

### Implementation Schedule

Since the completion of the study, the department has elected to go forward with several of the more significant recommendations. These include

- Restructuring the ATR program on a functional class and geographic area basis;
- Eliminating the PTR program;
- Installing a telemetry system at ATR locations;
- Reducing HPMS annual count requirements, including the introduction of automated vehicle classification equipment to minimize present manual counting; and
- Automating the count factoring process.

An 18-month schedule, which promises implementation by January 1985, has been adopted.

The FHWA has endorsed the implementation of this set of recommendations. The only real exception, which the department has agreed to, is counting HPMS

Interstate sample segments annually instead of on the recommended 3-year count cycle.

### IMPLICATIONS FOR OTHER STATES

This paper will likely have implications for other state transportation and highway departments. Traffic counting is a fundamental program, but unfortunately it can be extremely labor intensive and costly.

Because most state agencies conduct traffic count programs with similar elements (e.g., control counts, HPMS), the recommendations described herein will likely have nationwide applicability and provide opportunities for structuring more productive programs.

### REFERENCE

1. Peat, Marwick, Mitchell and Co. Review of the Department's Traffic Count Program. Pennsylvania Department of Transportation, Harrisburg, June 1983.

# Development of Washington State's Transportation Information and Planning Support System

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### ABSTRACT

In this paper is described the Transportation Information and Planning Support (TRIPS) system currently being developed by the Washington State Department of Transportation. The system is being developed in three major phases: analysis, design, and implementation. The information presented here is based on the work done in the analysis phase and in the early part of the design phase. TRIPS will be a data-based, integrated system that will include transportation information related to the highways in the state system. The major categories of data include physical attributes, counts, and accidents. The TRIPS system will be expandable to allow for future inclusion of additional data categories. Districts, head-quarter's divisions, and other authorized state agencies will have access, via computer terminals, to the information stored in the data base. This will permit authorized personnel to retrieve traffic counts, accident data, roadway data, and other key information directly from the data base. The findings of the analysis phase, the basic functions and features of the trips system, the computer-related technical environment, and a summary benefit-cost analysis are included.

Washington State DOT has an extensive data collection and analysis responsibility for the state highway system, which can be summarized under two major categories:

1. Traffic and travel, which consist primarily of the inventory and analysis of data related to operational characteristics of the total transportation system. These include vehicle-miles traveled,

average daily traffic, vehicle speeds, origin-destination studies, vehicle classification, truck weight studies, and accident analysis. The data are used in project-oriented analyses such as project feasibility, project location, and project design. Private business also makes extensive use of these data through direct inquiries to DOT staff or through publications such as the Annual Traffic Report.

2. Systems data, which consist of data related

to the physical condition and configuration of the various transportation modes. These include state highway inventories, horizontal and vertical alignments, roadway width, pavement type, pavement condition, railroad-highway grade crossing inventories, video logs of state highways, intersection and interchange information, and political jurisdiction boundaries.

The systems-related data are used to define physical and operational standards, determine the need for funding special programs, and facilitate plan development through priority ranking of projects and programs.

Although these activities have been supported by various computer operations, it has been apparent for some time that the computer applications were generally inefficient and in need of revision. Because most of the systems could not communicate among themselves, there was a growing issue of redundant data and inefficient processing (1). The Transportation Data Office (TDO), responsible for maintaining the data, undertook a project to develop an integrated approach to collecting, storing, maintaining, analyzing, and reporting the data. The TRIPS system will be the result of that effort.

The TRIPS system has two major objectives:

1. To put information into the hands of users. This will be accomplished by providing a central, integrated data base for the state highway network. The data base will include roadway attributes and inventory data, road use data, and accident data that are currently stored in separate TDO files. By consolidating the data into an integrated data base, TRIPS will increase the currentness and integrity of the data and will give the TDO the tools to more effectively and efficiently provide user support in the following areas:

- Construction program planning and priority ranking of projects;
- Safety improvement planning, priority ranking, and evaluation;
- Federal and state reporting requirements;
- Highway maintenance planning;
- Pavement management;
- Tort claims; and
- Public and legislative inquiries.

2. To provide a core around which additional files can be built in the future. At present, there are duplicate computer files and related data that are being maintained by other offices within DOT headquarters, such as maintenance, traffic design, priority programming, and the materials lab. In addition several districts maintain duplicate files related to their jurisdictional area. The TRIPS system will provide the department an excellent opportunity to streamline operations and incorporate most of these other files into a common data base.

#### DESCRIPTION OF SYSTEM

The TRIPS system will be a modern record-keeping system for collecting, maintaining, and reporting information about the state's highway network. It will maintain information that is used throughout the department for planning the construction program (including safety improvements), planning the maintenance program, and satisfying federal reporting requirements. TRIPS will be an on-line system that uses advanced data storage technology to provide information directly to people who use it. The system will also give the TDO a sophisticated and efficient tool with which to respond to special information requests (2).

The TRIPS system will be a centralized mainframe computer system that will use existing hardware, systems software, and communications facilities. The initial system will be a core system that includes essential data and processes required to support the department's basic information needs. The TRIPS system will be a beginning, rather than an ultimate, solution around which a more comprehensive roadway management system can be built.

The TRIPS system will integrate essential roadway data into a common, shared data base. This is an important and fundamental aspect of the system because it will help to ensure accurate, timely, and internally consistent data. The existing systems and procedures use a series of independent data files that contain specific subsets of roadway data. The current approach makes it virtually impossible to maintain accurate, timely, and internally consistent information. The TRIPS system data base approach will facilitate performance of current functions and will provide the flexibility to be more responsive to changing needs.

The three major functions that will be performed by the TRIPS system are

1. Maintain road inventory data,
2. Maintain road use data, and
3. Analyze road use data.

The major functions and the kinds of information that will be stored in the system are described in the following paragraphs.

#### Maintain Road Inventory Data

The TRIPS system will process and store information describing the state's road network. This information includes roadway geometrics, the location of various structures, jurisdictional boundaries, various classifications, and off-road features (3).

The geometric data define the physical characteristics that relate to the roadway, such as surface type, pavement width, and horizontal and vertical alignment. This information is based on construction and maintenance contracts or system changes noted during the pavement evaluation surveys that are conducted every 2 years.

The location of structures will be recorded in the TRIPS data base. The types of structures include bridges, railroad crossings, and tunnels. Descriptive information about interchanges, intersections, and tunnels will also be recorded in the data base, and detailed information about bridges and railroad crossings will be maintained on separate files by the Project Development Office (Bridge and Structures Branch) and the Utilities and Transportation Commission.

Several types of jurisdictional boundaries and classifications will be stored. These include functional class, DOT district, county, legislative district, and maintenance division boundaries.

Off-road features that will be maintained include milepost markers, rest areas, truck weigh stations, and permanent traffic counter locations. The TRIPS system will identify the specific roadway location and will store descriptive data about each feature.

#### Maintain Road Use Data

In addition to the information that describes the physical characteristics of the roadway, the TRIPS system will process and store information related to its use. This information includes traffic volumes, accidents, truck weight studies, and traffic speed studies.

The amount of traffic that uses the road as a function of time is critical information that is needed to perform traffic analysis, accident analysis, and transportation planning functions. This information is needed at various levels of detail depending on the analysis being performed. In some cases a total count for the year may be appropriate and in other cases counts by vehicle classification using a specific section of road in 15-min increments may be required. The TRIPS system will store "raw" traffic counts at the level taken and will provide the necessary processing to accumulate traffic counts as defined by the user for a specific application or study.

The TRIPS system will record the location of and the details about all accidents that occur on the state system.

#### Analyze Road Use Data

The TRIPS system will include computer processes that will help the department analysts evaluate the activity on the road network. For example, the system will calculate traffic volumes throughout the road network based on actual traffic counts at specific locations and will have the capability to perform high-accident-location analysis.

The system will be designed to automate several standard reports--Annual Traffic Report, Annual Accident Report, Trends Reports, and so forth. It will also have the capability of preparing various ad hoc analytical reports.

The TRIPS system will provide a tool for TDO and other department analysts to use when responding to special requests from various external users. These requests include turning movements, hazardous location identification, accident location analysis, and tort claim data.

A key concept that will be incorporated in the design of the TRIPS system is a new method for referencing roadway locations. The new technique is based on state route milepost (SRMP) and on the dates of each roadway event. This technique replaces the current control section milepost method and will be more understandable to people throughout the department. Control section definitions will be retained in the TRIPS system data base as an attribute of the roadway; however, they will not be used for location referencing. The new method will provide for maintaining current actual and historical SRMPs, reconstructing the network as of any specific time, and automatically correlating data about the roadway system (currently a tedious manual process).

#### DEVELOPMENT APPROACH

The TRIPS system is being implemented using a phased approach. The first phase of work, the analysis phase, was conducted by Arthur Andersen & Co. and DeLeuw Cather & Co. The project was completed in May 1984.

The design and installation of the TRIPS system will be completed by dividing the system into its three major components:

- Road inventory,
- Traffic, and
- Accidents.

A project team consisting of DOT staff and Arthur Andersen & Co. and DeLeuw Cather & Co. staff is currently developing the design for the road inventory subsystem. The installation of the road inventory system and the design and installation of the traffic

and accident subsystems will follow the current phase.

#### TECHNICAL ENVIRONMENT

The TRIPS system will be developed and operated on Washington State DOT's computer facilities. The software environment will be CICS, COBOL, ADABAS, and NATURAL and will include the use of the Data Manager data dictionary. The hardware environment will include the IBM 3081 computer, IBM 3350/3380 disks, IBM 5280 terminals, IBM printers, and IBM personal computers (PCs).

The TRIPS system will be a centralized mainframe computer application. The system will maintain and analyze data pertaining to the entire roadway network. The data will need to be kept in a central location to satisfy state route network reporting and analysis requirements. A mainframe computer will be required to provide the processing capability to prepare key reports such as traffic and accident reports. Also, a centralized system will provide improved control over the accuracy and timeliness of the data.

The hardware and software specified meet DOT standards. The organization is in place to provide technical development, operations, and maintenance support.

ADABAS is appropriate as the data base management system for the TRIPS system because

- Relatively low transaction volumes characterize the processes and
- Inverted list structure supports the system's requirement to provide many alternate access paths to the data, such as by district, by county, by control section, or by physical milepost marker.

#### BENEFIT-COST ANALYSIS

This section contains a summary of the benefits and costs associated with completing the TRIPS system. Ongoing operational benefits (tangible and intangible) and one-time development costs are considered in the analysis.

#### Net Operating Costs and Savings (ongoing)

Ongoing system cost reductions will result from replacing the existing systems and procedures with the TRIPS system. The cost savings will be achieved by eliminating redundant data and activities and automating time-consuming and tedious manual tasks. This will occur as a result of providing users with direct access to data and with advanced analysis tools. The net cost savings are estimated to exceed \$3 million during the first 7 years.

#### Intangible Considerations (ongoing)

In addition to costs and savings that can be reasonably quantified, there are many benefits that are difficult to quantify. The intangible benefits of the TRIPS system may be summarized as

- The TRIPS system will improve information quality to provide better responsiveness to the legislature's needs, better responsiveness to the Transportation Commission, and better support for tort cases.
- The system will increase support for planning and managing the state highway network through accurate, current information.

- The system will increase support for planning and managing the state roadways by providing the people in the Highways Division, Planning Division, and districts with direct access to the data.
- The system will provide Washington State DOT with a leading-edge system to efficiently service special information requests.
- TRIPS will provide the ability to increase responsiveness to user requests.
- The system will be responsive to changing user requirements.

#### SUMMARY

A primary objective of the TRIPS system is to provide a central, integrated data base of information about the state's highway network that is shared throughout the department. In attaining this objective, the system will provide a unique opportunity to significantly streamline departmental operations, particularly in the Transportation Data Office. It may be noted that the system will not change the basic functions being performed; however, it will change how the functions are performed.

The system will provide direct access to shared roadway data, via computer terminals, to the districts and other highway and planning divisions. This will enable departmental personnel to retrieve traffic counts, accident data, roadway data, and other key information directly (i.e., without going through the Transportation Data Office).

The department has other systems that process information from current TDO files, primarily the Road Log, Road Life, and Accident files. Interfaces will be built between the TRIPS system and these other processes. Each interface will be examined individually during the system design phase and decisions will be made about how best to satisfy the interface requirement--either the new system will continue to provide a file in the same format as the current file or the target system will be modified to use data in their new format. The selected approach will be based on cost and the availability of target system maintenance personnel.

The successful transition from current operations to the new environment will, in part, depend on thorough training of TDO and other user personnel. Specific training requirements will be defined in the system design phase, and a training plan will be developed and executed during the system implementation phase. Project team members will develop training materials, schedule training sessions, and con-

duct the training. The user procedure manuals that are developed during the system implementation phase will be used as primary training materials.

Finally, the analysis indicates that the system is cost-effective and will pay for itself in 5 to 7 years. It is apparent that Washington State will end up with a leading-edge system that will efficiently process DOT's information needs.

#### ACKNOWLEDGMENTS

It is apparent that the development of a system like this is a major undertaking involving consultants, TDO staff, and representatives from throughout headquarters and district offices. Without naming specific players, who by the way would be too numerous to list in this limited space, the author would like to thank all TDO staff members for their involvement to date and the enthusiasm with which they are participating in this project.

Special thanks go to Robert S. Nielsen, Assistant Secretary for Planning, Research and Public Transportation, who envisioned the project soon after joining the department. It is only through his persistent efforts that the project has reached this stage--on its way to becoming a reality. Nielsen has since left the department and is presently Executive Director, California Transportation Commission. Thanks are also due to Yvette Powell, Project Manager for Arthur Andersen & Company, for editing this paper to assure technical accuracy. It may be noted that the paper is primarily based on the work done for the department by Arthur Andersen consultants. Finally, thanks are due to the Executive Data Processing Review Committee, chaired by V.W. Korf, Deputy Secretary, for approval to go ahead with the TRIPS system in spite of extremely competitive budgetary pressures for other programs. The author is convinced that they will not be disappointed with the final results.

#### REFERENCES

1. Manus Services. Information Systems Plan for Planning, Research and Public Transportation Division, Washington State DOT, 1983.
2. Arthur Andersen & Co. DOT's TRIPS System, Management Summary Report. Washington State DOT, May 1984.
3. Planning Annex ADP System Study. Public Transportation and Planning Division, Washington State DOT, June 1, 1980.