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Transportation Data Center

DEVELOPMENT OF A TRANSPORTATION DATA CENTER

by

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16. ABSTRACT

As a result of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and various state laws and regulations, the data needs of the Washington State Department of Transportation (WSDOT) are changing to reflect the increase in intermodal policy and planning work required by the WSDOT. This report describes alternative approaches to obtaining and internally managing the data needed to meet these requirements. Specifically, it explores the utility, functionality, and organizational structure of a transportation data center within the Department.

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The Intermodal Surface Transportation Act of 1991 (ISTEA) brought a new perspective to the work of state departments of transportation. It increased emphasis on integrating the planning for and operation of intermodal facilities to enhance the movement of goods and people. Its intent is to provide the most cost effective and reliable transportation system capable of meeting the needs of each state. This shift in emphasis also requires data to be collected and integrated to perform intermodal analyses.

Currently, the primary data collection emphasis of the Washington State Department of Transportation (WSDOT) is highway-related information. Although data are collected on the state's ferry system, according to state statutes, the ferry routes are considered links in the state highway system. While various service centers and divisions within the Department collect data on non-highway subjects (statewide transit information, general aviation use, and others), for the most part, these estimates are summary statistics collected by operating authorities or jurisdictions that these jurisdictions submit to WSDOT for review. Despite these other data sources, it is apparent that many of the data needed for ISTEA functions are currently not collected by or submitted to WSDOT.

WSDOT's Transportation Data Office (TDO) has been charged with improving the Department's access to the data necessary for statewide intermodal and policy planning analyses that WSDOT will conduct. This report describes alternative approaches to obtaining the data needed, as well as several alternative structures for providing WSDOT and other public agency staff access to this information.

DATA NEEDS

Essentially, the new ISTEA regulations encourage state DOT's to improve passenger and freight mobility by involving themselves in all modes of transportation.

This new philosophy allows the Department to look at ALL aspects of ALL modes of transportation. While this idea makes perfect sense from a transportation management standpoint, it will create significant difficulty in the collection, storage, analysis, and reporting of information. Essentially, this creates an infinite need for data to answer an infinite number of potential questions.

For example, the Department might be faced with the abandonment of a small rail line. The Department would want to examine the costs of allowing the freight currently moved on that line to move by truck (i.e., the increased pavement deterioration caused by those trucks) and compare them to the cost of the subsidy needed to keep the rail line. Once the decision has been made to subsidize the rail line, the Department might want to track the expenses of the rail road operating that line to ensure that the funding subsidy was being appropriately utilized. Thus, the Department could end up needing access to detailed operating information from the private rail service providers.

While this is an extreme example, it illustrates the degree of difficulty associated with determining the "data needs" of the Department. The reality is that these needs will change according to the analyses that are important at any given time. That is, as policy issues arise, information will be needed to describe the impacts of specific policy decisions, as well as the potential impacts of alternative policies.

Given the breadth of potential information needs, the "data needs" of the Department are best summarized in broad terms, rather than as detailed variables. At the very least, the Department (or the state) must be able to monitor the rudiments of each of the basic transportation modes for both freight and passenger travel. These modes include:

- highways (including cars, buses, and trucks)
- rail roads
- air travel
- waterborne travel

- non-motorized transport.

The importance of these modes varies with the degree of interest the state has in each mode, and this degree of interest is expected to change over time. Highway travel (cars, buses, and trucks) will always be of significant interest to the state because a large portion of the state budget is spent on roadway construction, repair, and operation. The remaining modes will grow in importance as state government interest in them grows, both because they can be used in place of increased highway expenditures and because high quality transportation facilities can improve the economic well being of the state.

Summary of State Data Needs

The state should have access to basic information that describes the status of each mode of transportation. At a minimum, this means the ability to describe basic attributes of those modes. The Transportation Research Board divides these basic attributes into four categories:

- supply
- demand
- performance
- impacts.

The first two of these categories are most important for general, state-level, policy decision making. The third and fourth categories are most important to the providers (operators) of each mode of travel, although data in these categories may also be useful at the state level.

Supply

Transportation supply describes the availability of transportation services. It is particularly useful at the state level in that it describes the alternative methods by which freight and passenger movement can take place; the amount of that movement that is possible; the firms, agencies, and groups that provide that movement; and the availability of transportation services to various groups or users.

Variables that describe the supply of transportation modes include such items as the following:

- an inventory of the physical transportation system (miles of road, number and type of planes)
- the physical condition of those facilities (pavement serviceability rating, age of facilities, maintenance expenditures per unit of system)
- the capacity available via that mode of transportation (tons or car loads per unit of time, passengers per hour)
- the cost or fee structure for using the system
- the suppliers or providers of those transportation services.

Demand

Demand describes the actual use of the transportation supply. It describes the type and extent of services being used and, to a certain degree, illustrates the acceptability of the existing service to travelers. When used in conjunction with information on the available supply of transportation, demand variables also describe the ability of a transportation mode to carry additional traffic (freight or passenger) and to adapt to growing or changing needs for service. When tracked over time, demand variables also illustrate trends occurring in transportation and provide insight into future needs for transportation services.

Demand variables that are particularly useful at the state level for each mode of travel include the following:

- activity levels (traffic counts, arrivals/departures, tonnage)
- flows (origins/destinations, number of transfers, intermodal connections)
- user characteristics: (passenger demographics; freight characteristics such as bulk, density, shipment sizes, containerization, hazardous material content).

Performance

Performance information is most important to the operator of the transportation service. However, it can also be used to compare alternative services, either within the same mode or between modes. In this manner, it can be quite useful for answering specific policy questions at the state level.

Performance information describes how effectively and efficiently a transportation service is operating. It highlights the service areas that need improvement. It can also often provide both qualitative and quantitative descriptors of transportation service that illustrate how well specific goals or objectives are being met.

Performance variables tend to fall within the following categories:

- service delivery (level of service such as frequency of service or travel time between specific points, efficiency measures such as load factors, and quality measures such as on-time performance)
- safety and personal security (number and severity of accidents, accident rates by category)
- access and delivery (market share, the percentage of the market to which the service is available)
- cost to provide the service (per unit and per trip).

Impacts

The final category of basic information includes measurements of the impacts each transportation mode has on the state. These impacts can be physical, economic, and strategic. Many of these impacts are difficult to quantify, but the anticipated impacts of changes to the transportation system are often of primary importance to state level decision makers.

The types of variables used to measure and/or report the impacts of transportation systems include the following:

- environmental quality and land use (tons of air pollutant emissions by vehicles; effects of transportation systems on wetlands and other water sources; the size, extent, and cost of hazardous material spills)
- energy use (type of energy source; energy use per mile of travel, per passenger, or per ton of specific commodity)
- economic activity (tourism receipts, distribution costs in relation to retail prices)
- national security (condition and capacity of commercial transport facilities and special military needs).

ISTEA Management Systems

The ISTEA legislation requires WSDOT to construct, maintain, and utilize six management systems. Each management system is intended to cover a minimum of all the facilities that receive federal aid in the state (some cover more than federal aid facilities). These six systems include

- pavement management
- bridge management
- highway safety management
- traffic congestion management
- public transportation facilities and equipment management
- intermodal transportation facilities and systems management.

The federal rules and regulations for the management systems, interpreted in their broadest context, could require extensive and expensive data collection and analysis systems. WSDOT, and most other state departments of transportation, have taken a much narrower approach to the implementation of the management systems.

WSDOT's approach has been to use existing systems (including data collection, analysis, reporting, and decision making) to meet the federal requirements wherever possible. This has included formalizing several data collection, analysis, and decision-

making procedures that have been informally undertaken for several years. It has also included the creation of a formal submittal and (in some cases) review process so that WSDOT can obtain management system information from cities and counties, transit agencies, and other transportation system operators that are included in the management system structure.

The organizational result, from a data collection standpoint, has been that each of the six management systems has been assigned to a specific "group" or "office" within the Department. (For example, the pavement management system is the responsibility of the Materials Lab.) That group is responsible for formalizing its management system and deciding on the following:

- the data that WSDOT will collect and the data that other agencies will collect
- the data that will be stored within a database at WSDOT and the data (or results) that a transportation system operator will only submit as part of a written report or compliance letter to WSDOT
- the analyses that WSDOT staff will perform (or direction)
- how the management system will fit within the WSDOT programming and prioritization procedures
- the output of the management system (both for state-run facilities and for all facilities in the state).

The result of this process is that WSDOT's management systems are being developed at minimum cost, under the guidance of the WSDOT staff and offices most interested in using the management systems for the purposes intended by ISTEA. Thus, better attention is being paid to the data collected, and strong feedback is being provided when the data collection process is not providing reliable data, not providing sufficient data, or requiring too many resources for the benefit derived from the data collection effort.

In almost all cases, the management systems that are initially implemented will not contain all of the data that users would like to have collected. This is particularly true for the portions of the system that are off of the state highway system. However, system users do not have the funding available to collect additional data. As a result, the systems are designed by their users to collect the data deemed most important (and/or least costly) with the funds that are available. If better use for the available data collection funds are identified, the WSDOT office in charge of that system is able to change the system's design.

This solution for the design, control, and operation of the ISTEA management systems also allows WSDOT to avoid one of the bigger problems associated with centralized data collection and analysis. That is, when the data collection effort is given to a single organization, the cost (staffing and dollars) of the data collection effort is often separated from both the data users and the funding source. Over time, this separation often leads to a loss of funding and/or support for the data collection activity and a lack of responsiveness in the data collection activity to changing data needs. By concentrating the responsibility for the management systems (including data collection) in the WSDOT groups most likely to use that information, WSDOT has helped ensure that these systems will be managed to the benefit of the Department. These systems are also likely to evolve in a manner that reflects their utility and benefit within the Department.

The only major concern related to this approach to the ISTEA management systems is that because the systems are often operated wholly within one group in WSDOT, the data collected for the ISTEA system may not be readily available to other groups in the Department. Lack of availability can be caused both by the fact that others in the Department do not know the data exist and by placement of the data on a computer or in a database structure that does not lend itself to use by others in the Department. Both of these concerns can be easily overcome if care is taken in the design and operation

of the management systems. The proposed TDC may also assist in overcoming these concerns.

Other WSDOT Data Collection/Reporting Systems

WSDOT already operates and maintains a fairly large number of data collection, storage, and retrieval systems. Among the more important central databases in the Department are the following:

- the traffic and roadway information system (TRIPS)
- the capitol planning information system (CPMS)
- ferry system passenger ridership statistics
- the state accident reporting system (CARS).

In addition to these systems, WSDOT also maintains a variety of other databases, including systems that contain WSDOT portions of the ISTEA management systems mentioned above, various revenue and expenditure reporting systems, databases that result from the operation of traffic control systems, and project databases containing data collected to meet specific, one-time and/or routine uses. One example of a traffic control system database that is a resource for many WSDOT uses is the freeway operations data stored at Traffic Systems Management Center (TSMC) in the Northwest Region (NW Region). The freeway Surveillance Control and Driver Information system in the NW Region controls the ramp metering system and also stores large quantities of urban freeway data for use in operational analyses related to that freeway system.

The primary difference between "corporate" databases, such as TRIPS, and "operational" databases, such as the TSMC's, is the ease with which other WSDOT staff can determine which data are available and then access those data. "Corporate" databases like TRIPS are specifically designed to ensure easy access by all interested WSDOT staff. "Operational" databases like that at the TSMC are primarily designed for access by the operating staff who routinely use the system, and access to those data by other WSDOT

staff is normally treated as a secondary function, often requiring the assistance of staff from the operations center that collects the data.

"Corporate" databases are thus more useful to the majority of WSDOT staff, since the data in those systems are more accessible. "Operational" databases are also intended to provide "corporate" data, but data collection, storage, and retrieval is usually a secondary function for these systems. The result is that when budget limitations occur in the development of these systems, accessibility to the database is often sacrificed to concentrate limited resources on the control and operations aspects of the system. Database access tends to be costly, both because of the need for additional software programming and because of the need for extensive communications. Furthermore, providing access to persons outside of the operations center requires that training be provided in accessing and requesting data from the system and that staff support be allocated to helping outside users access the data.

The result of these limitations is that the Department collects many data that are not readily accessible to persons outside of the unit collecting the data. In reality, many of these systems are used only occasionally by WSDOT staff outside of the unit collecting the data, but those uses might increase substantially if the availability of the data were more widely known and if the data were more readily accessible.

The Federal Bureau of Transportation Statistics

The federal government has struggled with data collection and data access needs that are similar to the state's needs. However, the federal government has one advantage over the state in that it does not actually operate highway and transit facilities. The federal government's data needs relate primarily to answering policy questions, rather than operating facilities. Consequently, many of the federal government's new data collection requests are aimed at obtaining data that will improve management and policy decisions. The federal government has also realized that many (but not all) of the data it requires exist but are not collected in a consistent or comparable manner across the U.S.

In the past, this inconsistency has led to inaccurate comparisons of conditions in different states, which in turn has led to inappropriate policy decisions.

The federal solution to these problems, as well as to the general limitations in the quality and availability of multi-modal data, was the creation of the federal Bureau of Transportation Statistics (BTS). The BTS is intended to provide a focal point for the collection and integration of system-wide transportation data. It also acts as the key link among the operating administrations within the USDOT, other federal agencies and levels of government, and the private sector in the provision of these data. The primary role of the BTS is to conduct general purpose data activities to support the broad policy needs of the federal government. A secondary role is to provide support to other offices in the USDOT.

When the federal government considered options for improving the availability of information on all modes transportation in the U.S., it realized that collecting data costs state agencies money, and that the states do not have the resources needed to support large, new data collection efforts. Therefore, the federal approach has been to use existing data collection procedures whenever possible, to standardize those procedures so that they will be comparable from state to state, and to adjust requirements slightly, where necessary, so that the data collected will be usable for multiple purposes.

The BTS's role is to collect and organize the transportation data already submitted to the federal operating agencies to make the data more usable, and to identify areas in which existing data sources do not meet federal needs. The BTS then works to meet those needs, both by collecting a limited number of new data and by encouraging and promoting changes in the data collection of various federal operating agencies.

As an "independent" data collection group, the BTS is in a more objective position to judge the comparability of data from diverse sources and to recommend solutions for collecting new data to fill missing information gaps. However, implementation of those recommendations will have to be paid for either with limited

BTS funds or by convincing the various federal modal administrations that these changes are beneficial and worthwhile.

It is not clear how the BTS will organize data for use by the federal government. The initial products of the BTS are a paper report, Transportation Statistics, Annual Report 1994, and a CD-ROM containing data collected by several of the federal operating administrations. Transportation Statistics provides a national overview of transportation in the U.S. It is useful from a policy standpoint, but is not intended for research purposes. Conversely, the CD-ROM, while limited in the data it contains, is a good first step towards providing information to the research and analytical communities in a format that is more readily applicable to their research endeavors.

In general, the creation of a separate transportation statistics organization such as the BTS demonstrates two specific advantages. The first advantage is better access to transportation data. This occurs because the BTS emphasizes making the data that are collected readily available to users (for example, placing the data on CD-ROM so that they can be easily reproduced and shipped to users in a usable form). The BTS also makes sure potential users know about available data by advertising the existence of specific data products. These activities occur because the BTS's focus is on data availability, rather than on some operational or analytical task that uses data.

The second advantage of the BTS-type structure is that there is a specific advocate for improved data collection and reporting. Advocacy for data collection is often overshadowed within operating administrations by the need for funding to fix operational problems. With the BTS structure, data collection and dissemination are the basis for the organization and, thus, information needs are strongly voiced to the legislative oversight group. While a separate organizational structure may not be necessary within the state government to accomplish this task, the state TDC should be designed to provide these same advantages.

Summary

Many of WSDOT's data needs are already met as cost efficiently as possible. Specific groups that need data within the Department arrange to collect, store, and use those data. The areas in which the current system fails are the need to share data and the need for the Department to collect information that has not been required in the past.

The TDC must resolve these data needs by

- making existing data more accessible (making users aware of available data and helping users obtain those data)
- helping the Department meet new data collection needs as they become apparent.

FUNCTION OF THE DATA CENTER

Four basic functions could be incorporated into a transportation data center. These four basic functions are

- storage and retrieval of data (i.e., a database function)
- collection of data
- assistance in identifying and accessing data (a library function)
- analysis and/or reporting of data.

While a complete data center would contain all of these functions, a data center could operate effectively without all of these functions. Each function can be incorporated to a greater or lesser degree, depending on the needs of the Department. Each of these functional areas is described below.

Storage and Retrieval of Data

The initial image many people have of a "transportation data center" is a place that stores and retrieves many types of data. This function is essentially an expansion of one of the roles of WSDOT's Transportation Data Office (TDO). In this role, the TDC would obtain data provided by WSDOT personnel and store it in some manner for later use. The actual collection of data from the field is not part of this function. Collection of

data from the field (or from non-WSDOT sources) would still be the responsibility of other groups within WSDOT. These groups would be responsible for transmitting copies of data they collected to the TDC.

The storage mechanism for the TDC is intended to be electronic, but some data provided to the TDC might be in paper form (for example, original survey responses that were not coded electronically). The TDC would be responsible for developing the appropriate data storage mechanisms for all data submitted, as well as for developing a mechanism for retrieving this information. Finally, the TDC would need to develop and maintain some type of "catalog" so that both TDC staff and potential WSDOT users would be able to determine the information available through the TDC.

One advantage of performing this data storage function is that the TDC would provide a single, central location for many of the data needed within WSDOT. It would give WSDOT (and other state) staff a single access point for much of the data they required. This would help staff determine which data were already available within the Department and would reduce their effort to obtain information. This function is currently illustrated by the TRIPS and PMS databases.

If used properly, the existence of a central data repository would reduce the collection of duplicate data sets and thus reduce total data collection expenditures. The size of these savings is impossible to estimate, given a lack of information about the current duplication of data collection activities. (Money would be saved if data collection is now extensively duplicated or if the availability of data allowed more cost effective WSDOT design work. The creation of the TDC would increase data collection expenses if the operational costs of the center, plus the administrative costs associated with persuading others to submit data to the TDC, exceeded the benefits gained by having data in a central location.)

The primary disadvantage to a central repository would be, in fact, the administrative cost of WSDOT staff neglecting other job functions to provide data to the

center. The data center would only function effectively in the data storage and retrieval role if data were available to store. Data would only be available if either the data center collected the data (see the next subsection), or if data collected by other WSDOT staff were submitted to the center for distribution throughout the Department.

Unfortunately, many of the data collection tasks currently undertaken within the Department are performed to achieve specific goals. The data are collected, manipulated, stored, and summarized to meet these goals. The data are often not retained after they have been used, nor are they necessarily maintained in a format that may be easily used by other WSDOT staff. Time and resources would be needed to transfer these data to the TDC, along with a description of those data, how they were collected, and their format, should other WSDOT staff wish to use them. This means that WSDOT staff would have to take time from other job functions to "package" their data and transmit that package to the TDC.

"Packaging" of the data is important because the TDC staff would not be aware of the extent and limitations of the data without assistance from the staff that collected (or ordered the collection of) those data. The TDC staff would have to reformat the submitted data into a form that was readily usable by others in the Department, but to do this, they would have to have a clear understanding of the data, and this understanding would have to be provided by those originally responsible for the data's collection.

Because data are normally summarized after they have been collected (to meet some specific analysis need), both the "raw" and "summarized" data should be transmitted to the TDC. It is also important that the data "package" sent to the TDC contain a brief description of <u>how</u> the data were summarized.

Transmission of both "raw" and "summarized" data to the TDC should allow greater use of the available data. This is because the same "raw" data might be summarized several ways to achieve different objectives. At the same time, some WSDOT staff might wish to see only the original summary information and would save

time and resources by not having to create a duplicate summary. The description of *how* the data were summarized would also help the TDC conform to the USDOT philosophy of "truth-in-data," and would allow the data users to understand the origins and limitations of available information.

The key factors in a decision regarding whether to use the TDC to store and retrieve data collected throughout the Department are the cost of transmitting the data to the TDC versus the number of times those data would be used by other groups. If more than one WSDOT group would use the data submitted to the TDC, WSDOT would save money by creating the TDC. If the data stored in the TDC would not be *routinely* used by multiple groups, the cost of the TDC, combined with the extra work required to transmit the data from their collection point to the TDC, would result in a net increase in data collection costs to the Department.

Collection of Data

A second function the TDC could undertake is the collection of data for use by WSDOT. This effort would be most beneficial to WSDOT if it were performed in conjunction with the storage and retrieval function. This set of capabilities is essentially the role the Transportation Data Office (TDO) currently plays with respect to traffic volume, vehicle classification, truck weight, accident statistics, and pavement performance information. (That is, the TDO is responsible for collecting this information, storing it electronically, and providing access to it through computer databases.)

The TDC might have only limited data collection responsibilities. For example, the TDC might be charged only with collecting data that were not currently being collected by other WSDOT groups. The data to be collected by the TDC under this option would be determined by a steering committee comprising upper management personnel from within the Department (see Proposed Management Structure). This same committee would be responsible for obtaining a budget to perform that data collection.

Another option would be to make the TDC responsible for collecting data from other state transportation providers. For example, the TDC might be placed in charge of obtaining port activity information from the various public ports in the state. This process could extend to obtaining data collected by cities and counties that must be reported as part of the ISTEA mandated management systems.

The most extreme option would be for the TDC to perform all data collection for the Department. Under this option, the TDC would simply be a major extension of the TDO, with all data collection activity routed through the TDO.

In reality, collecting all WSDOT data would not be cost efficient. Many data collection activities need to be locally controlled and staffed (as opposed to centrally controlled and staffed) to make efficient use of data collection staff, to tie the data collection activity to the needs of the users, and to continually reinforce management's comparison of the cost of data collection with the need for those data.

Currently, data collection activities for different subject areas are spread throughout the Department. Even with traffic counting, Regional personnel (particularly in the NW Region) collect some of the data, while the remainder are collected under the direction of the TDO. Most data collection efforts are carried out by the individual WSDOT group that needs the data.

Still, some data collection needs might be best handled by a central TDC. These include the collection of summary statistics for non-highway transportation modes to describe the status of the state's transportation system. TDC collection of these data makes sense, as the need for this information tends to be policy oriented rather than operations oriented, and thus its collection often does not fall clearly within the scope of any one WSDOT group. (Data on WSDOT operated facilities should be collected by the WSDOT groups responsible for the operation of those facilities.)

Even this proposed data collection activity may not be appropriate for all forms of data collected outside of the Department. For example, the Transit Office may wish to

remain the primary contact and data recipient for information submitted by the state's transit authorities as part of the transit facilities and equipment management system. Where data from outside of WSDOT's operational programs are currently collected and used by an existing WSDOT group, that data collection should continue in the current manner, unless money will be saved by moving that function to the TDC.

Flexibility in data collection should be an important aspect of the TDC. That is, the TDC should have the charter to collect all types of information, but the data it actually collects should be limited to the items most cost effectively (over both the short and long terms) collected by a single, centrally located group. The structure of the TDC should be designed so that specific decisions must be made, and periodically reviewed, to direct the TDC to collect data. The budget for the TDC should be set to reflect this assignment of duties.

Assistance in Identifying and Accessing Data

The third potential function for the TDC would be to help WSDOT staff locate data. Users of transportation data would go to the TDC for assistance in obtaining transportation statistics and information. The TDC would act as a clearinghouse for transportation data collected within WSDOT, but it would not necessarily obtain or store that information. Obtaining and storing data would remain the functions of the WSDOT groups that needed data not already collected by some other WSDOT group.

In the role proposed here, the TDC would actively monitor the data collection activities of the transportation providers in the state, including the Regions and Service Centers within WSDOT. The TDC would maintain descriptions of available data (type, location, geographic coverage, cost to obtain, age) so that other WSDOT personnel (or outside users) interested in specific data areas could easily determine which data were already being collected, whether those data could be used to meet specific needs, and how those data could be obtained.

To perform this task efficiently would require that groups collecting data within WSDOT inform the TDC about the data collection activities they were performing, and that the TDC maintain close contact with non-WSDOT transportation service providers. The TDC would have to aggressively maintain contacts with other state and local agencies and private sellers of transportation data. Improving and maintaining these relationships would allow WSDOT to determine what information was available on transportation modes and facilities operated by others. WSDOT management would be able to decide which of these external sources of data should be obtained for WSDOT use, and whether the information gained from these sources would outweigh the cost of those data.

The advantages of this approach to the TDC is that it would not require data storage or retrieval systems (unless that function were also given to the TDC). It would require relatively little staff and would not require the manipulation and storage of data that might not be used by other WSDOT staff. The disadvantage of this approach is that without a central location for storing data, data collected for one purpose might not be maintained long enough, or in the appropriate format, for others to make use of it.

For example, Group A within the Department collects vehicle occupancy data. At the end of the project, the vehicle occupancy data are placed in a file cabinet. The TDC keeps track of the fact that Group A had collected vehicle occupancy data. Six months later, when Group B asks the TDC about the availability of vehicle occupancy data, the TDC refers the Group B staff to Group A. However, during those six months, the staff person in charge of the old vehicle occupancy project was promoted and left Group A. No staff are left who know where the data are located, understand the details of the data collection effort, or can answer whether the data collected six months ago meet the needs of Group B.

Analysis and/or Reporting of Data

The fourth alternative function for the TDC is to be an analysis and/or report production center. As part of this role, the TDC would be charged with producing specific reports and/or designated analytical tasks that described the state's current transportation systems. To fulfill these roles, the TDC would collect, store, and manipulate data from a variety of sources, but the guiding principal behind the collection and storage of those data would be the analytical/reporting function assigned to the TDC, rather than transferring data to other staff within WSDOT.

The USDOT's Bureau of Transportation Statistics is an example of this analytical/report production role when it produces its annual volume of transportation statistics that describe the current state of the nation's transportation systems. This report could be used as a model for work to be performed by a WSDOT-based transportation data center. The annual federal report draws information from a variety of existing data sources and concentrates it in one easily referenced document. A similar report written for the state of Washington would be a logical product for the TDC.

The federal report [1] summarizes the state of nation's transportation system and the consequences of the nation's selection of specific transportation modes and facilities for moving people and goods. The federal report describes (among other items):

- the economic impact of transportation (dollars expended, percentage of income spent on transportation, number of persons employed)
- the amount of travel that takes place (vehicle miles traveled, person miles traveled, ton miles traveled)
- inventories of the various types of facilities (miles of highway, miles of railroad track, number of airports, number of ports)
- the relative size of the different modes of travel (number of vehicles, aircraft, ships)
- trends in travel by mode and person/commodity (including market share)

- measures of system performance (travel speeds, system reliability, service area, on-time performance)
- transportation costs (cost of ownership, passenger expenditures (average fares), freight expenditures)
- safety (number and rate of accidents, number and rate of fatalities, severity of crashes)
- energy and environmental impacts (fuel use, use of alternative fuels, air quality, pollutant emissions, pollution control expenditures).

This information helps decision makers and other interested groups understand transportation's role in the economy, its role in people's daily lives, and why transportation mobility is so highly valued.

Because this information covers such a variety of topic areas, the availability of statistics in each of these categories for a WSDOT report would be a function of survey and data collection activities outside of WSDOT. As a result, WSDOT might not be able to collect or update many of these data annually or even biennially. In addition, much of the data collection performed by individual agencies or firms that might supply data for such a report is not meant to produce state-specific statistics. Instead, the data are collected to meet the needs of the sponsoring agency or group. These estimates could be manipulated to estimate state specific values, but they would have to be used with caution because of the effects of biases inherent in the data collection methodologies used.

STAFFING ALTERNATIVES

Both the number of TDC staff and their training would vary as a result of the functions assigned to the center. As more data collection was needed, more staff would be needed. At the same time, the more automated the data storage and retrieval process for the TDC was, the greater would be the computer skills required of the staff. On the other hand, if the primary function of the TDC was to help WSDOT locate and retrieve

data from other sources (rather than collect data), then librarian skills would be more important than computer programming or data collection knowledge.

It would be possible to meet these needs with either WSDOT or contract staff. Potential staffing alternatives for the TDC include the following.

- The TDC could be operated by WSDOT personnel from either within the planning section or within the TDO.
- The TDC could be operated under contract to a private, outside contractor.
- The TDC could be operated by a single WSDOT employee, with additional assistance from outside contractors.
- The TDC could be operated by the Washington State Transportation Center (TRAC) at either the University of Washington or Washington State University as part of an ongoing research effort.
- The WSDOT could choose not to create a TDC.

The first four options are discussed briefly below.

Transportation Data Center Operation By WSDOT Employees

From an operational standpoint, this is the best of the TDC staffing options. It would place the control and operation of the TDC firmly within WSDOT. It would also ensure that the TDC was viewed as an "internal" organization, which would likely enhance its use by WSDOT staff.

The primary disadvantage of this option is that it would require FTE staff positions at a time when the legislature is limiting the staffing available to WSDOT. The TDC would have to compete with the need for design and construction engineers in a climate of limited staffing. A secondary problem is that the use of WSDOT staff would limit the availability of skills that were available to the TDC and the Department's ability to change the TDC staff's skills if the nature of the TDC changed over time. That is, it would be difficult to "share" WSDOT staff. For example, if the TDC work required 1/2 of an FTE per year of computer programming time, 1/4 of librarian time, and 1/4 of

research engineer time, a specific WSDOT employee would have to have that mix of skills. It is not always possible to find an appropriate match between needed skills and available WSDOT staff. In addition, if the skill needs changed over time (because the focus of the TDC was changed by WSDOT management) the staff person selected for the original position might not have the appropriate skills to meet the revised needs.

From a cost perspective, the use of WSDOT personnel might be slightly less expensive (per staff hour) than hiring outside personnel, although the difference would depend on the cost of the outside staff hired. The use of a private contractor normally includes the cost of that contractor's overhead (a fixed cost not normally accounted for when adding WSDOT staff positions) and the addition of profit or fee to the cost of that staffing.

Transportation Data Center Operation By An Outside Contractor

The advantages and disadvantages of using an outside contractor to operate the TDC are almost the opposite of those of using WSDOT employees. The primary advantage is that the staff available for the project could be controlled through the contractor selection process. For example, if more computer expertise were needed, the next contract could include the revised staffing requirements, and the new contractor could be selected on the basis of computer skills. This flexibility would allow WSDOT to obtain the mix of staffing skills (and the associated labor rates) that would meet the changing needs of the TDC, without having to work within the limitations of the civil service labor regulations.

The primary disadvantages of using outside contractors for the TDC are the added costs associated with contracting and the problems of geographic and/or professional "separation" between WSDOT and non-WSDOT employees.

Added costs would come from several sources. One would be the cost associated with selecting the contractor and would include WSDOT staff time needed to:

- write the RFP

- review the submitted bids
- select a contractor
- monitor progress on the contract.

A second source would be the overhead costs associated with running a private business (including the cost of preparing proposals) that contractors must build into their cost structures and profit. These factors are generally reflected in a cost per labor hour that is higher than that of state employees.

Perhaps more important than the cost of using outside consultants would be the potential communication problems associated with using staff based outside of WSDOT. Geographic separation of staff has a significant, detrimental effect on the level of communication among staff. Organizational separation also has detrimental effects on communication. Thus, if the TDC were based outside of the headquarters or TDO buildings and were run by non-WSDOT personnel, the potential for lower than desired interaction between WSDOT staff and the TDC would be significant. To a limited extent, this problem could be remedied through the use of electronic mail and other media (for example, phone, fax, and newsletters); however, these techniques are rarely as effective as the face-to-face communications that take place among personnel located in the same building.

If an outside contractor were selected to operate the TDC, an important part of the selection criteria would be the contractor's plan for encouraging and maintaining communications with WSDOT staff.

Transportation Data Center Operation By A Single WSDOT Employee With Outside Contractor Assistance

An alternative that might produce the benefits of the first two alternatives is for the TDC staff to consist of both WSDOT and contractor personnel. The WSDOT staff member would be both the contract manager and the head of the TDC. S/he would have an office at WSDOT, as well as desk space at the contractor's office. This would enhance communication both at the Department and with the contractor's staff. At the

same time, by using an outside contractor for the remainder of the TDC staff, the Department would be able to obtain greater flexibility in staffing skills.

The disadvantages of this approach are the problems associated with having multiple offices (this would lead to inefficiencies in the work of the person with multiple offices), the need for an FTE for the WSDOT staff position, and the potential for confusion on the part of the contractor staff regarding who they work for (the head of the contracting firm or the WSDOT staff person) and how they should interact with the WSDOT TDC position.

Transportation Data Center Operation By TRAC

Another alternative that might limit the cost of hiring outside consultants is to use the resources at TRAC, either through the UW or WSU. Depending on the functionality desired for the TDC, WSDOT might be able to use University of Washington (UW) or Washington State University (WSU) resources (faculty, graduate and undergraduate students, and facilities) to provide the services needs from the TDC.

For example, the UW School of Library and Information Science might be able to design and operate the TDC. The design of the TDC would be performed as a research effort in conjunction with WSDOT staff. The TDC would then be staffed by UW students, under the direction of faculty. In another option, the TDC might be designed, developed, and operated under the guidance of the UW's Department of Technical Communication. A similar arrangement might be possible with the Department of Civil Engineering at WSU.

The primary advantages of using TRAC are that TRAC has a lower cost structure than private consultants and could use the existing resources of the two Universities to WSDOT's advantage. The primary disadvantages of working through TRAC are that the Universities are not in the business of meeting "client" expectations and thus might not be as responsive as a consultant might be, and that the use of student labor, while inexpensive, might be inconsistent in quality. The Universities have less control over the

quality of the work that students perform than consultants have over the work performed by their staff. Thus, the trade-off to WSDOT would be an increased level of uncertainty in the quality of the TDC operation in return for more labor hours or lower operating costs.

Physical Location of the TDC

Ideally, the TDC should be located where it would be visible and accessible to WSDOT staff. These two characteristics would be extremely important during early operation of the TDC so that WSDOT staff would be aware of the center, its resources, and its mission. Visibility and accessibility would also encourage people to work with the center by reducing the barriers that prevent personal interaction.

One specific barrier to use of the TDC could be geographic separation. Physically separating the center from WSDOT staff likely to use it would reduce the level of interaction with the TDC and decrease its utility to the Department.

If the TDC were operated with WSDOT staff, it would likely be located within the WSDOT Headquarters complex. This would be ideal in terms of communication with other WSDOT staff. Proximity to the Assistant Secretary for the Planning and Programming Service Center (PPSC) and the WSDOT Planning Office would put the Center closest to its most likely users.

If the TDC were operated by an outside contractor (either a consultant or TRAC), the location of a TDC office in the Headquarters building would be worthwhile, even if that office were staffed only part of each week. This arrangement would allow some routine, informal, face-to-face contact between TDC and WSDOT staff. This contact would increase the likelihood that WSDOT staff would know about the center and its capabilities and thus would use the Department's investment.

If the TDC were located outside of the main WSDOT Headquarters building, strong communication ties would have to be built between WSDOT staff and the TDC

staff. At a minimum, these would include the connection of the TDC to the WSDOT electronic mail system and use of other communication tools as deemed cost effective.

PROPOSED MANAGEMENT STRUCTURE

A management structure that could control the operation and evolution of the TDC would have to be developed. This structure would have to provide direction for the operation of the center (for example, the data to be collected and the reports to be generated), guidance on present and future priorities for the TDC's resources, and ensure funding for the operation of the center.

The management structure of the TDC should reflect the functionality chosen for the center, the staffing plan decided upon, and the resources available. However, regardless of the how the center operates, because the TDC will be a Department-wide, intermodal center, representatives of a variety of WSDOT data interests should have input on its operation. The structure discussed below was developed to ensure that a wide variety of data interests are represented in deciding the direction of the center and that the center continues to meet WSDOT needs.

The proposed structure consists of two layers of WSDOT committees that would provide direction to the head of the TDC. The TDC head would then be responsible for the actual implementation of the policies selected by the committees (i.e., supervision of WSDOT staff and/or contractor support). This structure is designed to resolve the biggest drawbacks to centralized data collection: the loss of support over time for the data collection activity within the larger organization and the inability to correctly focus the available resources on these data collection needs that are most important to WSDOT users.

Management Committee

The upper level of the committee structure would be a "management committee." This group would be responsible for defining the functionality assigned to the TDC, determining which data collection tasks the TDC should perform, and deciding how those

tasks will be funded. The committee would be responsible for prioritizing TDC activities and for allocating available resources among TDC tasks or functions.

This committee should represent upper level management from throughout the Department, with particular emphasis on data users. This committee should include WSDOT managers who would or might fund the TDC data collection activity, since one function of this committee would be to determine the level of funding available and, thus, the work the TDC would perform.

Setting the budget for the TDC should be an iterative process that compares identified data needs with the cost of collecting the data to meet those needs. Initially, defining the data collection tasks for the TDC would allow the development of specific data collection budgets. However, many data "needs" would become data "wants," given the cost of data collection. As a result, the management committee would need the power to change the initial budget of the TDC (by supplying additional resources if those resources were warranted) and to change either the data being collected (if sufficient resources were not available) or the other tasks required of the TDC (if resources would be better used in other tasks).

Technical Committees

The second level of the committee structure would consist of smaller working groups charged with the technical oversight of specific data collection/reporting tasks. These committees would serve as "advisory groups" to the TDC staff and would help direct the expenditure of TDC resources allocated to their particular areas of interest. A specific charge of these technical committees would be to ensure that the data being collected and/or reported by the TDC met the needs of WSDOT users. This task would include helping determine which data to collect, how to collect them, and how to make them accessible to WSDOT users, and then monitoring the success or failure of those actions over time.

Technical committees should be formed to reflect the TDC priorities determined by the management committee. While the technical committees could be modal in nature, a more beneficial structure might be "topic" oriented, in which each topic related to subjects of concern to policy makers and crossed modal boundaries. Potential technical committees could direct data collection for subject areas such as "freight transportation," "non-motorized transportation," and "import/export transportation."

The technical committees are not intended to be permanent bodies. Instead they should be formed and disbanded by the management committee in response to changing needs within WSDOT and the state. The number, subject area, and internal make-up of the technical committees should be changeable each year or biennium to respond to changing data needs and priorities. The intent is to create a group of active participants who would strive to continually optimize the data collection and retrieval process of the Department, within available budget limitations.

The technical committees would fulfill the dual role of being an advocate for the collection/dissemination of data and being the client for those data. The intent is to ensure that available data collection resources continue to be spent wisely. If support for specific data collection/reporting activities eroded, this lack of support would be apparent through the technical committee. At the same time, if the data being collected did not meet the needs of users, the technical committee would be aware of the situation and would be able to redirect the expenditure of TDC funds toward more necessary information.

Project Management of the TDC

The day-to-day management structure of the TDC would be dependent on whether the TDC was staffed by WSDOT personnel or by a consultant. If it was staffed by WSDOT, it should exist as part of the Transportation Data Office within the PPSC division. This would place the TDC firmly within the existing "corporate" data collection and reporting function of the Department, which should facilitate

implementation of the center. The WSDOT staff member assigned to lead the TDC would then be given a position (pernaps a non-voting position) on the TDC management committee. A TDC staff member should also be included on each of the technical committees.

If the TDC was operated by an outside consultant, WSDOT would require a contract manager. The contract manager could come from either the Transportation Data Office managerial staff or from the WSDOT Planning Office, which would probably be the single largest user of data that might be stored in the TDC. The WSDOT contract manager for the TDC should be a member of the management committee and be a non-voting member of the various technical committees. Contract personnel should attend and participate in these meetings, but they should not be members of either the management committee or any of the technical committees.

Alternative TDC Management Structures

In addition to the two-tiered committee structure described above, two other basic management structures should be considered. The first option would place the entire TDC management structure within WSDOT. Under this structure, the TDC would report to the Assistant Secretary for PPSC. An advisory committee could be formed of PPSC managers to provide input to the TDC manager (either a consultant or a WSDOT employee) on the data to be collected, reports to be developed, and methods to be used to disseminate data. This advisory committee would take the place of both the management and technical committees and would have an advisory role other than the direct management role discussed above.

This alternative would be better than the two-tiered structure described above if the users of the TDC data were primarily limited to the PPSC and if the time commitment of WSDOT managerial staff would have to be limited to a minimum. If PPSC were the only significant client, maintaining the TDC structure wholly within PPSC would reduce

the administrative "overhead" associated with the need to coordinate the input of other WSDOT service centers and divisions.

A second option would be to keep the management of the TDC within the Transportation Data Office. In this structure, the TDC would be responsible for determining the data to be collected and the mechanisms for collecting, storing, and reporting the data. This option has the advantage of being the simplest of the alternatives. It would require the least WSDOT managerial time, but it would provide for the least amount of input from WSDOT data users.

RECOMMENDATIONS

Functionality

A review of current and projected information needs and the current data collection, storage, and retrieval process shows that the creation of a transportation data center can benefit WSDOT. However, the TDC function should be limited to areas in which the Department can gain greatest benefit, at the least cost.

For the initial biennium funding cycle, the following functions are recommended for the TDC.

- The TDC should track and catalog data collected by or submitted to WSDOT.
- The TDC should serve as a "data librarian" for WSDOT, helping staff locate available transportation information, as well as storing data not stored elsewhere within the Department.
- The TDC staff should assist WSDOT staff looking for information, regardless of whether that information is available through WSDOT or from a source outside of WSDOT.
- The TDC should provide a report, at least biennially, that describes the status and impacts of transportation in the state of Washington.

- Only when the TDC is the logical group to collect information should it do so.

The primary idea behind the recommended data center is to make information more available to WSDOT staff at lower cost. Thus, it is important that the TDC not duplicate efforts that are already underway. Instead, the TDC should simply keep track of those data collection activities and transfer information about those data to others who need access to that information. In this way, the Department will gain the improved access to the data it collects, reduce the effort needed to collect those data, and avoid both the cost of duplicating efforts and the cost of creating new data storage systems.

Data to be Placed in the Transportation Data Center

The TDC should be capable of storing data. However, rather than creating a single, large database (i.e., something like TRIPS), the TDC should create a simple filing system (both electronic and manual) that allows storage of diverse data in the format in which they are provided to the TDC, along with a computerized database describing the data that are available. This second database would be essentially a "catalog" of the data available within both the TDC and the remainder of the Department. Where possible, the database should also describe other data sources in the state that are accessible and/or beneficial to WSDOT staff.

Data stored at the TDC would fall into two categories: data collected specifically by the TDC under the direction of one of the technical committees (i.e., data not currently collected by the Department) and data collected elsewhere in the Department that would be discarded unless stored by the TDC. This latter category would also include data purchased or obtained from outside sources but used in WSDOT analyses.

At this time, the author recommends that the TDC <u>not</u> be placed in charge of collecting or manipulating data for the ISTEA mandated management systems. These functions should continue to take place within their respective WSDOT division offices. This arrangement will allow WSDOT staff to remain familiar with both the management

systems WSDOT is operating and those the cities and counties are operating. It will help the affected staff understand the shortcomings of the management systems that are initially implemented and give them direct knowledge about the updates and improvements needed for those systems.

Staffing Plan

Given current and expected constraints on WSDOT staff availability, it is recommended that WSDOT contract out the TDC functions, rather than staff the TDC with WSDOT employees. The TDC contract should be managed by Transportation Data Office personnel, but with considerable input from other WSDOT managers. Particular attention should be paid to obtaining input from other managers within the Planning and Programming Service Center.

The personnel skills needed for the TDC would include the following:

- library storage and access
- computer database construction and design
- statistical analysis
- report writing and production
- graphics generation and presentation.

This mixture of skills reinforces the recommendation that the TDC effort be contracted outside of WSDOT. A contractor should be able to efficiently assemble this mixture of skills through the use of multiple staff members, each of whom would spend a portion of their time on the TDC effort.

Management Structure

The recommended management structure for the TDC is shown in Figure 1. The recommended plan gives the Transportation Data Office responsibility for contract management for the TDC, but it includes input from management and technical committees to provide direction and oversight for the center.

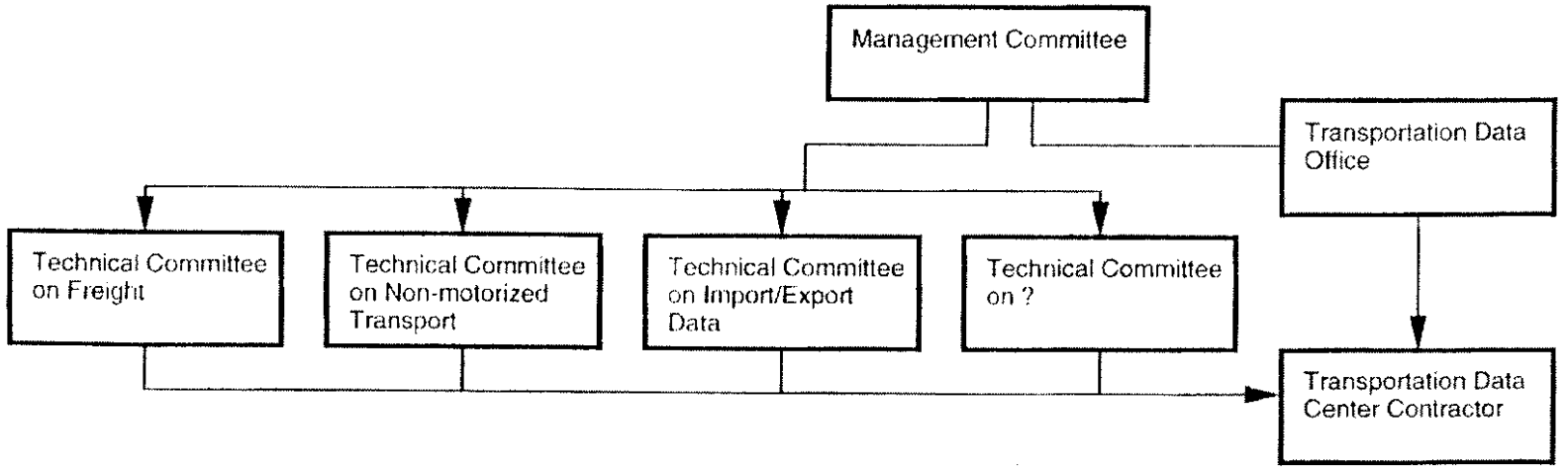

Figure 1. Recommended Management Structure for the Transportation Data Center

The Management Committee would be responsible for the overall budget and direction of the TDC. It should set the priorities of the TDC and define how the available budget should be allocated among the TDC's basic responsibilities. The Management Committee should comprise managers (or their designees) from the PPSC, plus representatives from the legislative staff, the Transportation Commission's staff, and WSDOT personnel from the Operations and Environmental and Engineering Service Centers, and the five modal divisions.

While the Management Committee would provide broad oversight, the Technical Committees should provide detailed technical advice. The Technical Committees would consist of WSDOT staff from each of the offices that would potentially use the data, as well as any WSDOT groups that might be involved in collecting that information.

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REFERENCES

[1] Bureau of Transportation Statistics, Transportation Statistics, Annual Report 1994, January 1994.