARINGHOUSE

A primary use of the Regional Transportation Data Clearinghouse as implemented on the GIS is as a sort of electronic traffic volume map. Figure 2 is a sample, showing 1991 freeway traffic volumes for the central portion of the Washington region. Note that the system can produce detailed color-coded outputs as well astheblack-and-whiteoutputshownhere. Contrast Figure 2 with Figure 3, which shows the model' s (MINUTP soflware) plotted output ofadiagrammaticnetwork. Althoughanenhancement overtabularmodel outputs, MINUTP's graphical output was impeded by the inability to show realistic, map-like geographical details, making it difficult for non-technical observers to interpret.

A further example focuses on the I-295/District of Columbia Highway 295 corridor. This corridor is one of the most significant radial corridors in the Washington region (see Figure 4). The roadway skirts the east side of downtown Washington, from an interchange with US 50 in Prince George's County, Maryland at a northern terminus, through Southeast Washington along the Anacostia and Potomac Rivers, back outside the District of Columbia to an interchange with the Capital Beltway (I-95/I-495) at a southern terminus, again in Prince George's County, Maryland. Just west of the southern terminus lies the Woodrow Wilson Bridge carrying the Capital Beltway over the Potomac River; the Wilson Bridge is one of the most heavily traveled facilities in the Washington region. The southern terminus of the corridor also has connections to Maryland Highway 2 10, a significant radial route to southern suburban areas. At the northern terminus, there are connections to two major highway facilities: US 50, extending from downtown Washington to Annapolis and beyond, and the Baltimore-Washington Parkway. In the middle of the I-295/DC 295 corridor, there are major connections to downtown Washington, including South Capitol Street, Pennsylvania Avenue, and East Capitol Street. The facility is surrounded by a combination of urban and large institutional land uses.

Even in the current early stages of Regional Transportation Data Clearinghouse implementation, an unusually good variety of data was available for this section of highway. First, there was traffic count information routinely produced by the District of Columbia Department of Public Works and the Maryland State Highway Administration. Additional data sources included periodic traffic counts performed by COG/TPB at defined cordon lines (this corridor crossed the Beltway cordoncountline), stopwatch/floating car runs to determine segment-by-segment travel times, and aerial photography surveys of the region's freeways to determine vehicle densities, speeds, and levels-of-service. These various travel time studies were amalgamated for the purposes of this paper, and are shown in Figures 5 and 6, sample average travel speeds for selected facilities.

The implementation of the regional GIS allows the marrying of detailed data as described above with geographic realism. These data also can be manipulated through the use of the GIS's relational database capabilities to answer analysts' questions more readily than before; e.g., cross-tabs of data to deduce delays or other congestion management performance measures for easy display. Cross-checking and error-checking data are also easier. Modeling results from different subarea studies or major investment studies, which are often petiormed by consultants or agencies outside COG/TPB, may now be compared to other studies or to the regional "official" forecast more readily. So far, our experience has been that the ability to produce such easy-to-read graphics has increased review committees' and the public's understanding of and interest in regional technical analyses. These capabilities will help the region's technical personnel guide elected officials and decision makers more effectively through a variety of possibilities or options for the region's transportation system.

FINDINGS AND RECOMMENDATIONS TO PRACTITIONERS

Based on the Washington region's experiences, the practitioner may find one or more of the following circumstances to be issues. First, many agencies have cut back on their routine data collection activities in recent years (budget limitations were often cited as a reason), thus the sheer volume of data available may be much less than it might have been years ago. Second, data availabiity was sometimes hampered by automatic traffic recorders (ATRs) being out of order, often due to weather damage, repaving, or reconstruction projects. Since ATRs are the unique source of seven-day-a-week 24-hour-a-day traffic count information, COG/TPB considers information from ATRs vital to the calibration of models and to the factoring and interpretation of data from other sources (e.g., traffic counts of a duration of only a few hours or a few days of the year).

Agencies relied on PC-compatible electronic storage and transfer of data less often than expected, necessitating time-consuming keypunching. Additionally, the institutional or functional ability to retrieve or transmit data expediently from mainframe computers may be lost, thus only the preprogrammed, hard copy data formats were available. There were limits to how far back historical data covered; data from before 1986 were almost never available in the case of the Washington region. There was some reluctance by agencies to release some link-level data (iicludiig HPMS[9] in some cases) for anything other than the originally intended purpose, or to other than the originally intended users, conceivably because of the complexity of sampling, adjustment, smoothing, or factoring methods that may have been used. The Washington area may be more complicated on this point than other areas due to having three separate jurisdictions (District of Columbia, Maryland, and Virginia), all with independent and somewhat differing procedures. Overall, the practitioner should anticipate that some data may be "sensitive" in nature for these and other reasons.

Some general recommendations for practitioners from these findings include the following:

- Create or maintain a regional travel monitoring program. Involve a variety of parties or agencies, both planning and operations-focused. An inter-modal travel monitoring program may achieve ends beyond those achieved by mode-specific monitoring programs such as HPMS or transit ridership reporting programs.

- Concentrate on a focused, achievable subset of the region's transportation facilities or links, perhaps through a statistically-based sampling plan. HPMS may be a good basis, although the Washington region found it more advantageous to base ours on the regional travel forecasting model network, ensuring compatibility with forecast information.

9 The federally-mandated Highway Performance Monitoring System of traffic counts and other highway usage information.

- Prioritize data needs within limited budgets, time constraints, and computer and database constraints.

- A GIS is greatly helpful as a basis for a clearinghouse, but not absolutely necessary. Such a system could be implemented using more widely available tools including spreadsheet programs, travel forecasting software, and, of course, hard copy.

FUTURE NEEDS AND FUTURE ACTIVITIES

We are still in the early stages of implementation of the Regional Transportation Data Clearinghouse. Gladly, we have attained a stage where there are products to demonstrate. But there remains a fairly long list of completions and enhancements. It likely will take at least another two years for completion of the Clearinghouse as envisioned, plus there will be many maintenance and enhancement activities for the years to follow. Needed activities include:

- Continued work on creating and maintaining GIS networks compatible with the networks or the regional travel forecasting computer model (and variants thereof coming fi-om subarea or major investment studies);

- "Filling in the blanks" of missing data, for years in which there was no count on a particular link, or where the count(s) available were questioned for some reason;

- Creating and instituting automatic electronic processes for collecting agencies to share data with other agencies;

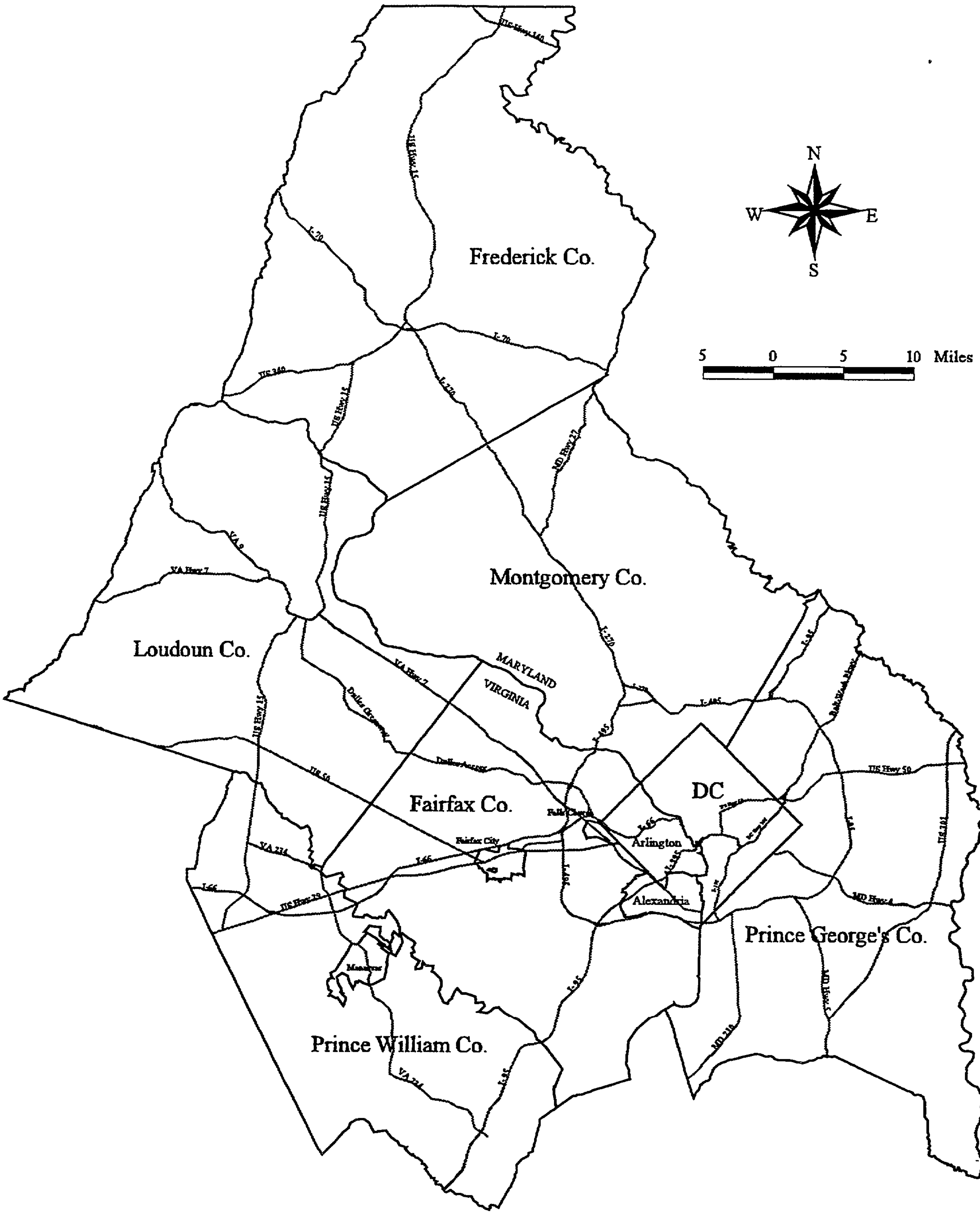
- Working with the agencies on data collection activities:

    - Achieving agreement that a dollar spent on a siigle-purpose piece of transportation system usage data (that cannot or will not be shared with other agencies) is a dollar wasted--all data should be collected with multiple purposes and users in mind;

    - It would be advantageous for all parties to work together to agree on how best to speed the limited data collection budgets for the maximum regional benefit from the data collected (e.g., types of data collected, locations where it is collected);

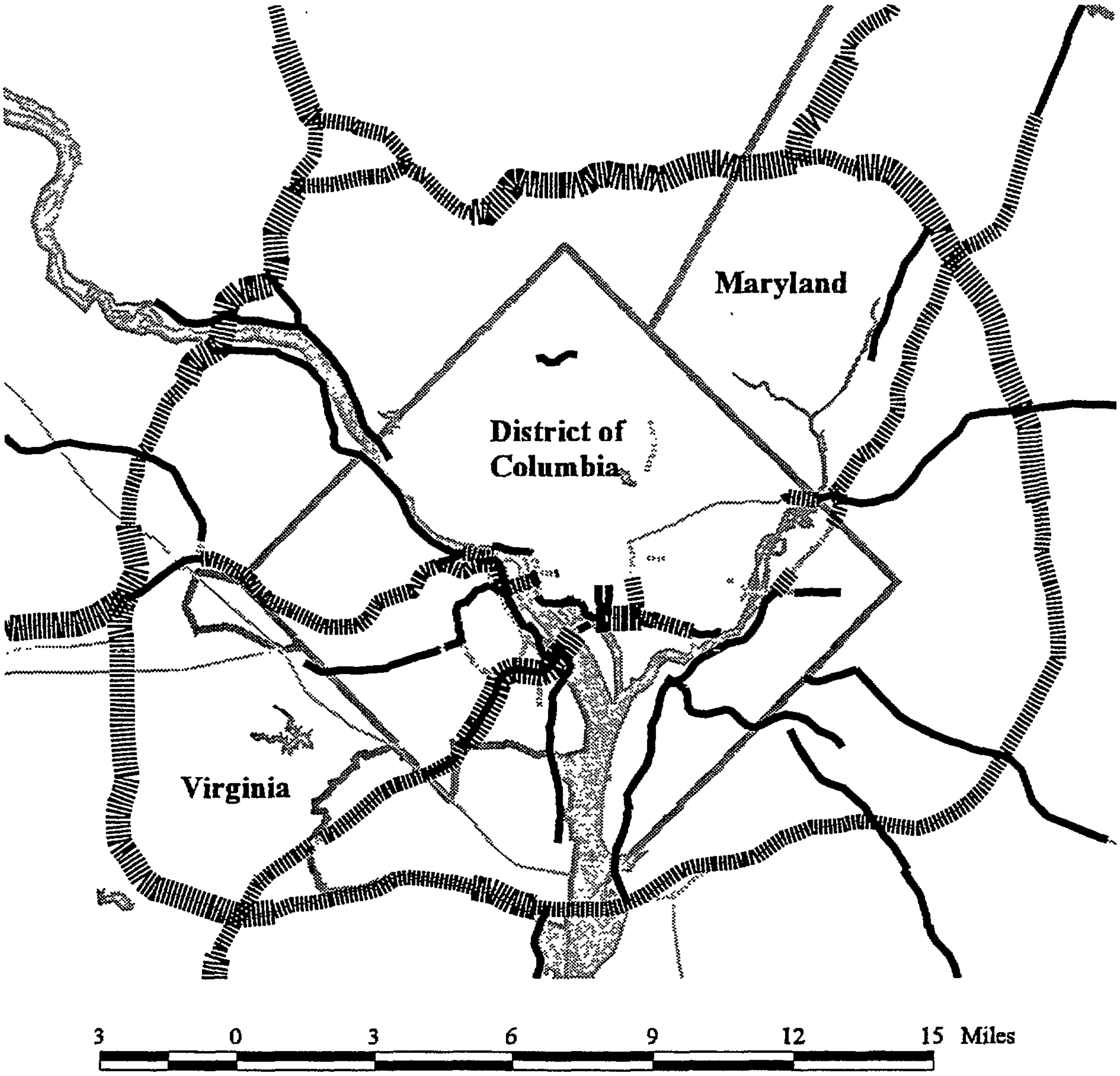
- Explore improved elected official, decision maker, or public/citizen access to analysis results or even the GIS itself, possibly through the Internet; such sharing of information would truly fulfill the vision of the Regional Transportation Data Clearinghouse.

FIGURE 1: Planning Area of COG/TPB (District of Columbia and Suburbs in Maryland and Virginia)



SOURCE: Metropolitan Washington Council of Governments
National Capital Region Transportation Planning Board, 1996

FIGURE 2: Sample 1991 Freeway Traffic Volumes from the Metropolitan Washington Regional Transportation Data Clearinghouse



1991 Avg. Annual Daily Freeway Volumes

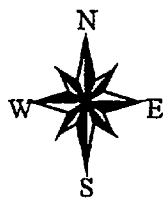
Low Volume (1 - 79,999)

Moderate Volume (80,000 - 144,999)

High Volume (145,000 - 245,000)

Uncounted Freeway Segments

Jurisdiction Boundaries



SOURCE: Metropolitan Washington Council of Governments
National Capital Region Transportation Planning Board, 1996

FIGURE 3: Sample Output Plot from Metropolitan Washington Council of Governments MINUTP Regional Travel Forecasting Model (portion of plot showing ground counts inside the Capital Beltway)

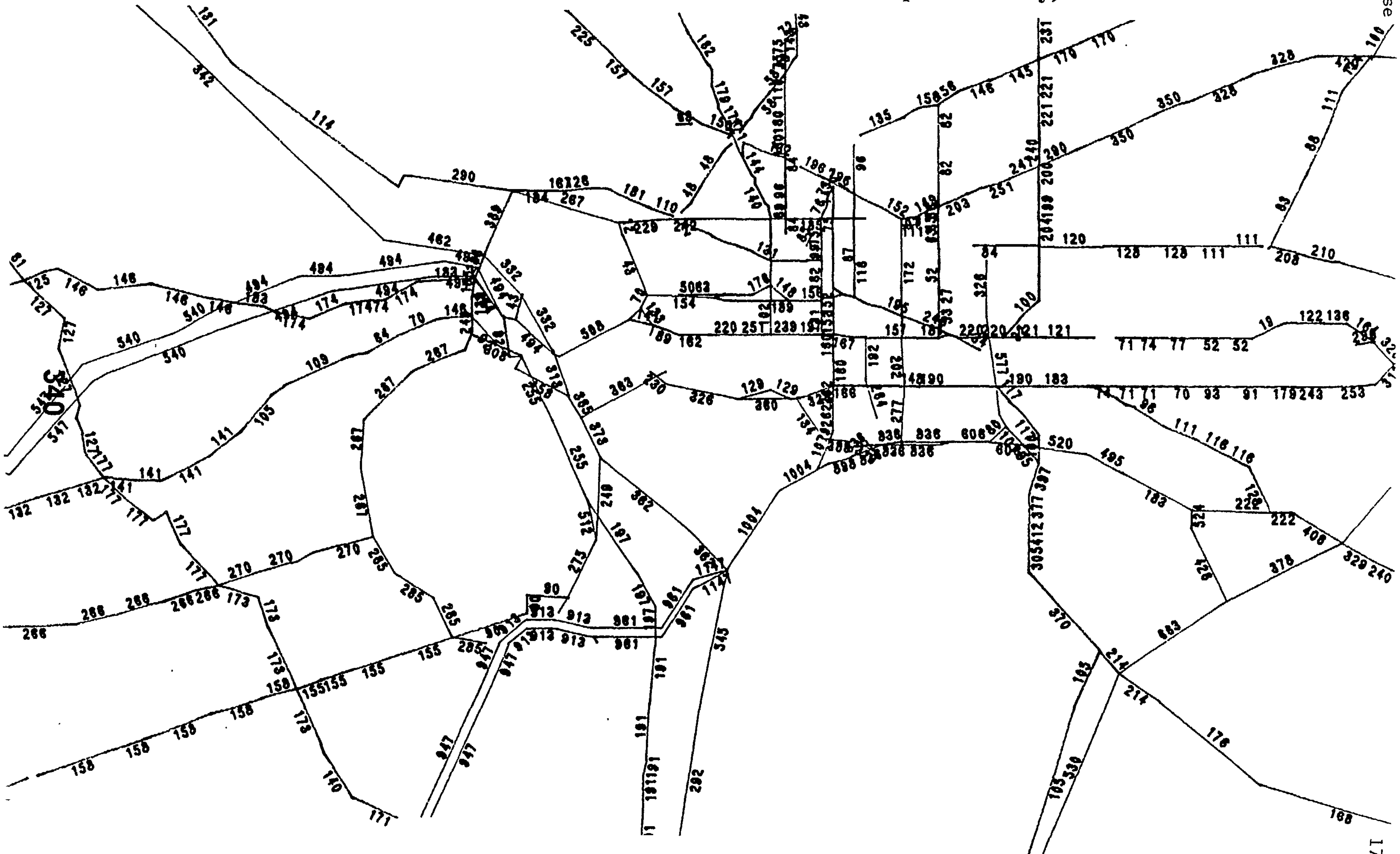
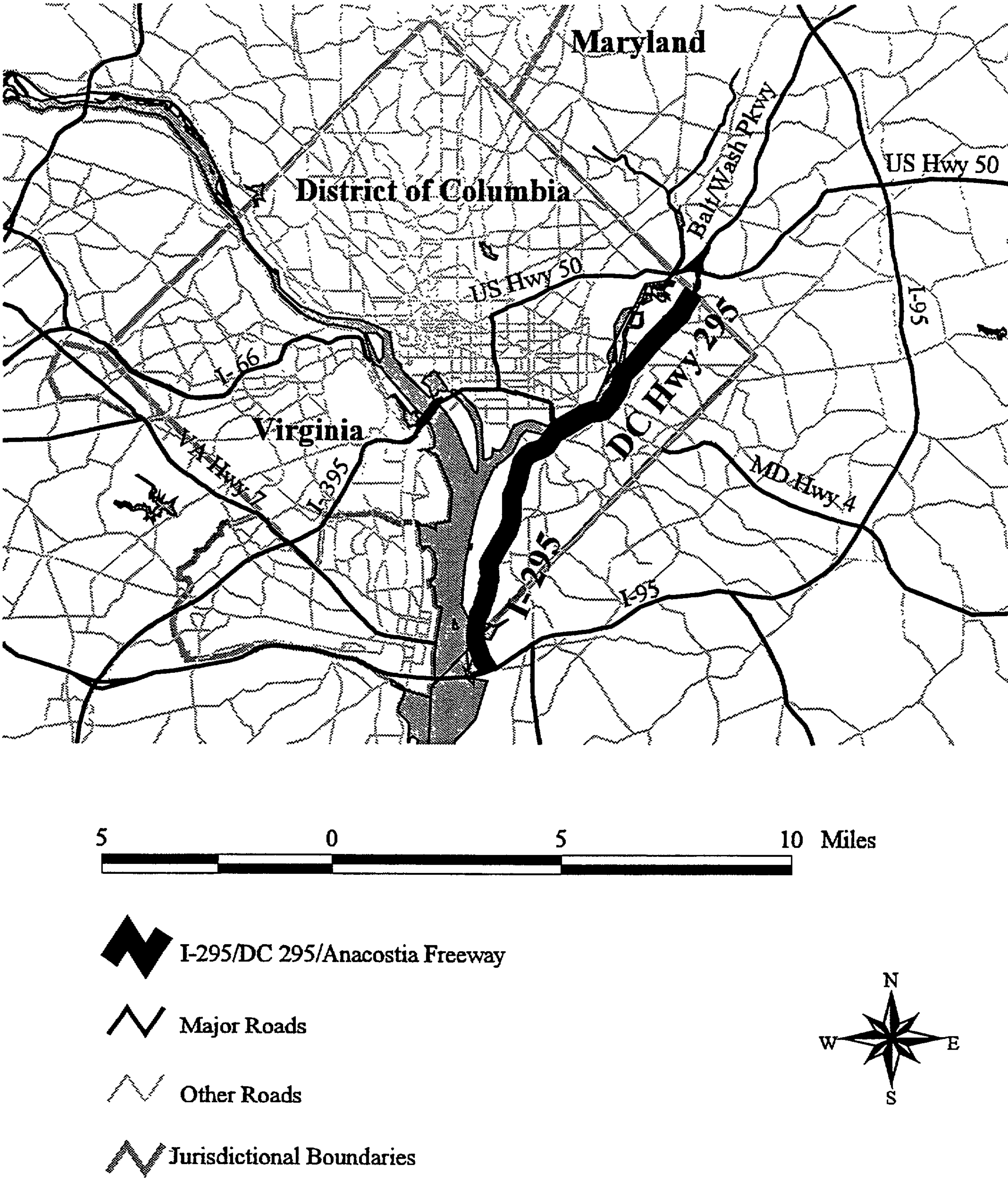
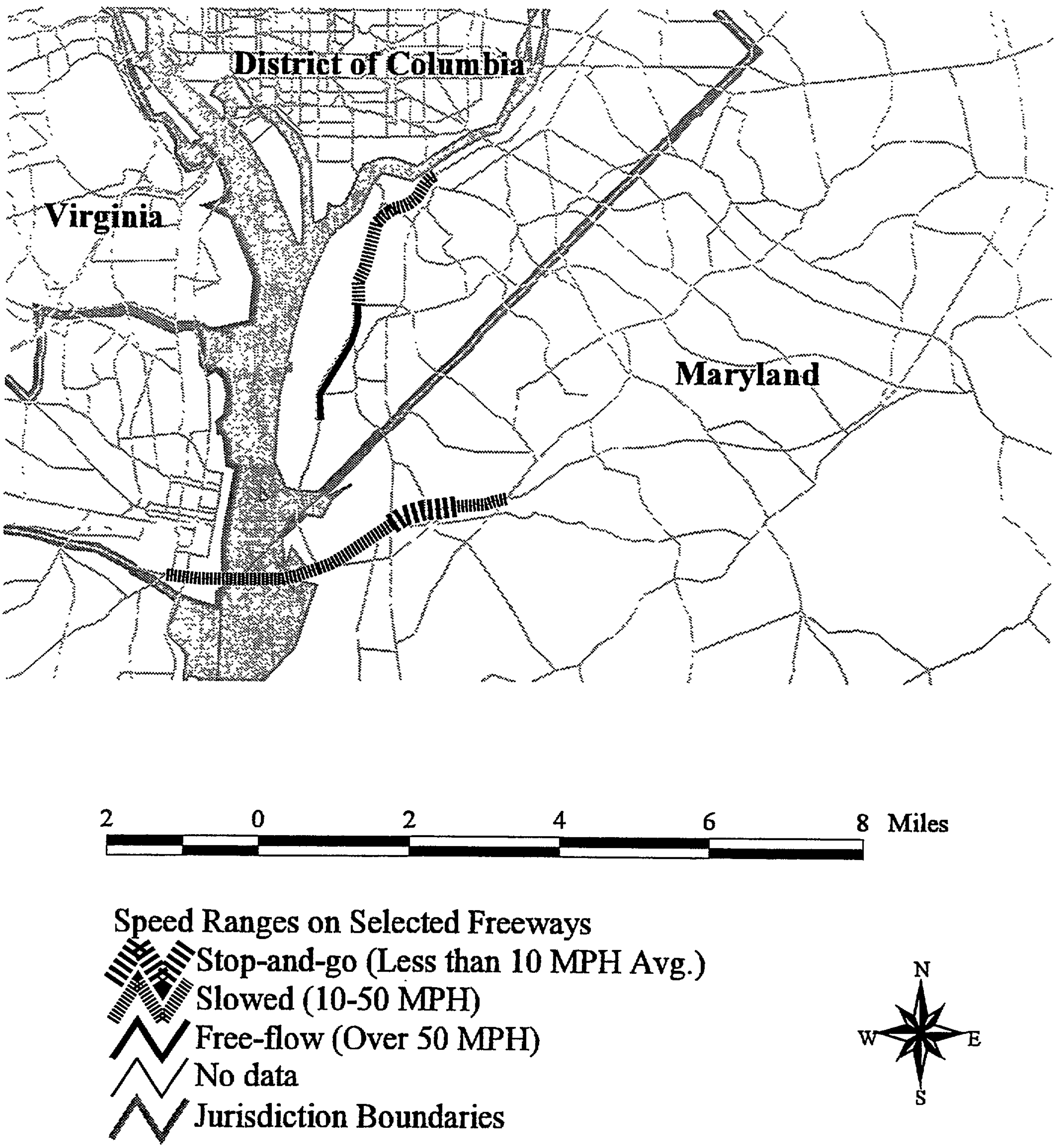


FIGURE 4: I-295/DC 295/ Anacostia Freeway and Vicinity



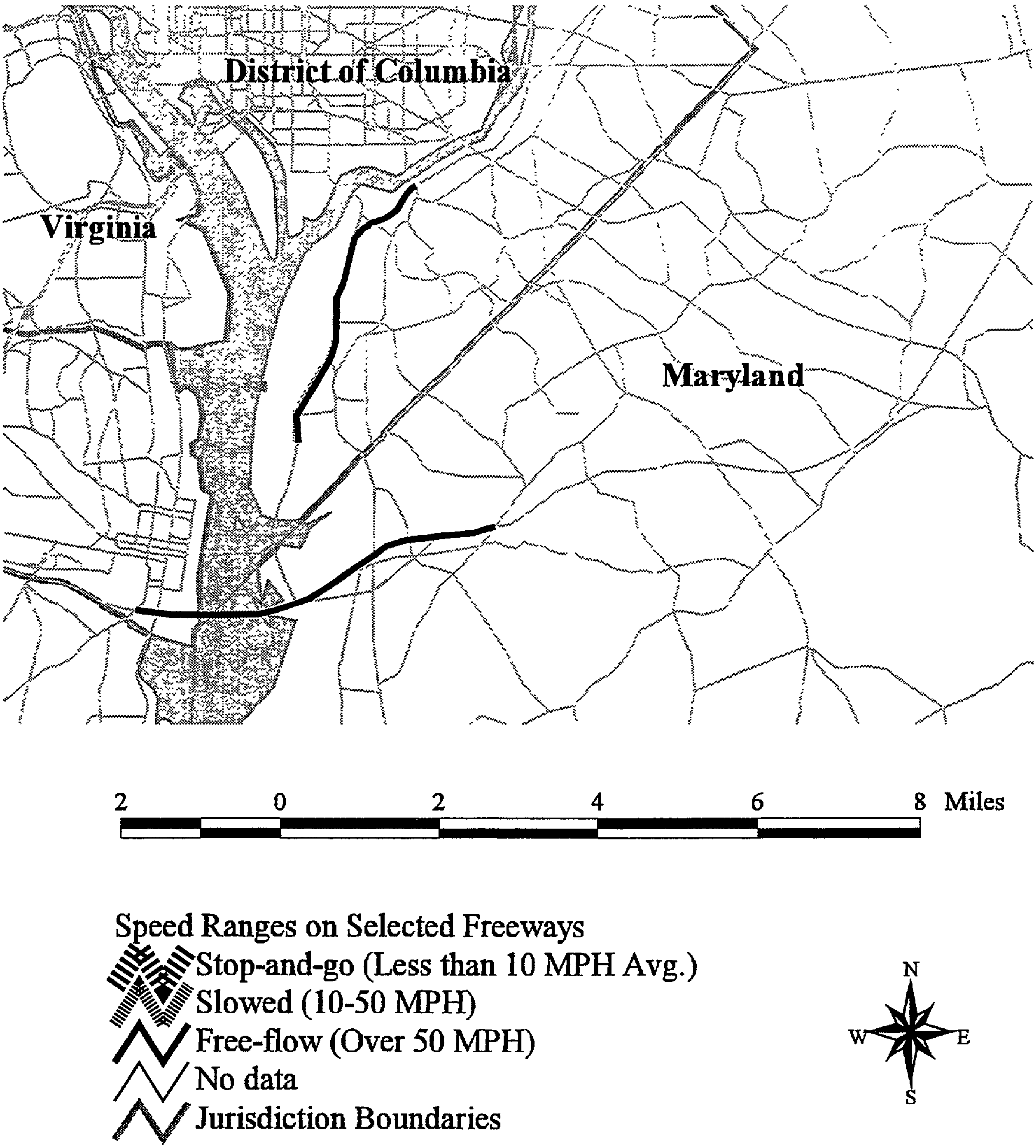
SOURCE: Metropolitan Washington Council of Governments
National Capital Region Transportation Planning Board, 1996

FIGURE 5: Sample P.M. Speeds from 1995 Travel Time Studies I-295 and Nearby I-95 (including Woodrow Wilson Bridge) Northbound and Inner Loop Directions Only



SOURCE: Metropolitan Washington Council of Governments
National Capital Region Transportation Planning Board, 1996

FIGURE 6: Sample P.M. Speeds from 1995 Travel Time Surveys I-295 and Nearby I-95 (including Woodrow Wilson Bridge) Southbound and Outer Loop Directions Only



SOURCE: Metropolitan Washington Council of Governments
National Capital Region Transportation Planning Board, 1996

TRAFFIC MONITORING FOR AIR QUALITY
AKA VMT ESTIMATING TRACKING AND FORECASTING

Ed J. Christopher
Chicago Area Transportation Study

Presented at
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Traffic Monitoring for Air Quality

aka

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Abstract

This paper reviews traffic monitoring issues related to the requirements of the Clean Air Act Amendments of 1990 and the Intermodal Surface Transportation Efficiency Act of 1991. This review was inspired by activities of the Illinois Department of Transportation and the Chicago Area Transportation Study (the Metropolitan Planning Organization for the Chicago region) and their effort to come to grips with the vehicle miles of travel estimation and forecasting requirements of these national laws.

The review first identifies the ties between traffic monitoring and the transportation/air quality analysis process. Traffic monitoring is discussed in terms of the need to estimate, track and forecast travel. Following this, the air quality/traffic monitoring VMT activities of the northeastern Illinois region are discussed. Several issues relating to traffic monitoring are highlighted where the northeastern Illinois region has taken significant steps to work within the conformity process. As a result much has been learned. The author hopes to transfer some this information to others.

The paper documents some of the nagging problems that exist. Foremost there seems to be the issue of consistency between the results of the ground count programs and the model processes. The issues involved are complex and not easily understood. The paper concludes that regardless of what the process is for calculating air quality benefits with transportation data, the planning community ought to take advantage of this opportunity to “dial-in” and “fine tune” their processes. Models can be updated and ground count programs scrutinized and improved.

Keywords: HPMS, **VMT, Forecasts, Estimates, Air Quality, Conformity, Travel Models, VMT Tracking, Traffic Monitoring**

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List of Exhibits

I .0 Introduction

On November 15, 1990, traffic monitoring took on new importance with the signing of the Clean Air Act Amendments (CAAA) (I). This importance took shape in the use of Vehicle Miles of Travel (VMT) estimates and forecasts as measures of the nation's progress to reduce pollution from mobile sources. VMT estimates would come in the form of good ground count programs, and the forecasts would flow from fully validated local travel models. For the first time ever the knot between counts and forecasts was being tied--legally.

To completely understand the legal, regulatory and written agreements surrounding the implementation of the CAAA as it relates to VMT can be somewhat daunting. To help the transportation community sort things out, the United States Environmental Protection Agency (USEPA) provided the rules of the process in a document known as the "187 VMT Forecasting and Tracking Guidance" or the 187 Guidance for short (2). Accompanying this are the conformity regulations (3) and two sets of amendments (4, 5). Finally, there are numerous memorandums of understanding and a formalized "consultation" meeting process which includes all affected federal, state and local agencies. Taken together these established the ground rules under which a region must operate.

To assist the transportation planner who must work on the transportation components of the air quality processes, the Federal Highway Administration (FHWA) developed a short training course in the National Highway Institute series (number 15265) which focuses on the technical analysis methods and transportation data needed by the process. There is also a longer course speaking to the "Fundamentals of Air Quality for Transportation Planning and Project Development" (6). For a brief overview of the Federal laws and their relationship to the local non-attainment area refer to Appendix A.

Exhibit 1 attempts to put the uses of VMT in the regional air quality context in perspective. As can be seen, there are two types of VMT: an estimate based upon vehicle counts, and an estimate derived from the local travel demand models. The important difference between the two is that the count based VMT is the historic record and is used to help validate the travel models. Once the travel models are validated (meaning that they can be shown to produce current year conditions), explanatory variables such as population and jobs can forecasted, the physical network can be altered and a future-year VMT forecast produced. If the models cannot be validated to known values it may be necessary to adjust (tweak, re-compute, fix) various elements of the models.

Although the 187 Guidance allows for exceptions and deviations to the process, the USEPA has been quite clear about the preferred tools and processes that should be used for VMT estimating and forecasting. The Highway Performance Monitoring System (HPMS) must be used to provide current year VMT estimates, and the locally derived travel demand models are preferred for forecasting VMT and handling specialty analysis that HPMS cannot perform.

1.1 Ground Count Based VMT

The first step when considering VMT monitoring for air quality is to obtain a good ground-count based VMT estimate. In the early discussion with USEPA on this issue, FHWA encouraged USEPA to use the HPMS to meet this need. This seemed reasonable since HPMS was a standardized, universal method already used by the states and some local governments that was fully capable of producing an area-wide estimate of VMT. Accordingly, the use of HPMS would minimize and avoid duplication of efforts for travel reporting by the states, MPOs and local governments.

The FHWA and the states, beginning in 1978, jointly developed and implemented a continuous data collection system and called it HPMS. All open-to-the public roads are represented in HPMS. Each year, the states must furnish data on these roads in a two-tiered process, universe and sampled (7). According to a consultant report on HPMS prepared for the Illinois Department of Transportation (IDOT):

The universe data provides coverage of the entire public road mileage, and the sample data provides additional detailed data for a permanent randomly selected subset of the universe known as the HPMS Sample Sections. Using this method measured characteristics of the sample sections can be expanded to the universe (18).

The Annual Average Daily Traffic (AADT) is one such characteristic. For each sample section an AADT is represented as well as the means to calculate expansion factors to expand the number to universe. In addition, there is also a forecasted AADT on each sample segment. This holds for all roadways except the most local urban and rural roads.

1.1.1 Historical Record

One of the requirements of the air quality process is the need for “good” historical VMT data. Embedded in the HPMS process is the requirement that each state produce an area-wide number reporting daily vehicle travel and system length. By multiplying these two numbers it is possible to obtain a daily VMT for the non-attainment area.

Each year, as part of the HPMS data submittal, every state must report an area-wide geographically aggregated estimate of vehicle travel and system length for several different measurement units. These include a statewide total, one total for all urbanized areas, one total for all small urban areas, one total for all rural areas, a total for each independent urbanized area and the non-attainment areas. The non-attainment area contains two components, the part that is urban and the part that is considered rural (the donut area). This information is provided on the area-wide template. For the purpose of area-wide grouping and stratification, HPMS uses volume groups, functional classes and the FHWA adjusted urbanized area boundary definitions (8).

This information is reported annually and acts as the historic record of travel in the areas represented. Provided that the boundaries of the areas do not change over time it is possible to produce the VMT historical trend for the area in question.

1.1.2 VMT Tracking

One of the most direct air quality traffic monitoring requirements is the need to track VMT. According to the 187 Guidance, areas exceeding a specified Carbon Monoxide (CO) National Ambient Air Quality Standard (NAAQS) must conduct an annual comparison of forecasted VMT prepared for the State Implementation Plan (SIP) with the actual VMT reported to FHWA under HPMS. If the actual growth exceeds the forecasted growth by 4 percent in any year, sanctioning provisions in the form of contingency measures are imposed. In fact, the acceptable 'actual vs forecasted' growth difference was 5 percent in 1994, 4 percent for 1995 and 3 percent for 1996 and on (6). An example of a sanction is autoless Saturdays. To establish the forecast, either local models or trends developed from historic records can be used (2).

The following example illustrates how this might work. Assume that the New York City region is a moderate non-attainment area for CO. In preparation of its 1992 CO SIP Revision the region used the HPMS historic data for 1985 to 1990 and projected a straight-line growth trend out to 1995, the year the NAAQS for CO would be met. Since then the "actual" VMT growth as measured by HPMS for 1990 to 1994 occurred at a lower rate of increase than forecasted. This in turn means that none of the USEPA required "contingency measures" identified in the CO SIP would need to be implemented.

1.1.3 Validate Models

The last area where ground count based VMT comes into play is with the validation of the travel models. In its simplest form the concept of validation means comparing a known value to a modeled value. In this case, a ground count based VMT would be compared to a model based VMT. If it compares favorably the model is deemed validated. If the comparison is not so favorable, the model is adjusted. According to the Guidance, a simple adjustment of the model's area-wide future year VMT by the proportional differences in the base year is recommended.

For example, assume the Los Angeles area is attempting to validate its model for VMT tracking. And, after the model is run it produces an area-wide air basin (this is the LA non-attainment area) base year VMT that is 4 percent below the HPMS estimate for the same geographic area. To remedy the difference in the two processes the model's horizon year forecast is adjusted upwards by the base-year difference.

(While this explains the validation process recommended by the Guidance for air quality purposes, it must be understood that there is a much more rigorous calibration and validation process that takes place within the development of the travel demand models themselves.)

1.2 Modeled VMT

Modeled VMT is just as important to air quality as ground counts. It brushes with air quality in three separate but interconnected ways: forecasts, the Transportation Improvement Program (TIP) conformity and sub-regional analysis. The TIP is the program (list) of transportation projects to be built in the region.

I.2.1 Forecasts

Just as historic records of VMT are important to air quality so are "good" forecasts. As explained in Section 1.1.2 the forecasts play an integral role in the VMT Tracking requirement. They are also at the focal point of the TIP Conformity process as explained below. For these and many other reasons too numerous to list, it is best to identify the forecasted VMT as a separate element of the air quality process.

Another element of the forecasts is that HPMS requires them on the sample sections. These forecasts must be between 17 and 22 years in the future. Although FHWA staff have stated that this forecast is not used in any analytical sense, a recent examination of the sample section forecasts produced some interesting results. In all cases it was reported that the rate of VMT growth produced for the sample section data was greater than that produced by the Metropolitan Planning Organizations (MPOs) (25). This is starting to cause concern especially if HPMS sample forecasts were to be interjected into the air quality analytical process.

1.2.2 TIP Conformity

Another place where VMT comes into play is in the process used to do the technical conformity analysis of the TIP and the Regional Transportation Plan. Conceptually, the conformity goal is much easier to understand than the actual process. Reference (9) is a national transportation perspective on the process while the documentation of a local process can be found in references (10, 11, and 12).

The conformity analysis simply asks the question “What will happen to air quality from mobile sources if the TIP (or the plan) is built?” The measure is based on the future VMT. Because of the need to forecast the use of the highway system given a specific mix of projects the travel models are logically the best tool.

The first step in the process is to code the TIP projects into the network. Once all the TIP projects are in the coded network, the travel models can be used along with future population, land use and socioeconomic data to produce future year traffic forecasts. These traffic forecasts are then used to estimate a future pollution burden. According to the conformity tests, if the TIP projects and the region’s growth produce more pollution than the budget allows, the TIP does not conform and the project mix must be reviewed.

1.2.3 Sub-regional Analysis

While the regulations have not called for specific sub-regional analyses per se, many of the air quality planning questions related to TCMs and Congestion Mitigation and Air Quality (CMAQ) projects require a micro or sub-regional analysis. The travel models are uniquely qualified for this. In fact, in the Guidance, USEPA notes that it will accept speed data and other data from the models where HPMS is statistically fallible. As a result, both modeled and counted sub-regional VMT are important components of the air quality traffic monitoring processes.

2.0 The Case for Northeastern Illinois

In northeastern Illinois there has been considerable discussion concerning the VMT used in conjunction with the approval of the air quality process. During the conformity process for the FY94-98 TIP and 2010 TSD Plan Update completed two years ago (13) the issue of VMT for the metropolitan area emerged as a point of concern. In the USDOT August 19, 1994 letter approving the conformity analysis there was a call for an agreement on "...how to upgrade and use the HPMS database as the basis for VMT estimation, projection and monitoring, for both emissions inventory and conformity" (14). There was also a call for interagency consultation between the air quality and transportation agencies to agree on a consistent, acceptable treatment of VMT forecasting in the Chicago non-attainment area.

The result of the consultation was an agreement among IDOT, the Chicago Area Transportation Study (CATS) and the Illinois Environmental Protection Agency (IEPA) on how to upgrade and use HPMS as the basis for VMT monitoring, for both emissions inventory and conformity analysis purposes. It was further agreed that HPMS would be used for all VMT monitoring and the models would be used for all forecasts.

According to the agreement:

> *The HPMS database will be used in accordance with the federally prescribed procedure. This means that the corresponding modeled VMT will be compared to HPMS estimated VMT and modeled VMT will be adjusted to match HPMS estimated VMT as appropriate. VMT projections for the SIP development and conformity analysis and the future year traffic projections included in the Illinois HPMS submittal are based on the results of applying the CATS travel demand modeling process fo the official socioeconomic forecasfs for northeastern Illinois. VMT projections may be made for other purposes and/or by other entities, but it is herein agreed that fhe VMT projections made through this CATS modeling process are to be used for SIP development and conformity analyses (15).*

The fact that there seemed to be a conflict between the two processes was not new. While the region has always had an approved ground count program and travel models that traditionally rank with the state-of-the-practice, the differences between the two processes emerged in the late 80s before the conformity requirements (16). VMT estimates produced from the ground count program did not exactly match the base year estimates produced by the travel models; near term model forecasts did not align with those estimated by IDOT; and questions about the quality of both processes were being raised. Over time, it became an accepted fact that the two systems were out of sync. Locally, this was “naturally” not an issue since the two processes had distinctly different purposes, methodologies and uses. With the creation of the conformity process and the other VMT related air quality requirements, the differences would soon have to be addressed.

What caused the issue of VMT to surface in the late 80s was an IDOT analysis that attempted to use the data from the two processes to support each other. Specifically, the analysis called for interpolating a 1987 VMT value from a CATS 1980 base and 2010 forecast and comparing it to current ground count based VMT. Needless to say the two did not agree. It was reasoned that this type of interpolation was not well suited to travel models since they are not driven by VMT or other traffic trends. Instead the models use socioeconomic information and reflect policy commitments such as a higher future transit mode split.

This difference surfaced again in 1990 when IDOT was asked to make a short term VMT forecast out to 1996 for the northeastern Illinois non-attainment area as part of the SIP development. What occurred was not a surprise. Using the historical VMT and following commonly accepted trend analysis methods, the IDOT-produced 1996 VMT resulted in an annual growth rate around 3 percent a year. Clearly, this was not a desirable result. Using the CATS base year VMT, which was now 1990, and the 20-year forecast VMT, a simple compounded annual growth rate of about one percent per year was calculated. Could they both be true? As would be expected suspicion was cast upon both methods and their comparability.

Finally, in the spring of 1995, the issue came to a head. A consultant was retained by IDOT to provide technical assistance in the development of an enhanced HPMS for use within northeastern and southwestern Illinois. The purpose of the effort was to produce what became known as a “confidence-based” HPMS VMT estimate. The models in turn would be validated against that value.

The detailed scope of the consultant’s work is shown in reference (18). In general the work called for:

> *. ..an enhanced HPMS system that will address all uses established by USDOT and USEPA, and provide the information necessary to meet the requirements resulting from CAAA, ISTEA, subsequent*

> *regulations and memorandums of understanding. Of primary concern is the ability to track VMT using the HPMS in a manner that is consistent with the conformity* analysis *performed by CATS using its transportation demand modeling system and consistent with the development of emission budgets in the SIP. The enhanced system is intended to provide statistically reliable measures for various levels of geography, classifications of roadways and seasonal variation. The system will be compatible with FHWA standards and criteria, with USEPA's VMT tracking guidance, with IDOT's standards* and *will meet criteria set forth in 40 CFR 57.452(b) (17).*

The lead consultant also engaged four sub-consultants to assist in the study. The sub-consultants are nationally recognized experts in the HPMS and VMT estimation fields. The sub-consultants are responsible for technical review, evaluation, guidance, direction and support of the consultant's work. The contract itself calls for five tasks that include: reviewing and evaluating the current HPMS and VMT estimation processes; developing a methodology to select a high quality, unbiased sample of roadway sections; developing a methodology to gather necessary information; documenting enhanced HPMS; and providing final reports summarizing the study. Consultant work on this contract began in June 1995 and is expected to be completed in 1996.

To date the consultant has produced an assessment of the current HPMS and VMT reporting systems (18) and is preparing recommendations to improve the HPMS process. Concurrently, one of the sub-consultants is developing a statistical analysis of the HPMS as a method for tracking VMT while another sub-consultant is developing a separate VMT estimation report. Once this work is complete the consultants will develop the sample roadway sections and recommend improvements for using HPMS as a VMT tracking tool.

3.0 What We Have Learned

Through-out the region's involvement in the VMT/conformity/air quality debate, CATS staff has continually learned more about the process and the issues. Prior to 1990 the transportation community did not concern itself with how to get from VMT to tons of CO, Hydrogen Carbons (HC) and Nitrogen Oxides (NOx), Build-no build, Action-base line, conformity, air quality impacts and regulation interpretation. After 1990 things changed.

Prior to the CAAA no one at CATS would have ever dreamed that any of the staff would be involved with a consultant contract to enhance HPMS, been able to secure funds to greatly improve the travel models, or would become students of something called a conformity process. Truly the direction in which the technical transportation planning community is focused also changed.

3.1 HPMS Consultant Work

Through this investigation a great deal has been learned about the region's HPMS process and traffic counting in Illinois in general. Foremost is the realization that the current process is far from perfect. However, to the region's credit the consultants are concluding, "that the current procedures produce estimates that appear to be within an acceptable range of accuracy. This is based upon a review of VMT history in other states and large urban areas" (18). The report goes on to suggest that the weaknesses identified may be compensating or offsetting. Maybe perfect is too high a standard.

While the Assessment report (18) has over 120 pages plus appendices loaded with detailed analysis, presented below are some of the findings and issues that may be of wider interest.

3.1 .I Boundaries

In 1990 for the first time the MPO was called upon to establish the adjusted FHWA Urban Area Boundary. In addition, a 20-year metropolitan planning area boundary also needed to be established. On top of this, a non-attainment boundary was declared by USEPA (19) which at the time did not align with the traditional planning geography. Exhibit 2 identifies the Census Urbanized, the FHWA Urban and the non-attainment area boundaries. Not shown is the 20-year metropolitan area boundary which is almost coterminous with the non-attainment area.

Prior to 1990, for FHWA data reporting purposes, the region was carved up into six distinct urbanized areas corresponding very closely to the Census Urbanized area boundaries. After 1990, with CATS input the true Census Urbanized boundary was smoothed out and called the FHWA urban boundary. this new urban boundary subsumed the smaller areas. In terms of planning, CATS always extended itself far beyond the Census defined Urbanized Areas so, when given the opportunity to have input into the definition of the FHWA boundary it seemed logical to subsume the Census areas. Besides, the new boundary met the criteria established by ISTEA (8).

While this may sound like a trivial activity, the implications have yet to be fully realized. According to the consultant's report, historical comparisons of VMT before and after 1990 are meaningless (18). Beyond this, it has: totally skewed the current HPMS sample the remedy for which is still evolving (sample tweaking vs. a new sample); was not well accepted by FHWA; and seemed to have confused those who were used to the old Federal Urban boundary when it followed the Census defined areas. Given all of this, its impact on the ability for modeled VMT and ground count based VMT to track with each other is not known and is subject to debate.

3.1.2 Automatic Traffic Recorders

One of the strongest recommendations coming out of the HPMS consultant contract is the recommendation that northeastern Illinois needs additional Automatic Traffic Recorders (ATRs) and a better distribution of them. Exhibit 3 is a map showing the location of the 11 counters in use. The need for more ATRs was something that CATS staff discovered when preparing the FY94-98 TIP and Updated TSD Conformity (20).

At that time, one of the concerns raised with the public comment (draft) conformity document was that the travel models produce a number akin to an Average Annual Weekday Daily Traffic (AAWDT). However, what was needed for the pollution burden calculation was a traffic representation for a typical weekday in July when the ozone is presumed to be at its worst. To get to that number the IDOT monthly seasonal factor of 1.09 had to be used since it was what was already used in the inventory for the SIP.

Concerned that 1.09 "seemed" high, CATS staff investigated the composition of that number and reached two conclusions. First, it was obvious that the distribution of AIR units in northeastern Illinois was not sufficient to produce a true urbanized number for the region. While it was conceded that 1.09 may be more representative of the smaller urbanized areas in the state, an independent examination of applicable data suggested that the "true" rate could be near 1.02. The conclusion was that there needed to be additional ATRs added in the region (21). By the way, for all the conformity related work 1.09 was in fact used.

The 'issue of ATRs is important for two reasons. First it is unlikely that the experience in northeastern Illinois is unique. Regions grow, change and shift around which can affect the quality of the ATRs. Second, as we begin to look at our urban areas separately and require high quality traffic data we will need more ATRs to be able to properly represent localized conditions. Based upon the consultants preliminary work an additional 35 ATRs will be needed.

3.1.3 CATS Network Linkages

Early in the consultants' analysis, they became concerned with the lack of comparability between the CATS network and the network associated with HPMS. There was a "mismatch" between comparisons of the mileage of the two based on functional class which made any further analysis impossible. Although CATS carries a functional class variable on its network the quality of its coding was suspect (18). Exhibit 4 shows the functional class definitions in use by the relevant agencies. As can be seen there are some considerable differences.

At this juncture an interesting gap emerged. For modeling CATS has no need of a variable such as functional class. It has not been used in quite some time. It was a "leftover" variable that was carried along but is not used. The "roadway type" variable (Exhibit 4) on the other hand, has a place in the mathematical calculations of the model. However, it is not the same as FHWA's type variable and not very usable for any detailed comparisons.

This is especially troublesome for the HPMS consultant's VMT investigation because of the stratification importance given to this variable in the HPMS scheme. On one hand the ground count programs stratify well among things like volume groups and functional classes while travel models do better with geographically aggregated VMT.

3.1.4 Coordination

Since no investigation into how to improve something that affects so many agencies would be complete without a coordination component there certainly is room for one here. One of the consultant recommendations calls for better coordination and exploitation of data collected by local traffic programs and existing speed monitoring stations. However, this does not go far enough. There are a great many entities in the northeastern Illinois region all with the potential to be data suppliers. In addition, there are also a growing number of intelligent transportation systems, interconnected signal controllers, demand actuated signal systems, and grade crossing devices that also have traffic counting potential. All of these systems could be set up to feed a regional ground count data program.

3.1.5 Other Issues

The northeastern Illinois region and IDOT are just now reviewing the bevy of recommendations that are coming from the consultant's HPMS work. Exhibit 5 contains a brief list drawn from early discussions with the consultant. At this time the Draft Recommendations Report is being evaluated and decisions being made. One of the more important, but not surprising, findings is that the HPMS sample is geographically biased and would benefit from modification. However, other actions must be taken to achieve a discernible improvement in VMT estimates (24). ATRs are an example. What should be obvious when reviewing the recommendations in Exhibit 5 is that many of them will take some time to bring to fruition even under the spot light of the CAAA process. Quality does not come without a price.

3.2 Model Improvements

In all fairness a great deal of activity has taken place on the model development front. Exhibit 6 highlights many of the major improvements and a considerable discussion is devoted to this in references (10) and (12).

3.3 Conformity Reliability

The transportation planning community has, since the adoption of the CAAA, been rather suspicious of the emissions estimating process and the demands placed on the planners relative to the precision of the models and data with which they work (9). At an April 1993 TRB conference Gary Hawthorne remarked "I remember in that very TRB session that Neil (Pedersen) 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" (22).

This is particularly pertinent when one considers what goes into the final pollution burden calculations that make up the TIP conformity process. Exhibit 7 presents a copy of the final table of the CATS TIP conformity process. It shows that in each scenario (1996, 2001, 2007 and 2010) the total emissions are lower than the 1990 SIP. In addition, the VOC emissions are also lower in each scenario than the budget from the 15 percent ROP SIP for 1996 that is 253.7 tons per day. The question that concerns the traffic data community is, how do we get from our pollution burden back to VMT? That is, where does VMT enter the process?

Exhibit 8 presents a picture of the linkage as it is typically depicted (6) followed by Exhibit 9 that depicts the precise linkage between the two. The actual pollutant burden is the coming together of an estimated VMT from the travel models and a pollution rate from the air quality MOBILE models. Embedded deep within the travel models is the ability to produce estimates of hourly traffic and speed for each link in the CATS highway network for nine vehicle types. VMT are then summed for each vehicle type and the 63 specified speed ranges. The speed ranges are in 1 mile per hour increments up to 65 miles per hour (MPH) and beginning with 2.5 MPH or below (12).

Once this matrix is generated it is multiplied by a similar matrix containing the nine vehicle types by the speed range and pollutant. The data on this second table is actually the pollution rate per mile of a certain vehicle type at a given speed. The pollutant rate matrix is derived from the air quality MOBILE model and supplied to CATS by IEPA. A small portion of this pollution rate table is shown in Exhibit 11 as an example. Once the two matrices are combined the results are summed for all vehicle types and speed ranges to produce the resultant pollution burden. To help illustrate this, Exhibit IO presents a generalized version of what the CATS VMT table and the pollution rate table would look like followed by a sample of the detailed rates produced by the MOBILE model (Exhibit II). The entire process is explained in excruciating detail in (12).

To the casual observer this looks like a great deal of precision is built into the process. However, at each step of the process, both within the travel models and the air quality models, there is variation in the numbers being used. Phases such as “bordering on the absurd” usually pop up when transportation planners get together and talk about the process as it relates to its product. Many times this author has to be reminded to think of this as a regulatory and not a planning exercise.

And, one final point for those in the data world. While the purpose of this is not to bash the process used for determining mobile source emissions, the closer one gets to the process the easier it becomes to be critical of it. Take for example the simple concept of typing vehicles. Exhibit 12 presents the various vehicle typologies used by the various processes involved with supplying inputs to the pollutant burden calculation. What becomes obvious is that there is not a one-to-one correspondence between them. As a result, a degree of manipulation and conversion takes place within the data processing which only helps to add some fuzziness to the final result.

3.4 HPMS and Model Issues

Early on it was thought that the northeastern Illinois region was the only area with concerns about the interplay between the HPMS process and the travel models. Later it was learned that these concerns were topics of conversation across the country. One concern that emerged early on was concerned the relationship between ground count (HPMS) and modeled VMT. For example, if one takes a base year and a horizon year VMT from the regional modeling process and then connect the two data points it will be very probable that, over time, the resultant growth rate produced by the model will be less than the growth rate provided by the HPMS program. While this is troubling and has raised many questions it has never been thought to be a fatal to either process. It cannot be emphasized enough--they have different purposes.

Adding to this concern is something that is part of the HPMS data base itself. As item number 73 in the HPMS data base a 17 to 22 year forecast AADT is required on each sample section. While FHWA has stated that this number is not used in an analytical sense a recent examination of the forecast compared with those produced by the MPOs had some perplexing findings. The HPMS forecast consistently yielded higher VMT growth rates than the locally validated travel models. To some this was a shocking finding but to others it was an expected result given the differences in methodologies and statistical variability of the two processes. After all, can a sample of sections with future year forecasts realistically be expected to match those derived from a fully validated network model?

Because the analysis performed for the conformity process relies on a cozy relationship between the two VMT processes it seems to make sense to ask that the HPMS based VMT and the travel models VMT be in lock step and supportive of each other. Since the HPMS is producing the factual-historic record and the models are producing forecasts it’s logical that where the two speak to the same temporal points that they should be supportive of each other.

During the past year a small group of individual from across the country familiar with the modeling processes and HPMS have been discussing HPMS issues. One concern that keeps emerging is issues involving the consistency in VMT between HPMS and the models. Below are some of the issue areas identified by the group (Exhibit 13).

There is suspicion that a degree of variability within each state on the methods used to establish the VMT estimates exists. What is counted, when, where, and how it is manipulated, expanded and systematized all offer threats to consistency within a state. While the concept of “truth in data” has flourished, the real fact is that focus on capital programs has skewed the count programs. In general, the states are cutting back data collection and modifying their count programs. In one respect the trend appears to be toward programs that produce generalized average numbers that can outright obscure the precision of the data.

A second area is the conceptual and computational difference between the forecasts and estimates. VMT estimates are rooted in link-level count-based programs while VMT forecast are produced by regional household based behavioral models. In the smaller urban areas simple growth factor and trend methods are common. These conceptual and computational differences notwithstanding, is a further concern over the quality and consistency of link-level forecasts. These concerns are becoming exacerbated with the increased emphasis put on the use of this VMT information especially when used in combination with other factors and statistics. It is thought to be ball park at best.

A third area is what is being asked of the forecasts which use macro-level household based behavioral travel demand models. Unlike ground based count programs, where weaknesses tend to be tied to factoring, extrapolation and measurement bias, travel demand models have a completely different and more complex set of areas where bias exists. One major, almost impossible task, is to ask a regional model to match a specific link level volume (like those on the sample sections) in the base year, let alone in the horizon or forecast year. While the models will produce values, careful analysis of them on a section by section basis usually shows some unexpected results. Added to this is the fact that the quality of the models is dramatically different from area to area.

A fourth issue is the actual use of the VMT statistics that are produced. There is a strong tendency to compare year-to-year VMT changes at a small area geography (non-attainment area) and smaller without regard for the actual sensitivity of the number. HPMS contains a wealth of data and once the Linear Referencing System coordinates are in place the ability to over extend the analysis of the data will become great. This is especially of concern since the stability and limitations of the existing data are not “truly” known.

A fifth concern is that the providers of both must have a buy-in to the data to assure that the process to collect the information is sound. Many things crop up in the field that can bias the data and ultimately the result. If its assumed that this buy-in from the states and locals has not been universal then a bias is likely to result in the final data.

A final concern is an area where some research is warranted. Is it even possible to estimate VMT to the degree of accuracy that is being asked? Are the travel demand models used for forecasting capable of being calibrated, validated and adjusted to produce link level numbers that match the ground count programs? Should there be a closer tie between HPMS sections and travel models when considering current year estimates? Is it realistically possible? Is the HPMS capable of producing a VMT estimate with a margin of error that is less than 3 percent?

4.0 So, Where Do We Go From Here?

It should be quite clear that there are a great many questions looming out there regarding air quality analysis, VMT monitoring, tracking, estimating and forecasting. However, many of these questions have shifted away from learning how to follow all the rules over to question the quality of the analysis. Just how far along and where we are on what some suggest may be the conformity growth model (Exhibit 14) is uncertain. For some individuals the uses of the transportation data and what is being asked of it are believed to be far beyond the limits of the data. To others this is seen as a challenge to improve and enhance the technical processes.

4.1 CATS Area

In northeastern Illinois we are just at the beginning stages of choosing alternatives and implementing the results of the consultant effort to help produce a truly credible HPMS data base. At the same time we are also bringing on line a variety of travel model improvements. In many respects we look like we are on the high road to accepting the need for high quality ground-count data. However, the reality will be for staff to work hard to assure that this happens. One fear is that the air quality and VMT knot will be loosened and all hopes of producing higher quality data would be lost. We will be thrown back to the middle 80s when modeling and data were far off in the background of planning.

Assuming all goes well with HPMS, the next big question facing the region will be one of validation. Although CATS staff did manage to show an adequate validation for the past two conformity findings both the HPMS consultant and others feel more stringent validations should be done. At what level will any validation take place? How will adjustments be made when differences are found? These are all legitimate questions. To satisfy the regulations, all that needs to be done is to follow the Guidance and do a simple region-level adjustment. But this is not of any real use to the models. Where and why there are differences are the truly important questions. These will be the questions the planners will want to answer. Also, on the network side, once there are good computer linkages between the CATS network and the various other networks even more scrutiny is likely to be placed upon analyzing the differences between the two. The comparisons will become microscopic. It will be unavoidable.

Working to offset this is the fact that the technical modeling process is in a large way held hostage by its own committee process. In order for work to occur on the regional models, which the CATS staff maintain, a specific project must be identified and funding secured. CATS' model projects are generally funded from one of two sources, IDOT directly or more often with federal planning funds secured through the regional planning process. This process is committee driven where nine potential recipient agencies compete for the region's planning funds. The actual selection process is guided by a multi-layered committee process. Consequently, projects such as collecting data and working on models are thought to be high order needs and sell best under crisis times.

4.2 Nationally

At the national level FHWA is very much concerned with the issues surrounding consistency between models and count based processes. These issues are just now beginning to be explored and the questions formulated. It is important for the data community to help formulate the questions and concerns. The issues are very complex and the current fixes are spotty. As a result, there needs to be a great deal of open discussion about "just what are the issues?" We all need to throw down our political defenses and put aside our personal biases. As we explore the issues we will find ourselves bumping into some very fundamental questions. What is the purpose of the ground count programs and the travel models? These need to be reassessed.

On the regulatory front some speculate that the air quality transportation related analytical process is doomed to statistical failure. On another front we are awaiting more regulations, more likely missed dates, further process and more confusion. To move from this future will be difficult. However, there is something the planning community can get out of this and that is to beef up our programs. Nationally there are a variety of efforts underway all of which are aimed at strengthening model and data related programs.
One simple task is to make sure we all stay tuned into these discussions, processes and developments.

4.3 General

I may talk harshly about the air quality process but I do feel strong about using it to help better our planning tools, ground counts and models. I have always thought that it would be a planners' utopia if we had an HPMS (or other named system) that actually produced high quality "reliable" traffic flow type data. As Illinois knows, flow maps can be quite useful for a variety of planning purposes including the validation and adjustment of ground counts (23).

It would also be nice to see the current flow data for a base year match the planning network data for the base year without overt adjusting. After all, isn't it one of the roles of the technical travel demand modeling process to build mathematical representations of our behavior? It seems to me that the time is upon us to get away from the single notion that the travel demand modeling process is only to test future scenarios and forecast travel changes. With forty years of experience behind us we should begin to ask questions about the quality of how well the models are representing our behavior. At a local level this will not happen without the proverbial gun to our head. The CAAA has help load that gun.

Finally, it behooves all of use to do some soul searching about our processes and the directions we are heading.

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APPLICATION OF AUTOMATED DATA COLLECTION SYSTEMS FOR CONGESTION MANAGEMENT SYSTEM PERFORMANCE MONITORING

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Application of Automated Data Collection Systems for Congestion Management System Performance Monitoring

The Central Puget Sound Experience

ABSTRACT

The collection of data has for a long time been an arduous and expensive task of traffic engineers and transportation planners. Efforts to improve the effectiveness and efficiency of data collection especially to monitor transportation system performance has been of high interest in the central Puget Sound region in the state of Washington. To help meet the performance monitoring requirements of the federally-mandated Congestion Management System (CMS), the Puget Sound Regional Council has been investigating how existing and planned data collection efforts can be applied for CMS performance monitoring purposes. Investigation into data collection schemes within the region has shown that there are actually opportunities to collect data today and these systems can be implemented in other metropolitan areas with a reasonable level of effort. To help meet the long-term needs of its CMS performance monitoring element, the Regional Council has begun a project that will provide linkages to regional data collection sites, retrieve, manipulate and archive data for CMS analysis, as well as other applications such a regional travel demand model validation. The project will also provide interactive links to databases via the agency's Geographic Information System.

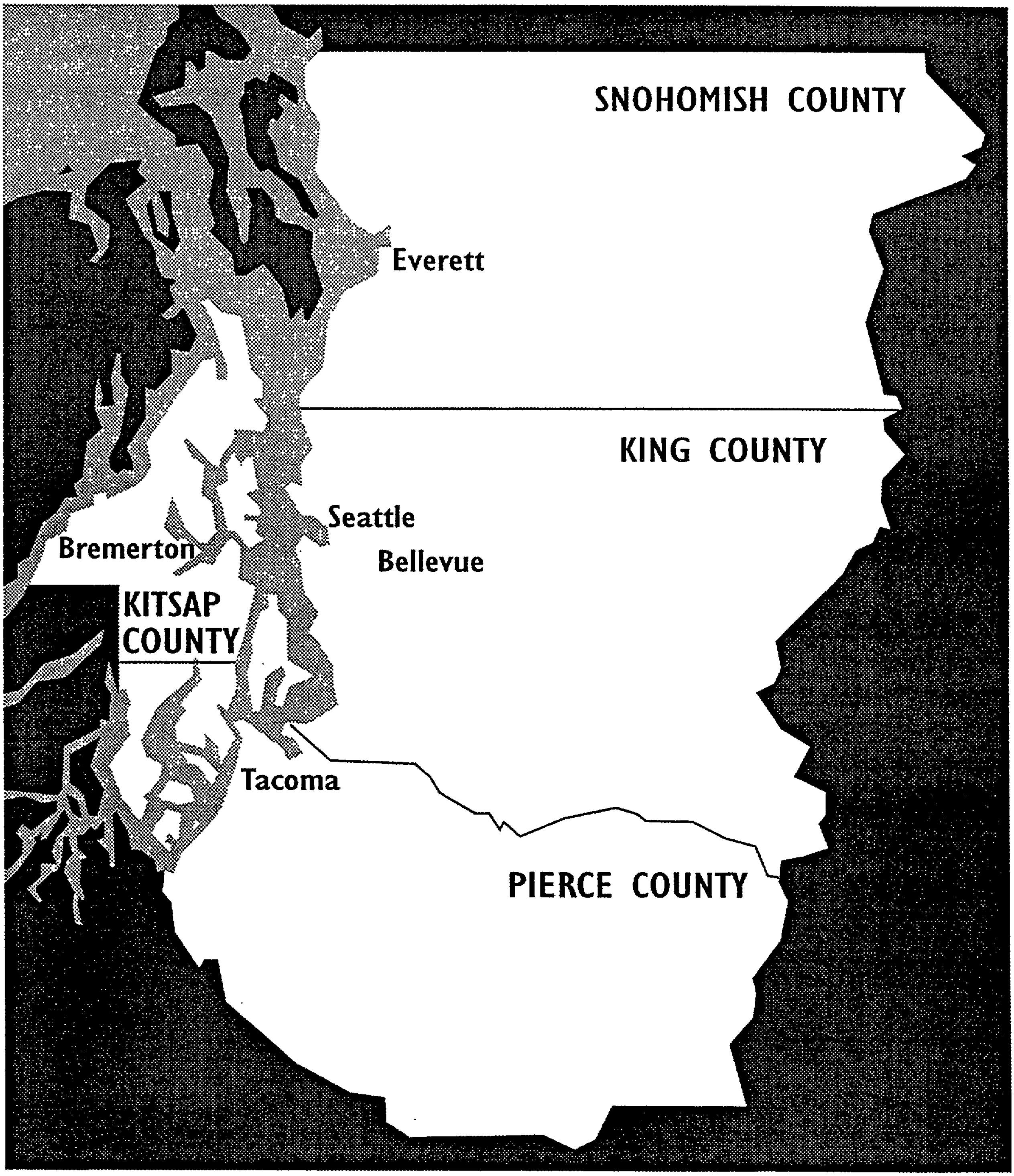
CONGESTION TRENDS IN THE CENTRAL PUGET SOUND REGION

Recent trends show that the central Puget Sound region (see Figure 1) in the state of Washington has experienced high levels of growth in population and employment with a dramatic increase in vehicle miles of travel. As shown in Figure 2, population and employment growth between 1981 and 1990 has been 20 and 35 percent, respectively. Mirroring national trends, the growth in vehicle miles of travel (VMT) has been even more dramatic than regional population and employment growth. Between 1981 and 1990, VMT has grown by over 80%. Analysis has shown that factors that contribute to the growth in VMT include more vehicles per household, two-income families and longer commute distances. Needless to say, with limited investment in highway expansion and the increase in the number of vehicle trips accessing the highways, the central Puget Sound region has seen its highway facilities experiencing increasing levels of vehicle volumes and delay.

The future also presents more challenges for state, regional and local transportation planning professionals in meeting the demands of an expanding region. The Puget Sound region is expected to grow from 1.4 million residents in 1990 to 2.7 million by 2020. which will make it one of the fastest growing metropolitan areas in the US for years to come. While the City of Seattle is its largest city,

Figure 1

Central Puget Sound Region



recent trends and forecasts show that future population and employment growth is moving to the outlying areas. Figure 3 shows higher growth percentages in Kitsap, Pierce and Snohomish Counties in comparison to the more developed King County. Urban centers, such as Tacoma, Bellevue and Everett, are expected to absorb an increased share of jobs and households in the coming years. And, like other urban areas across the country, the Puget Sound region will experience a higher growth in vehicle miles traveled relative to its population and employment growth.

Figure 2

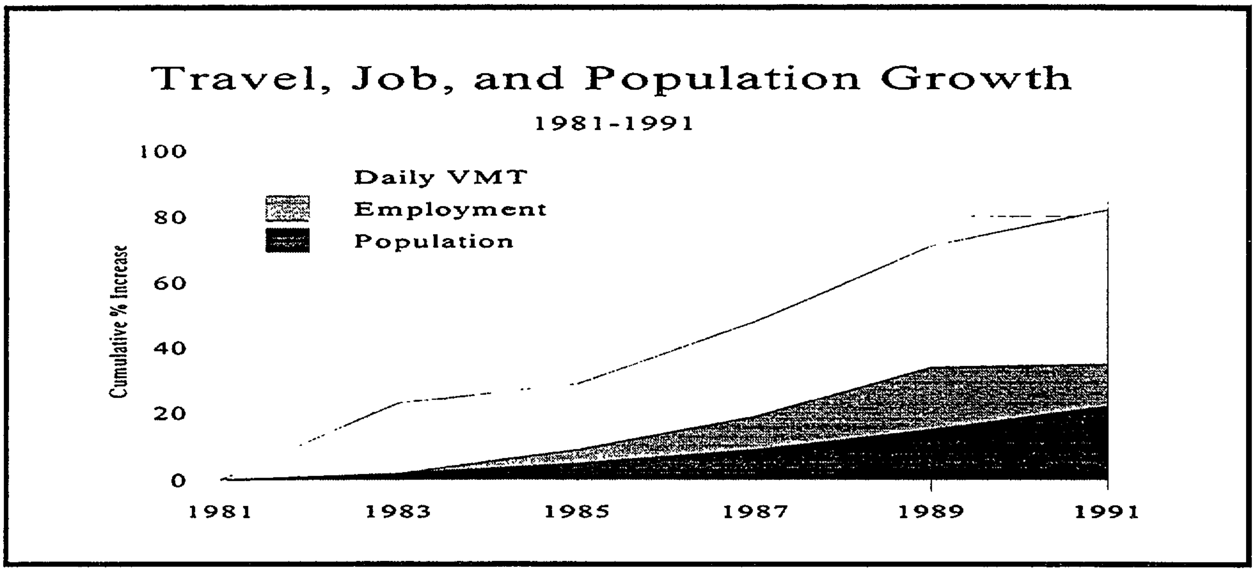
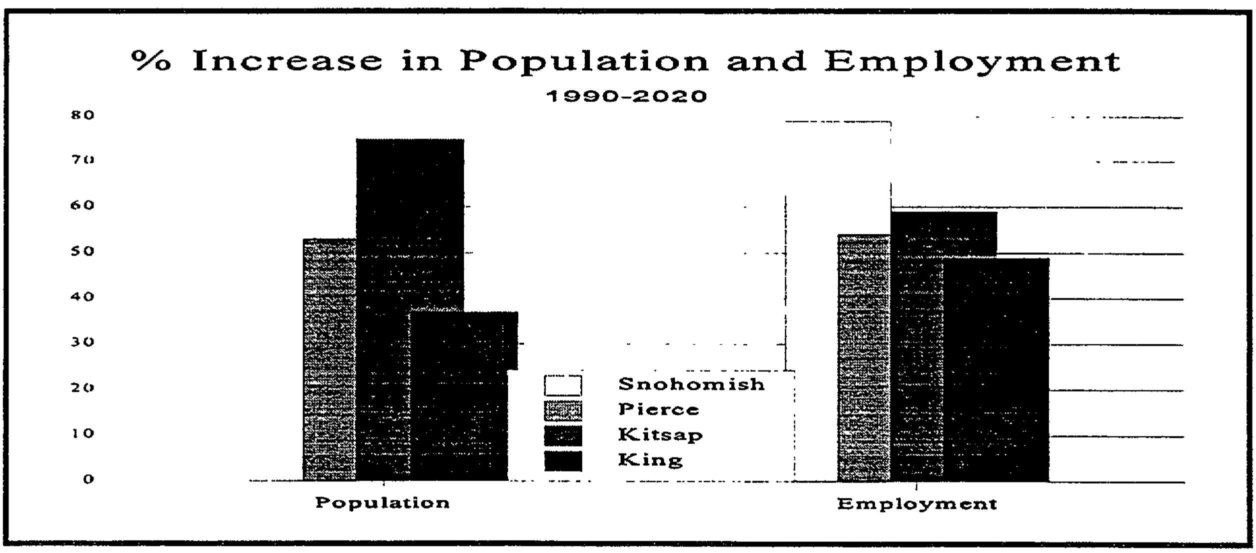


Figure 3



CONGESTION MANAGEMENT SYSTEMS

The Intermodal Surface Transportation Efficiency Act of 1991 set in place the new directions for state Departments of transportation and metropolitan planning organizations (MPOs) to deal with the problem of mitigating traffic congestion. To help major metropolitan areas deal with the problem of congestion, ISTEA set in motion the concept of the congestion management system (CMS). According to ISTEA's Management and Monitoring Systems Rule, a congestion management system is "...a systematic process that provides information on transportation system performance and alternative strategies to alleviate congestion and enhance the mobility of persons and goods. The CMS includes methods to monitor and evaluate performance, identify alternative actions, assess and implement cost-effective actions, and evaluate the effectiveness of implemented actions."

A congestion management system contains the following elements:

- Performance measures,
- Data collection and system monitoring,
- Identification and evaluation of proposed strategies,
- Implementation of strategies, and
- Evaluation of the effectiveness of implemented strategies.

The central Puget Sound region CMS is scheduled to be fully operational by October 1997.

CMS PROGRAM ELEMENTS

Regional Planning Framework. As an integral part of the region's transportation planning process, the CMS will provide valuable data on the performance of the regional transportation system. The CMS is coordinated with the long-range transportation planning policies and is an element of the region's long range metropolitan transportation plan (MTP), which provides the framework for the development of a management system that proposes to use advanced technology in a cost-effective manner to meet federal, state and regional regulations and policies. In September 1994, the Puget Sound Regional Council adopted a Congestion Management System (CMS) Work Plan which begins to address its citizens concerns about traffic congestion,

CMS Monitoring System. The CMS performance monitoring network will be primarily focused on the regional highway, and ferry route system. The network provides a structure from which to gauge not only single-occupant vehicle performance, but comparable, transit, and high-occupancy vehicle and commercial vehicle performance. To a lesser extent, travel demand management strategies, while more difficult to measure, are part of the CMS performance monitoring system.

The focus of the CMS performance monitoring system will ultimately be on the proposed Metropolitan Transportation System (MTS). The MTS includes both transportation facilities and services which provide regionally significant travel opportunities to facilitate access to locations and activities crucial to the social or economic health of the central Puget Sound region. On the highway side, the MTS includes the regional portion of the designated National Highway System (NHS) routes, as well as principal arterials and other arterials of regional significance. The MTS can be viewed as a planning tool used to identify regional transportation problems, develop regional solutions, define the transportation **network** required for regional air quality analyses and serve as a focus for required state, regional and local transportation system performance monitoring, particularly congestion monitoring for the CMS. The MTS is intended to be an evolving regional system that will periodically be updated as projects and programs are advanced for the purposes of improving its performance or adding capacity.

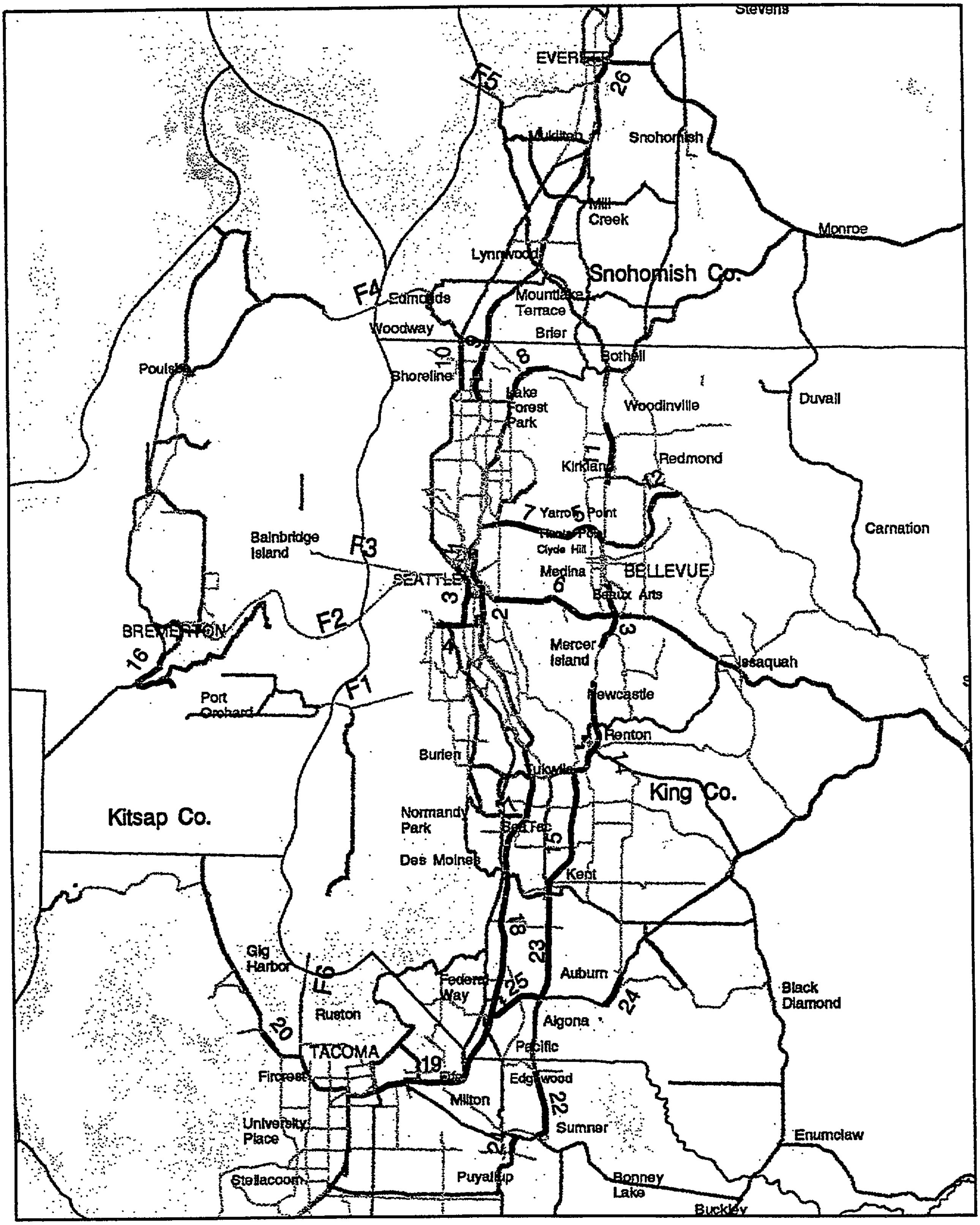
In the interim (the next two to three years), the CMS performance monitoring network will be focused on the NHS facilities and the state ferry routes. As data collection systems become more mature and extensive, the CMS monitoring network will expand **to** encompass additional NHS segments in addition to critical non-NHS segments on the MTS. In the coming months, the region's CMS Subcommittee will be developing a process for identifying new segments for CMS monitoring purposes. Some elements the Subcommittee will consider will include data availability, importance of a segment as it relates to regional policies, and system continuity.

As required by federal guidance, the Regional Council, in the fall of 1994, adopted a series of "critical segments" from which to begin data collection. The criterion used to select these initial segments was based on 1990 travel demand model estimates that reflected those facilities that experienced LOS E for at least five hours during the afternoon peak travel period. Since that time, the initial segments **were** refined based on 1995 model estimates and local staff professional judgement. The refined collection of critical segments is shown in Figure 4.

CMS Performance Measures. Performance measures are the central element of any CMS. **According** to federal requirements, performance measures will provide the **basis** for identifying the extent, severity and specific locations of congestion on a system wide basis. This information can be used to track

Figure 4

Congestion Management System Initial Critical Segments 1995 PM Peak Period



changes in congestion over time, identify potential congestion causes and provide information to decision-makers and the public.

Short and a long-range approaches to monitoring congestion on the CMS network have been adopted. The monitoring of performance is important in that it focuses on areas of high congestion that need mitigation strategies by any number of multimodal solutions. Regional and local transportation planning policies emphasize strategies that favor movement of persons and goods over vehicles. To better address the movement of persons over vehicles, the region adopted an approach to performance monitoring strategies that supports these policies. Travel time is a performance measure that supports these policies and can be applied to more reliably measure the performance of not only automobiles but also transit, carpools, vanpools, and trucks. By supplementing travel time data with vehicle counts and average vehicle occupancy information, for example, performance of effective mobility for person travel can be measured.

Travel time monitoring systems are now emerging in the region; however, they are not yet complete enough to meet the CMS performance monitoring requirements. Therefore, the region is implementing a two-phased approach. The initial performance monitoring system will focus on a vehicle-based strategy, since that data is readily available and can be used to transition to a travel time strategy. The volume-to-capacity ratio (v/c) approach (based on traffic counts) will be transitioned to the travel-time based approach as soon as feasible (estimated date for the transition is 1997/98). The initial data collection effort for the CMS network will also include, to the extent available, other data related to the identified NHS nerwork including:

- Ferry boat wait or delay,
- Transit operations and passenger volumes in the corridors,
- HOV volumes,
- Average vehicle occupancy,
- Park-and-Ride lot usage,
- Person throughput,
- Commute trip reduction program (TDM) effectiveness, and
- Subarea air quality.

Under Phase 2. approximately 1997198 and beyond, the CMS performance monitoring system will be fully transitioned to a travel time framework. The measuring of travel time will be done through the use of existing travel time data collection equipment. including automatic vehicle identification (AVI) technology. The AVI systems approach is currently being implemented by two transit agencies (Metro and Community Transit), and there is interest by other transit agencies as well. The AVI technology can be applied to all forms of surface transportation so that multimodal travel times can be obtained for SOVs, trucks, and even bicycles. It is anticipated that some of this data will also be beneficial in making regional recommendations to WSDOT regarding issues being addressed in the state's required safety management system.

Other performance measures that may be considered as part of the regional CMS in Phase 2 include:

- Transit schedule variability (reliability),
- I met-modal transfers,
- Truck and rail vehicle delay,
- Non-motorized facility coverage,
- Incidents, and
- Special Events.

AUTOMATED DATA COLLECTION SYSTEM APPLICATIONS

Data collection is an integral part of any CMS. Data is needed to identify critically congested segments, evaluate system performance against adopted performance measures and evaluate the effectiveness of CMS strategies once they are in place. In the central Puget Sound region, there has been a long tradition on the importance of good traffic data. Prior to the development of the CMS the output of data collection efforts have been used to not only track system operating conditions, but also pavement management, incident response and other applications.

VAX Data Retrieval System. The Northwest Region Office of the Washington State Department of Transportation has developed an integrated data retrieval system that allows users to access traffic information for the major interstate and state highways in K'ng and Snohomish Counties. The VAX Data Retrieval System, or VDR, is basically a data archiving scheme centered on the state VAX minicomputer. Data generated from roadway loop detectors are transmitted back to the VAX minicomputer and stored for use by traffic engineers, transportation planners, or other users. The data is available continuously for 24-hours a day, 7 days a week and stored for up to 13 months. If a user needs data from a point in time longer than 13 months, WSDOT technicians can provide access to this data, which is stored on CD-ROM disks. The data available to users consists of vehicle volumes and lanes occupancies at 5, 15, and 60 minute intervals. Users can download data in ASCII format or Microsoft Excel spreadsheet format. User requirements include a IBM-compatible PC with Microsoft Windows 3. I or greater, and a modem.

North Seattle Advanced Traffic Management System. The North Seattle Advanced Traffic Management System (NSATMS) is an innovative effort to link various city, county state and transit agency traffic data collection systems into a centralized database format which could be easily accessed by traffic engineers and transportation planners. The project, under the direction of the Washington State Department of Transportation, with Parson Brinckerhoff/Farradyne as the lead consultant, has an overall goal to promote agency coordination and cooperation throughout the north Seattle region in order to more efficiently manage traffic. The project will include the purchase of computer hardware for each participating agency as well as special software to provide access to multiple traffic databases. A unique feature of the system will be the ability of traffic engineers to visually observe traffic conditions in real-time, which will help local jurisdictions implement traffic control plans to deal with unusual traffic network load conditions.

The NSATMS will provide an important source of traffic data for multiple purposes. In addition to traffic volumes. the NSTAMS could provide the following types of data:

- level-of-service data (speeds, lane occupancies, etc.)
- ramp metering data
- travel time
- signal timing parameters
- video images and incident information
- variable message sign display
- automatic vehicle identification data
- roadway operational status
- vehicle classification data

The regional CMS will be especially concerned with level-of-service data, travel time, vehicle occupancy and automatic vehicle identification data.

The region is also looking to expand the ATMS concept to the Eastside and southern portions of King County and discussions are underway to expand into Pierce County as well. The NSATMS is expected to be in limited operation later this year.

METRO Transit Signal Priority Project. The METRO Signal Priority Project will incorporate the use of ITS technology to assist in the improvement of the speed and reliability of transit coaches within the King County METRO transit service area. Improvements in the operations of transit vehicles will lead ro increased system reliability, customer satisfaction and potentially an increase in overall transit system ridership. The goal of the demonstration project is to provide METRO buses with "priority" at signalized intersections by altering the timing systems at traffic signals to favor such vehicles.

METRO plans to incorporate the use of automatic vehicle identification (AVI) systems for tracking of buses for signal priority purposes. Some discussions have identified the use of a radio frequency-based system that has been used for identifying railroad cars and containerized cargo. In terms of transit applications. the system would use transmitter tags mounted on the transit coach and signals are received by antennas mounted on the side of the road or overhead.

Data output from the METRO AVI system can easily be transferred to the NSATMS and plans are underway to do such a thing. Once the systems are in place, planners will be able to access transit travel time performance and ridership information that would be applicable for CMS system performance monitoring purposes.

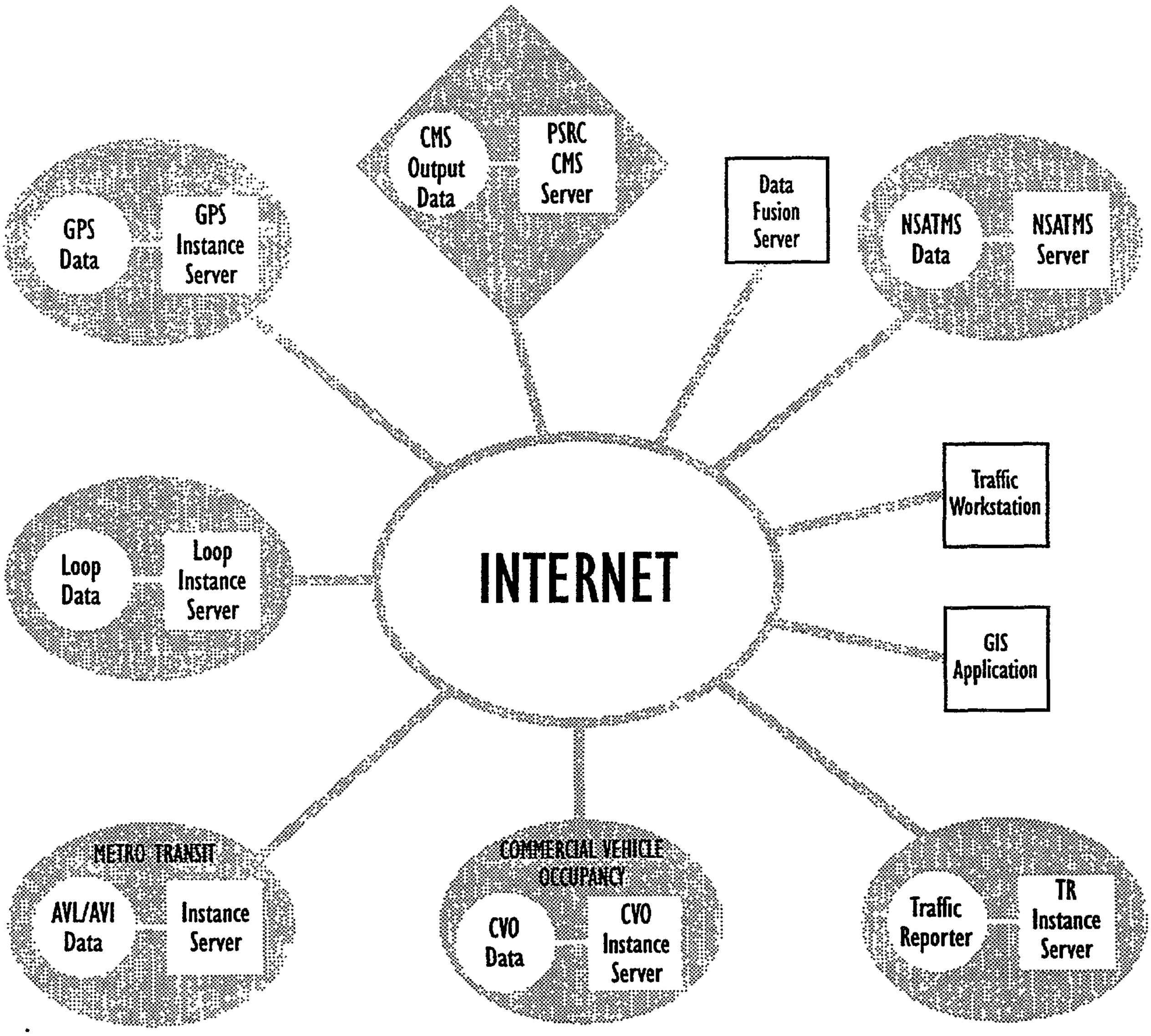
ITS Backbone. One of the unique features of the Puget Sound region's CMS is the application of Intelligent Transportation Systems (ITS) technology in data collection, especially for monitoring multimodal travel time performance. It is no secret that data collection can be time consuming and expensive. Traditional data collection techniques such as vehicle occupancy studies, origin-destination surveys and transit on-board surveys can be cost prohibitive to many areas. Unless the CMS data collection is included as part of an existing data collection effort, it will be difficult for states and region's to justify the expense for a such a system. The CMS for the Puget Sound region is designed to "piggy back" on other data collection efforts currently underway. Since data collected for other applications is now becoming available, with a little bit of effort, it can be relatively inexpensive to capture data for CMS purposes.

One key effort. known as the Intelligent Transportation System (ITS) Backbone Project, is to link the data collection systems through one communication pipeline. This project will provide data collection linkages with local and regional agencies and the state WSDOT. The project, developed in cooperation with the University of Washington, the City of Seattle, and the Washington State Department of Transportation, will provide connections among jurisdictions and agencies through the Internet.

As shown in Figure 5, data produced by an agency can be accessed by any or all members that have access to the Internet. Automobile travel time estimates can be obtained from the WSDOT traffic loop detector system. Transit vehicle travel time could be obtained through a transit agency automatic vehicle

Figure 5

ITS Backbone: Communications Architecture



Source: D. Daily, UW 1995

identification system. Most data for travel modes could, theoretically be collected and distributed through the ITS Backbone. The project will provide an opportunity to link to data collection sites to the regional CMS.

As shown in the Figure. by attaching to the Internet, the Puget Sound Regional Council will have immediate access to the various data collection activities mentioned above. Once the data is collected from the various sources, the server at the Regional Council that is attached to the Internet would house specific information that could be manipulated through various computer program algorithms to produce final CMS travel time reports for CMS reporting purposes. Another benefit of the system would be that other local, state and federal agencies would have access to the PSRC CMS data simply by having access to the Internet or through the PSRC's Bulletin Board System (BBS).

Data such as vehicle counts and speeds could be gathered from a source (e.g., WSDOT loop detectors) and "pulled" into the CMS server located at the PSRC through the ITS Backbone system. The data could then be manipulated through a series of algorithms to develop CMS output needed for CMS reports. In addition. this summarized information could be used by others for non-CMS applications such as transit route planning. freight and goods scheduling or long-range land use and transportation planning purposes.

PSRC Automated Data Collection Project. A large number of Puget Sound Regional Council tasks require the use of traffic data to describe the use and performance of regional roadways. The data is used for a number of applications that support the Regional Council's federal and state metropolitan planning organization and regional transportation planning organization mandates. These efforts include, but are not limited to regional travel demand modeling, ISTEA congestion management system performance monitoring and long-range transportation plan updates. In addition, this type of data is often requested from the Regional Council by its member agencies, academic institutions and private companies. Measurements of the use of central Puget Sound roadways is routinely collected by a variety of agencies, but these data are not readily available to the Regional Council, nor shared between agencies. Much of this information is stored electronically by the agencies that collect the data.

The Regional Council's Automated Data Collection Project is the first step to develop the first linkages to collecting real-time data from an off-site source. The project would provide the base computer hardware and software needed to provide limited linkages to the ITS Backbone, described above. The project would link to one data site such as the North Seattle Advanced Traffic Management System, develop a CMS "home page" for data access by internal and external planners and provide the necessary procedures to implement communication links into the future. The project will seek to create a database that contains stored traffic and transportation data and place them in a single central location where they can be accessed for a wide variety of purposes. The intent of this project is not to collect more data but simply to make the data that are collected readily available to a wider group of users.

Another objective of the project is to create a database system (data collection, storage, and retrieval) that provides the Regional Council planners with easy access to manipulated data via a Geographic Information System (GIS) to better use planning tools for detailed transportation analysis and decision-making. The Regional Council will obtain electronic copies of collected traffic statistics from the state Department of Transportation, transit agencies, and its member city and county governments. The data will be then be reformatted, and geocoded within the Regional Council's geographic information system (GIS). These data will then be made available to the Regional Council staff and member agencies as needed. In addition, the database and GIS platform will be developed in such a way as to easily link to existing and planned data collection sites in order to access "real-time" data.

The project has just begun and Regional Council staff are now beginning the steps to determine what applicable external traffic and transportation data is available from city and county traffic engineers and transit agency staff. After the identification of data sites has been completed, staff will begin the database design stage of the project. This step will address the basic database structure needed to house the traffic data identified above.

Once the database architecture and GIS geocoding structures are in place, the project team will explore the possibility of using different methods to remotely access the Regional Council database. At this stage. the project team will determine if it would be possible to set up a data access mechanism through the Regional Council's bulletin board system or the Internet (see ITS Backbone, above) that will enable a remote user to determine the data available at the Regional Council and then to request or access those data.

Once the database and GIS software design and procedures manual is completed, the project team will physically collect the available data from participating city and county agencies and load the data into the database. The database will then be tested to ensure that data can be successfully retrieved and that new data can be successfully added.

In addition to the database and GIS system hardware and software elements, the project will produce two reports. The first report will be a user's manual for the database system. It will include instructions on obtaining the traffic data, geocoding the data to fit within the existing Regional Council GIS, uploading the data into the GIS. and then using the GIS to obtain output reports of desired traffic statistics.

The second report written will be a final report that summarizes the project as a whole. It will include a description of the database, a review of the capabilities of the system, and a review of how the system will benefit the Regional Council and its member agencies. Finally, the report will list improvements to the system that Regional Council staff believe should be made once additional funding becomes available. The project is expected to be completed in the fall of 1997.

If all goes well during the above project, the Regional Council will seek linkages to other data collection sites. To develop the additional CMS linkages to the ITS Backbone, the PSRC would extend the initial data collection systems concept developed through the Automated Data Collection Project to other data sources. The effort would also support staff in providing enhancements to the overall CMS program, especially the performance monitoring element. Some of the specific activities would include the development of:

- Communication protocols to access data,
- Interlocal agreements to access and use data, and
- System support and training for staff and other activities.

Additional information can be obtained by contacting Nick Roach, Puget Sound Regional Council, at (206) 464-6843, or e-mail, nroach@psrc.wa.com.

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