

TRANSPORTATION RESEARCH

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Enhancing the Value of Data Programs

A Peer Exchange

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Enhancing the Value of Data Programs

A Peer Exchange

Vail, Colorado
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Prepared by
James P. Hall

For the
Transportation Research Board
Statewide Transportation Data and
Information Systems Committee

July 2005

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Background

Highway, traffic, and other condition-type data are essential to the operation of a successful Department of Transportation (DOT). Data are necessary for performance monitoring, asset management, resource allocation and reporting to customers. Decision makers are becoming more reliant on accurate, timely data. However, there are many issues associated with integrating data into the operation of DOTs. There are also many data gaps. For example, reauthorization efforts are finding that some critical data elements for tracking system performance and determining long-term funding needs traditionally have not been included in the analysis process.

To explore the importance of data programs further, the TRB Statewide Transportation Data and Information Systems Committee organized a peer exchange in conjunction with the TRB Joint Midyear Meeting. This committee is concerned with statewide transportation planning data and information systems for all modes of transportation. The FHWA Office of Planning, Environment, and Realty provided funding to support travel of public sector committee members and guest transportation professionals.

This peer exchange provided a forum to share ideas on raising the awareness of data programs and ensuring that our data add value to the operation of our departments. It also allowed the sharing of what states are doing to address data gaps and as a result to raise awareness of the importance of data programs to decision-making processes. Participants benefited by sharing best practice ideas and by developing collective strategies to help each other with emerging problems.

Topic areas included the following:

1. How can we ensure that data affect program management and statewide plans?
2. What examples are there where data on trends and performance measurement have enriched statewide planning and programming?
3. Better data analysis, including trends, adds value to data. How is this being accomplished?
4. Better access and visualization tools result in value added for data. What are examples of this?
5. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. How can we address this?
6. How are data gaps being handled and how is this raising the awareness of data programs?

State DOT representatives were requested to answer eight questions as part of each of their presentations. These eight questions are

1. What is the biggest data issue you will be facing in the next 18 months? Examples may include budget cuts, data access, data needs for new programs (asset management, performance measures), data needs for statewide plans, etc.
2. How are you preparing for it?
3. How are you ensuring that your data are being used in program management and the development of statewide plans?

4. Better data analysis adds value to data. How is this being accomplished in your agency?

5. Better access and visualization tools result in valued added for data. What are examples of this in your agency?

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

7. Should data be treated as an “asset” by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

8. What other issues do you have with respect to ensuring that your data program adds value to the operation of your agency?

Introductory Remarks

RON TWEEDIE

Consultant

Ron Tweedie, Chair of the TRB Statewide Transportation Data Committee, discussed the need for good data in DOT operations. As programs continue to struggle for resources, there is an increasing need for data regarding performance measures and the diverse environments and data needs of decision makers. A major topic of the Statewide Transportation Data Committee is to enhance the value of data and data collection activities. The purpose of the peer exchange is to develop the trends on valuing data.

There are increasing data needs to address issues such as statewide planning, rural planning, tourism planning performance measures, elderly issues, financial forecasting, transportation land use, smart growth, freight, and environmental justice.

There is frustration in the aggregation and use of data with issues such as data comparability and usability. There is a need to link data and measures to decision-making activities. Data collection and data analysis activities can be the first to be cut with downsizing but are extremely important to the long-term effectiveness and survivability.

There is a problem that although it seems some data collection never stops, new data collection activities are becoming more important. The recognition of data collection as the basis for a strategic resource (and that proper management of data collection is required) is important.

Overview of Trends on the Value of Data

JAMES P. HALL

University of Illinois, Springfield

James P. Hall of the University of Illinois at Springfield presented an overview of the issues of managing value with data programs in state and local Departments of Transportation (DOTs). His background of 25 years of experience with the Illinois DOT includes the management of road inventory databases and geographic information systems (GIS) applications.

The collection, management, communication, and use of data are increasingly important in state DOTs. Rapidly evolving communications and information technologies are transforming the roles of data personnel from data collection to management of the data resource.

This presentation focuses on data valuation issues, organizational issues, concepts on viewing data as a resource, and thoughts on adding value to data programs. Data managers are not merely data collectors but rather managers of the data and information resources that have significant operational and strategic implications for state DOTs.

DATA VALUATION ISSUES

Although there is increasing recognition of data as a resource, a major issue for both public and private entities is the determination of the value of the data. [Table 1](#) shows possible methods to quantify the value. These methods generally are difficult to quantify and may not represent the value to the organization.

Ultimately, the true value of data lies in its capability to improve strategic and organizational decision making and to accelerate operational efficiencies to serve the public good. In order to achieve this, data quality is an important issue.

Quality of Data

The expanding use of data has resulted in a greater focus on the quality of data. This is a complex issue. Data quality encompasses many parameters, as demonstrated in the 11 factors displayed in [Table 2](#) (Mallach). These data characteristics reflect their applicability to needs of personnel in the organization.

TABLE 1 Potential Methods to Determine a Value for Data

<ul style="list-style-type: none">• Cost to collect• Financial implications if inaccurate• Risks if not collected• Financial impact of less informed decisions

TABLE 2 Factors Associated with the Quality of Data

• Relevance	• Usability
• Correctness	• Accessibility
• Accuracy	• Consistency
• Precision	• Conformity to Expectations
• Completeness	• Cost
• Timeliness	

Relevance to the user and decision maker is of utmost importance. Data should not be collected based on what has historically been collected, but rather focused on the needs of the organization. The national Highway Performance Monitoring System (HPMS) reassessment effort several years ago is an example of a comprehensive reevaluation of information needs by the actual users of data. Unnecessary, irrelevant, or poor quality data were eliminated from state DOT data collection requirements.

Correctness, accuracy, and precision refer to the quality of data resources in collection or input processes. Completeness refers to the totality of collection for individual database elements. Infrastructure data inventories, for example, should be updated comprehensively as conditions change. Multiyear program development requires a complete inventory and condition assessment of the structure and roadway inventory.

Timeliness is of critical importance. For example, current bridge inspection data must be available to assist the programming process. Information on accidents, traffic, and infrastructure condition is essential to program development and strategic resource allocation decisions.

Usability refers to how well the user can understand and explore the data in decision making activities. Characteristics in the data must be packaged in understandable formats. For example, the identification of a structure as functionally obsolete may not provide sufficient information to make decisions on priority and funding options for resource allocation.

Accessibility refers to how readily the user can access the data. Depending on the level of user sophistication, the accessibility may encompass many forms. Options for access are advancing rapidly and include direct database, geographic information systems (GIS), and intranet.

Consistency is the adequacy of the data across the historical and organizational spectrum. For example, the comparison of traffic data collected with different equipment and accuracy levels over time may not be appropriate for certain analyses.

Finally, the proper collection, management, and delivery of the data resource represent a significant cost to the agency. These activities include data collection, entry, storage, packaging and delivery (which require personnel), hardware and software, and time. Thus, the costs associated solely with data collection are only a portion of the overall costs.

ORGANIZATIONAL ISSUES

The concept of data as an organizational resource is rapidly expanding beyond the traditional view of bits, bytes, numbers, and letters. Information is data that is used in decision making. Information now includes such multimedia aspects as graphics, images, video, and sound. The data resource also provides value as a historical source in identifying changes over time. Data ultimately represents a measure of the knowledge that can be communicated in an organization. The access, delivery, and packaging of the data resource is extremely important.

Data collection activities in state DOTs are complex operations and are spread across the organization. Often, data collected by one area are used across multiple areas. An example is traffic data. These data are collected through various traffic counting methods and processed for eventual entry into a database. Access to these data is critical as traffic data are one of the most requested and used data elements for such diverse purposes as roadway design, traffic management, pavement management, accident analysis, and environmental monitoring. These uses are internal and external to the organization.

Thus, management of the data resource requires an enterprise focus while addressing diverse organizational issues. These issues include low priority, low visibility, nonrecognition as a resource, complexity, disconnection with strategy, changing data environment, and limited data collection resources.

Low Priority

Data collection activities may be a low emphasis area. In periods of downsizing with shrinking staffs and budgets, data collection may be one of the areas cut through the mistaken perception of the activity as being nonessential. The tradeoff of data collection versus the need to support construction and maintenance efforts can be difficult to defend. Management also may perceive data collection activities as purely federal requirements and of no value to the organization.

Low Visibility

Data collection is often a low visibility activity. Although data are the lifeblood of information systems, when data are used for organizational and strategic purposes, the data collectors and providers may not receive full recognition of their significant efforts. In contrast, data seem to garner more attention when they are inadequate in meeting organizational needs.

Nonrecognition as a Resource

The organization may not equate data with value. In reality, data are as much an agency resource as roads and bridges. Every agency has an information systems infrastructure with multiple support activities. Data collection activities require proper management with a budget, staffing, and support resources. If data activities are not perceived as a strategic resource they may suffer from lack of attention.

Complexity

Data collection and management activities are complex functions. They often require specialized high-demand skills in areas such as software programming, system analysis, database design, computer science, and electrical engineering. State and local agencies, at times, have difficulties hiring and retaining personnel with the necessary skill sets. Data collection and data management activities often are spread throughout the organization. The integration of these activities can be difficult.

Disconnection with Strategy

To be most effective for the organization, data collection activities should be focused on the strategic direction of the department. There may be a disconnect between what management believes is important and actual data collection efforts. Only when data are identified as strategic can they be managed effectively as a strategic resource.

Changing Data Environment

Aside from data collection, data management activities include data entry, database management, data storage, data warehousing, and data delivery. Increasingly, there is a user focus for data delivery. Data kept solely in individual levels of the organization are not a resource. Data are only useful if supplied to users in an understandable format.

Data also include diverse multimedia components such as video, pictures, graphics, and sound. This has profound future implications in managing the data resource.

Limited Data Collection Resources

The collection and management of high-quality data requires significant resources. This includes staffing, hardware, software, and technical expertise. There are major budgetary support issues that require diligent management.

Good News

The good news is that data and information are being used to a much greater extent in state DOTs. This results from rapid advances in communication and information technologies that improve information packaging and delivery to users. Thus there is an increasing realization that data collection is important.

Information Systems and the Organization: The Future

Technologies for the acquisition, analysis, and distribution of data are advancing rapidly. Public expectations for data access and delivery also are increasing. The Internet provides the means for global information access. These trends emphasize that information access is important and that information system delivery systems provide value to the agency. Private organizations are recognizing proper management of information resources is a key component of strategy.

The implementation of complex management information system projects is also providing significant organizational benefits. For example, one study of the Illinois DOT estimated a 200% return on investment over a 10-year period from the implementation of GIS capability due to increased operational efficiencies and better decision-making capabilities (Hall). Information systems specialists, by their products, are frequently seen and used as assets in the organization.

Data are the lifeblood of this burgeoning information systems infrastructure.

Data delivery and analysis tools for decision support are important for using the data resource. Research is evolving on multiple platforms for information system management and delivery. These include management information systems, decision support systems, GIS, data warehousing, and executive information systems. Analysis tools include data mining, expert systems, neural networks, statistical analysis, and forecasting.

There is an increasing focus on delivering information to users. Presentation and analysis tools provide information in more user-friendly formats including GIS, modeling, graphics, and summary reports. The Internet and intranet delivery of this data resource continues to grow in importance as expectations increase.

The tools for using information will continue to expand and grow in importance.

DATA AS A RESOURCE

Given the increasing importance of data, organizations are working to develop methods to quantify the value of the data resources.

Levitin, in the *Sloan Management Review*, evaluated issues in characterizing data as a resource. Levitin compares data with traditional measured resources such as a physical plant. His resource characteristics of data are listed in [Table 3](#).

This view of data as a resource introduces the concepts of valuation and management from an organizational perspective. Data has some of the resource characteristics of physical assets, such as roads and bridges. However, data also has more robust capabilities of copying, transporting, shareability, and versatility.

Data management includes significant issues of depreciability, renewability, and storage. Valuation, however, continues to be difficult.

Implications for Management

Levitin also described the implications for managing data as an asset as displayed in [Table 4](#).

The data oversupply issue deals with the multiple data collection efforts in an organization. With a plethora of data collection activities, it is difficult to determine the data that is necessary as an organizational resource, especially for historical purposes.

The identification of users and their needs is increasingly difficult. There are a great variety of uses and potential uses. It is now more difficult to monitor this across the organization. Requests for data can be erratic and unpredictable.

Access to data is of prime importance. There is a need to manage data as an enterprise resource. Data are more useful from a strategic and managerial standpoint when integrated with other relevant data. Speed, flexibility, and control of access are important issues. Fortunately, technological improvements are advancing.

TABLE 3 Characterization of Data as a Resource

<ul style="list-style-type: none"> • Intangibility • Shareability • Copyability • Transportability • Nofungibility • Fragility 	<ul style="list-style-type: none"> • Versatility • Valuation • Depreciability • Source • Renewability • Storage
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SOURCE: Levitin.

**TABLE 4 Managing Data as an Asset:
Implications for Management**

<ul style="list-style-type: none"> • What’s important? • Data oversupply • Identifying users and their needs more difficult • Data requests erratic and unpredictable • Cost and value poorly understood • Lower level organization for individual needs • Selection of data suppliers

SOURCE: Levitin.

Levitin recognized other data issues: security, quality, and usage management. The organizational issues are key. The organizational structure for access and use of the data is changing. No other resources are changing as rapidly as the data resource.

ADDING VALUE WITH DATA PROGRAMS

To add value with data programs, data managers must develop skill sets to promote data usage. [Table 5](#) provides a summary of strategies for managers of data programs to develop and promote data value actively to their organizations and management. This is based on the work of Levitin and personal experience.

Enable and Promote Usage

Data in a database are not information. Only when used for decision making do data provide value to organizations. Data collection is the first step. The data manager must focus on the universe of users and develop distribution strategies to promote usage.

TABLE 5 Managerial Emphasis Areas to Add Value with Data Programs

- Enable and promote usage
- Determine and focus on high priority/high visibility data elements
- Manage the data resource
- Upper management presence
- Organizational/customer focus
- Integrate with other internal/external data
- Incorporate data analysis technologies
- Cost/benefit of the data resource
- Be ready to deliver

Determine and Focus on High Priority and High Visibility Data Elements

Not all data are created equal. The allocation of resources spent on data collection activities should be assigned in the context of strategic use of the data resource. For example, the determination of data significant to the program development process, such as performance measures, is critical. As such, the resources to acquire quality data should be ensured.

Manage the Data Resource

The data collection, management, storage, and distribution infrastructure, like the transportation infrastructure, require proper management. There may be a tendency to believe that data collection and management activities are ingrained in the organization and only require minimal management attention.

To the contrary, the rapid evolution of information technologies has provided a multitude of options to manage and deliver data. However, these efforts must be properly managed so that relevant, current, nonredundant information is delivered throughout the organization. There are many examples of information system projects that were excessive or abandoned because of implementation and organizational issues. These can represent significant costs in agency resources and reputations. Proper management is vital.

Upper Management Presence

Upper management knowledge of the information systems infrastructure and use of information system products is invaluable. Upper manager active participation is essential if data management is to be managed effectively as a strategic resource.

Organizational and Customer Focus

Data collection should not be conducted in a vacuum but rather with a focus on the eventual user of the data. Thus includes both internal and external users. The data quality factors, as presented in Table 2, represent this end-user emphasis.

Integrate with Other Internal and External Data

The value of data can be enhanced with the integration of data from other sources including databases internal and external to the organization. For example, the integration of traffic data, census data, and aerial photographs can portray information in new ways for decision making. The development of a data warehouse of historical data can provide the capability of evaluating changes over time.

Incorporate Data Analysis Technologies

Advancing information technologies, such as statistical analysis tools or GIS, should be incorporated when appropriate with a user focus. Rapid advances are occurring in visualization, decision support, integration, and analysis technologies. The agency should work to develop and maintain staff competence in these areas.

Cost–Benefit of the Data Resource

Data collection activities represent a large cost. As such, their management entails determination of the costs and relative benefit to properly manage the resource. Benefits from improved decision making may be difficult to quantify but can provide useful information for resource allocation.

Be Ready to Deliver

Developing the capability to react to ad hoc management requests for data and information is critical. This capability requires knowledge of the data resource and the development of tools to accumulate information and deliver it in understandable formats. The ability to deliver can promote visible products that should elevate the level of management recognition.

SUMMARY

The valuation of data encompasses many complex issues. However, true data value is realized when it improves organizational decision making. Proper management of the data resource will provide significant benefits to the agency.

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Policy Perspective on the Uses and Value of Data

DAVID S. EKERN

Minnesota Department of Transportation

David S. Ekern, Assistant Commissioner for the Minnesota Department of Transportation (DOT) presented his thoughts on the challenges for the data community from the perspective of management and state policy.

Data collection and its relationship with management and policy is a complex organizational issue. For the data community, it is important to understand what the organization needs. At times this may involve clairvoyance. Managers seem to know what they want only when they see it, which can be frustrating for data managers. However, data are needed to justify policy. This presentation focuses on a description on how DOTs are changing, why they are changing, and how this affects the data management function.

TRENDS

For state DOTs, trends can be classified into three types: societal, transportation, and institutional. Societal trends involve demographics, mobility and the elderly, the labor force development, and economic patterns. Transportation trends include travel patterns, modal pressure, congestion, safety, funding shifts, and customer expectations.

State DOT institutional trends include the following parameters:

- Smaller more diverse work force,
- Retirement occurring earlier,
- New workers are older workers, entering DOT as 2nd or 3rd career,
- Increased use of private sector, outsourcing and privatization,
- Procurement reform,
- Performance measurement, and
- Shift from building to operating systems.

THE FUTURE

Within the context of these trends, DOTs must focus on doing the right thing and doing it well. The business of transportation and the role of government are changing.

Transportation will be

- International in scope,
- Intermodal in form,
- Intelligent in character, and
- Inclusive in service.

Government will be expected to

- Be accountable, responsible, and limited;
- Never forget it is the people's money;
- Do the right things and do them well; and
- Provide incentives for desirable behavior.

Because of these emerging trends and environmental changes, transportation agencies will be motivated to

- Increase output with a smaller workforce,
- Restructure organizations with a focus on horizontal institutional arrangements,
- Streamline processes,
- Automate activities,
- Manage a less stable workforce,
- Reshape and train workforces differently,
- Focus on asset management and operations, and
- Increase outsourcing.

IMPLICATIONS

The implications of these issues for the data community are many:

- Need for decision maker awareness/partnership;
- Competitive product
 - Quality,
 - Timeliness, and
 - Cost;
- New tools/visualization technologies;
- New data sources;
- Finding new and innovative financing;
- Redefining the customer;
- Integration across functional and modal stovepipes;
- Restaffing the professional community; and
- Assure IT and GIS training in DOT cultures.

In organizations, there may be a large gap between the activities of senior management and data collectors. Data are a product and involve quality, timeliness, and cost.

The Information Systems Infrastructure is a \$4 million operation in Minnesota DOT. This involves an extensive and diverse information architecture. There are new tools to collect and to distribute data. However, these are expensive. The data collection budget is in competition with operations. Management also must deal with the loss of staff and focus on developing skills in new staff.

The data management function should anticipate what's needed. Senior managers are usually reactive. True visionaries are few. Executives are interested in useful data. It is important to bring the data visionaries and management together.

Texas Department of Transportation

KIM HAJEK

Texas Department of Transportation

Kim Hajek presented Texas Department of Transportation's (DOT's) perspective of emerging data issues and the valuation of data, responding to the eight questions as follows:

1. What is the biggest data issue you will be facing in the next 18 months?

- Data access (mainframe vs. PC);
- Data needs for GIS;
- Data needs for statewide plans;
- Data needs for programming and scheduling;
- Data needs for off-system road network (Texas has 220,000 miles of off-system roads);
- Need statewide model that incorporates roadways, water, rail and air passenger and freight due to impact of NAFTA;
- Need different data collection capabilities to meet Traffic Monitoring Guide (TMG) guidelines; and
- Need to eliminate the maintenance of multiple versions of the same file(s) for different reporting purposes.

2. How are you preparing for it?

- New training for staff;
- Develop a linear network (on- and off-system) that supports GIS;
- Use multiple databases [HPMS/Texas Reference Marker Data (on-system)] to meet needs for statewide plan;
- Develop systems similar to PROTRACK (Project Tracking System) to support programming and scheduling;
- Develop methods to collect and process off-system IRI data;
- Develop methods to collect off-system traffic data; and
- Develop information systems that will
 - Integrate multiple databases into a suite of systems that is easily accessible (use of web-based technology, client-server architecture, GIS) and
 - Provide information on demand to handle the increase in ad-hoc requests.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

- Multiplication factor (MF) data are extracted from Design, Construction, Information System (DCIS).
- DCIS data creates the Unified Transportation Program (UTP).

- UTP is submitted to the Texas Transportation Commission annually.
- Meetings are held to answer questions on UTP
 - Transportation Commission,
 - State Transportation Planning Engineer,
 - Director of Programming and Scheduling, and
 - Commission gives final approval of the UTP. Project Status in DCIS is updated.
- UTP includes projects scheduled for the current calendar year and three additional years.
 - Transportation Planning and Programming (TPP) works with the 25 Texas DOT districts on a daily basis to ensure that the quality of data in DCIS is good. Texas' current UTP (\$12 billion dollars).
 - Future programming work will focus on corridor project development.
 - Use GIS to facilitate this kind of project work.
 - Statewide planning data will continue to be provided by HPMS, Texas Reference Marker (TRM), and other sources as available.
 - After the consultant completes the plan it is then reviewed by TPP Division, the districts, and meetings with the general public soliciting feedback.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

- Through continued development of such information systems as STARS using GIS. STARS will
 - Provide visual linkages between field data collection (weigh-in-motion sites) and traffic analyst (TPP),
 - Provide interface tools for rapid and efficient customized statistical and engineering analysis,
 - Support statewide passenger and freight models through a platform aggregating input data, travel patterns, validation measures, transportation networks, and multimodal facilities, and
 - Further travel demand modeling analysis requirements for the Texas Transportation Plan.
- Through information systems such as TRM, HPMS, DCIS, Pavement Management Information System (PMIS), Bridge Inventory and Inspection Appraisal Program (BRINSAP), which provide data found closest to the source.
 - District planners and designers have easy access to data for engineering analysis, planning, and roadway design work.

5. Better access and visualization tools results in value added for data. What are examples of this in your agency?

- Texas Reference Marker System:
 - Mainframe data,
 - PC software, and
 - Microstation.
- TRM: on-system seamless linear road network for state.

- TRM:
 - On-demand produces an automated road inventory diagram from the database,
 - Displays straight line drawing of the road, and
 - Errors in the database are easily identified through review of the Automated Roadway Inventory (ARI) diagram.
- TRM:
 - Data downloaded for ArcView GIS;
 - Used to create
 - HPMS sample maps,
 - Functional class maps, and
 - Any other map types with attributes available in TRM.
- County Road Inventory Program:
 - GPS,
 - Distance Measuring Instrument (DMI),
 - ArcView, and
 - dbf exported into Access.

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

- Pilot project using LIDAR (light detection and ranging) technology to map road network to within 1 meter of accuracy.
 - Pilot in Harris County.
 - Results were verified using the data collected by Global Positioning System (GPS) inventory (GPS data were more accurate).
 - The use of LIDAR did not capture all data as needed.
 - In some cases, yes, the focus on using the “latest and greatest” does not give us what is needed.
 - Verification of data quality through the use of multiple applications and comparison of the results allows us to identify the best methods for obtaining the best quality data (e.g., LIDAR vs. GPS).

7. Should data be treated as an “asset” by DOTs as part of their asset management programs? If so, what steps need to be taken?

- Yes! Data are an asset and should be treated as such.
- It is easy enough to assign dollar value to data when it is worth \$2 billion dollars annually to our DOT. The penalty to Texas, for example, of our mileage certification not arriving at FHWA would be approximately \$200 million dollars or 10% of last year’s apportionment.
 - Texas DOT’s Retooling Program (1994–1998) identified mission critical data and proclaimed this type of data to be enterprise-wide data.
 - Assigned data stewards in districts and divisions to maintain the highest level of accuracy for the enterprise data.

- Information systems required to be designed and developed with security in place to protect these valuable assets.
- State legislation mandated severe penalties for breaching security on information systems.
- State law also required annual reporting to the Department of Information Resources and the Legislative Budget Board any information resource project development for projects over \$1,000,000.

8. What other data issues do you have with respect to ensuring that your data program adds value to the operation of your agency?

- We need to emphasize at the very basic levels of the organization why the data are critical to the agency and how each individual bears a responsibility for ensuring the utmost accuracy of the data.
- We need to look at what additional or different data may be needed to evaluate success (or lack thereof) in meeting performance measures, per the Agency Strategic Plan.
- We need to respond to citizens, elected and appointed government officials, community leaders, businesses, and the media regarding inquiries about what we are doing in their area and what our plans are for the future.
- The success or failure of this effort depends on
 - The ability to change our policies, procedures, and methods of collecting, analyzing, and reporting data, and
 - The ability to meet new federal and state mandates in a timely manner.
- Success equals sound decisions made based on best quality data readily available to the decision makers (FHWA, Congress, Executive Administrators, state DOTs, state legislatures).

Kentucky Transportation Cabinet

ROB BOSTROM

Kentucky Transportation Cabinet

Rob Bostrom's presentation focused on the following aspects of data for the Kentucky Transportation Cabinet: issues, use and analysis, access and visualization, quality, asset, and adding value.

DATA ISSUES

The Kentucky Transportation Cabinet is merging GIS, Global Positioning Satellite (GPS) and Highway Information System (HIS) activities with a common focus. The Cabinet is developing a new HIS using Oracle and EXOR. They also are incorporating GIS tools in this development. GPS is being used to develop centerlines for all state roads and 911 maps. Six thousand GPS units have been distributed to police.

New data needs have been determined for Mobile 6.0, addressing environmental issues. Speed data are needed by functional classification and county. Highway functional class categories include 4 MOBILE6 categories with 32 vehicle classes and also the 13 FHWA categories. Vehicle data are collected for the ozone nonattainment areas.

However, Kentucky is experiencing a budget cut of \$30 million. The effect of reduced hours is not yet clear and may significantly impact operations.

DATA USE AND ANALYSIS

Data are used extensively in meetings and in partnerships. Example uses are state program management, with extensive status reports, and the development of the Statewide Plan.

Kentucky's \$3.3 million research program incorporates varied data analysis techniques. The Traffic Monitoring System (TMS) includes index stations and vehicle classification. Analysis is conducted of vehicle miles of travel (VMT) data. New tools include spatial and statistical analysis with appropriate training. TMS research is partnered with other interested areas in the organization.

DATA ACCESS AND VISUALIZATION

Data access and visualization are increasing with the incorporation of GIS, scanned maps, and PDF files in data products.

There are several ongoing GIS initiatives. EXOR will provide true GIS/RDMS for road asset management. EXOR uses ORACLE 8i and ArcView. Kentucky plans to migrate to ARC 8.1 and to produce all maps through GIS. GIS-related data will be improved through GPS centerline data of all publicly maintained roads at sub-meter accuracy. GPS units will be used in

all police cruiser working accidents. Using ArcIMS 3.1, Kentucky is developing Internet mapping capabilities to provide greater public access to data.

Examples of GIS analyses are varied. GIS and ORACLE data are used to determine land ownership for herbicide application on nonfederal land. GIS provides a powerful method to evaluate cultural resources in project corridors. This improves response time and reduces project delays by integrating internal data with external agency data. GIS also is being used extensively in the six year plan (STIP) and in the Statewide Plan.

DATA QUALITY

Kentucky has ongoing data quality efforts. Quality assurance and quality control (QA-QC) initiatives include process ownership, partnerships, and a quality office.

GIS and GPS efforts are expected to add value. The accuracy goal is sub-meter but no worse than two meters. The GPS verification will include all 7,500 miles of public roads, which will provide a new base layer for state government. The project is expected to be completed by 2003.

Data quality is also an issue for traffic modeling and forecasting. New data will include NPTS add-ons and Reebie data. Under development are new modeling methods, software, and new tasks such as air quality modeling.

DATA AS AN ASSET

Data are an important component of asset management. The Division of Accounts is leading the effort to place a value on all physical assets due to the new GASB requirements.

An Operation Management System, with links to the Highway Information System, is being developed. Subsystems will include maintenance, equipment, pavement, and bridges.

DATA ADDS VALUE

The Office of Quality has developed a litmus test question to determine the value of data: Can a decision be made from the data analysis? Information and data that do not facilitate decision making have minimal value.

Data are very important in the Kentucky Transportation Cabinet and are used for the strategic plan and day-to-day operations.

Montana Department of Transportation

BILL CLOUD

Montana Department of Transportation

Bill Cloud presented a summary of Montana Department of Transportation (DOT) data management issues and activities, responding as follows to the eight questions:

1. What is the biggest data issue you will be facing in the next 18 months?

The biggest data issue facing the Montana DOT depends on which individual or group of individuals may be asked the question. Coordination among these entities has become a major focus. Some of the more critical issues are

1. Increased data needs:
 - New data items,
 - More specificity in existing data items because of improved modeling and analysis tools, and
 - More efficient access (user friendly automation).
2. Increasing staff levels:
 - Field data collection,
 - Data processing and analysis, and
 - Programming.
3. Meeting the performance programming process data needs.
4. Meeting the GASB 34 requirements.
5. Integration of the project and financial management systems

Every program area's data needs and concerns are equally important, and it would be difficult, if not impossible, to identify a single most important issue. However, the common link between data in almost all program areas is *systems integration*. In order to become more efficient in the use and exchange of data between Montana DOT's management systems and other programs, the department began the process several years ago to develop an Oracle-based Transportation Information System (TIS). Since that time, virtually all applications have been rewritten in Oracle. An integrated information architecture, the TIS, has been built, and work continues to fully integrate all the major information systems (bridge, pavement, safety, congestion, performance programming, project scheduling, financial, and others).

2. How are you preparing for it?

Montana DOT's Information Systems Bureau has more than 55 full-time equivalent (FTE) personnel and several term contractors that handle a vast amount of programming and support for the department. Additionally, Montana DOT is calling on expertise and assistance from additional outside consultants. There are three large initiatives that are currently under way or will be in the very near future. Although these initiatives branch out into specific issues, systems integration remains the common thread among them.

A. Integrated Systems

This project involves developing an approach to integrating the project scheduling and financial management systems.

B. GASB 34

This project involves hiring a consultant with the expertise to lead Montana DOT through the GASB 34 process, to include providing assistance in choosing a reporting method, identifying the data items that need to be reported, and assuring that reporting will be comprehensive and adequate per state and federal needs.

C. Infrastructure Inventory

This project has not yet been scoped but will likely consist of identifying data items that are currently collected, who collects them, and how they are used; identifying any duplication of effort; identifying the need for any new data items and who should collect them; and looking in-depth at four major management systems in an effort to determine how they can function (provide answers) in a more efficient manner.

All of these projects have the common thread of systems integration.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

The best example of Montana DOT's use of data in program management lies with the relatively new performance programming process. This process involves measuring the performance of the various highway systems using data from the bridge, pavement, congestion, and safety management systems. In these times, when DOTs are more than ever being held accountable for the expenditure of funds and the related performance of the highway systems, high level officials have found data analysis tools to be more valuable and more important than ever before.

Another prime example is the effort to integrate the program and project management systems. These two systems are crucial to program delivery, and integration will assure that these processes proceed smoothly.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

A large component is metadata. Montana DOT has progressed a great deal in the area of defining its data elements and making that information readily available to users. Although much work remains to be done in this area, the results of what have been done are very positive in that data are more widely available and therefore are being more widely used, understood, and trusted. Because program managers are more aware of and comfortable with existing data, more detailed analyses can be conducted. The advent of Montana DOT's performance programming process is only one of several examples of the value of being able to access and analyze data in an easier and more efficient fashion.

The use of GIS also has greatly enhanced data analysis. We are able to bring in a variety of layers of data (e.g., environmental, economic) from outside entities in order to deal with questions that we were unable to answer before.

5. Better access and visualization tools result in value added for data. What are examples of this in your agency?

Montana DOT has made great strides in providing wider and easier access to information and developing and implementing visualization tools.

A. Metadata

Metadata have changed drastically the ability to access and understand data. Because users can now easily access information about data, they tend to make much wider use of those data with a higher degree of confidence. This makes the data much more valuable than before if only because of the wider area of use, hence the expanded capabilities to analyze data from more perspectives.

B. Image Viewer

This tool consists of digital images of Montana's Interstate, NI-NHS, primary, secondary, urban, and state highway systems. These images consist of 6,372,472 images (two imaging cycles), each image with 10 meters apart in both ascending and descending reference marker directions (about 26,000 miles of directional roadway). In addition to the image itself, this tool contains offset and reference marker information, state plane coordinates accurate to within +/- one meter, geographic location information, and access to point specific roadway data. It also has such features as a sliding reference marker locator, viewing features including "U-turn," "skip by," "reverse," and a "zoom," and viewing capabilities that allow you to view images of the same location taken at different times. All images are updated on a three-year cycle.

C. ARCVIEW

Montana DOT has adopted ARCVIEW as its GIS mapping software. ARCVIEW has proven to be invaluable when presenting data-intensive subjects to anyone who wants the information, especially high level administrative staff and commissioners. Not only is "a picture worth a thousand words," but data that took days or weeks to prepare only a few short years ago can in many cases now be prepared and displayed in a matter of minutes.

All of Montana's approximately 13,000 miles of on-system roadways (and their attributes) can now be plotted in ARCVIEW. All of the city, county, and urban maps currently are being converted from Microstation to ARCVIEW and should be ready for use in the next six months.

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

That is quite the contrary within Montana DOT. With the creation and continued development of the TIS, data are much more widely exposed to a variety of users who did not previously have access to those data. Data are more closely scrutinized by the users. As such, the data managers are held more accountable for the quality of their data than ever before. The department uses an extensive quality assurance and quality control process when collecting and inputting data.

When the TIS architecture first was being developed, there was an extensive up-front analysis effort to ensure that the architecture would meet the needs of all the users. In developing an architecture of the nature of the one at Montana DOT, it forced a level of data analysis that serves the purpose of assuring data quality.

7. Should data be treated as an “asset” by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

The jury is still out on this issue at Montana DOT. This probably will be directly addressed in the infrastructure inventory process mentioned previously. However, to a large degree Montana DOT already treats data as an asset in that top-level management recognizes the value and importance of data in the management systems. Regardless of how Montana DOT will officially view data, data certainly are considered more of an asset today than ever before. Probably the biggest question looming, if data should officially be considered an asset, is how a value can be attached to data.

8. What other issues do you have with respect to ensuring that your data program adds value to the operation of your agency?

Because there is such a wide variety of data maintained by a wide variety of offices around Montana DOT, management of that data is sometimes cumbersome. As such, a recommendation will be made to the administrative staff to develop a data governance structure.

Additionally, by making the accessibility to data more user-friendly, more employees will use the data. Feedback from these employees is an ongoing mechanism that ensures data meets the ongoing needs of the agency.

Minnesota Department of Transportation

JONETTE KREIDEWEIS

Minnesota Department of Transportation

Jonette Kreideweis presented “Minnesota Perspectives on How Data Are Reshaping Business and Transportation Planning Processes.”

BACKGROUND

In the last few years, data have played an increasingly important role in helping to reshape Minnesota Department of Transportation (DOT) business and transportation planning processes. For example, data have become the foundation in helping achieve more of a customer-focused and performance-driven organization. Throughout the department, functional areas are collecting, reporting, and using data to understand and share information on

- The performance, needs, and priorities of the transportation system;
- The status and availability of multimodal choices and alternatives;
- The performance of the organization; and
- The extent to which customers are satisfied with the products and the levels of service offered.

Data also have played a key role in helping sort out and clarify roles and responsibilities within the department. In recent years, there has been a definite push to move decision making closer to customers. District and field offices have become much more involved in transportation planning and investment decisions. At the same time, corporate central offices have focused on articulating strong strategic objectives and directions, together with policies, standards and guidelines, technical training, and quality assurance tools to assist field offices.

Data have become a critical component in tracking progress toward the department’s strategic agenda, *Moving Minnesota*. Specific data-driven performance outcomes, measures, and targets have now been identified for each of the strategic directions identified in Minnesota DOT’s *Strategic Plan 2000*. Examples include the following:

Interregional Corridors—To ensure that corridors of statewide significance link the state’s regional trade centers.

Target: 86% of high priority interregional corridor routes will achieve average travel speeds of 60 mph by 2003.

Program Delivery—To streamline highway construction and maintenance program delivery processes while improving quality and cost effectiveness.

Target: 70% of major construction projects will be open to traffic within 5 years after environmental and preliminary design approvals are obtained.

Target: Customer satisfaction ratings with highway maintenance will achieve 7.0 or higher on a 10-point scale.

On the district and field office side, data are also the cornerstone in helping allocate highway improvement dollars among districts to support Minnesota’s decentralized transportation investment process. [Table 6](#) illustrates the current formula being used to determine district targeted funds for the Statewide Transportation Improvement Program (STIP) investment process.

In addition, data have played a key role in determining long-range district needs and priorities. In 1998, all Minnesota DOT district offices prepared long-range plans to guide highway investment decisions. These plans were designed to be performance based with specific performance measures and targets identified for

- Pavement quality,
- Bridge conditions,
- Safety, and
- Congestion.

As part of this process, a number of new data reporting and data mapping tools also were developed to assist districts in mapping these data from the department’s Transportation Information System (TIS).

These initiatives have resulted in greater use and reliance on data within the department. They have reinforced the importance of data quality and consistency—for example, the need for all of our data and information systems to speak with one voice. All of this also had a side benefit of clarifying who should be responsible for data stewardship and the integrity of individual data elements.

TABLE 6 Current Formula To Determine District Targeted Funds for the Statewide Transportation Improvement Program Investment Process

MEASURE		FACTOR	WEIGHT
System Size 40%		Bridge Area	10%
		Lane Miles	25%
		Buses	5%
Usage 60%	Present	VMT	25%
		HCVMT	5%
	Future	Future Population	30%

MOST PRESSING DATA ISSUE ON THE HORIZON

Moving ahead, there are a number of issues on the horizon with significant data implications. Perhaps one of the most challenging for us has dealt with the subject of organizational performance. Minnesota's current governor was elected on a strong platform that advocated responsive, accountable, and limited government. It has not been business as usual. Governor Ventura has challenged all state agencies to demonstrate in clear, measurable terms what they are doing to improve the efficiency and effectiveness of internal business processes while enhancing the competitiveness of government services. As our Governor says, "Never forget it is the public's money."

For Minnesota DOT, this charge has translated into a strategic objective focused on streamlining the program delivery process. Key objectives include

- Making optimal investment decisions with limited resources;
- Streamlining project development and design activities;
- Providing faster turnaround times for central office support functions;
- Taking more advantage of outside expertise, either through partnerships or consultant arrangements; and
- Maintaining high quality plans and proposals.

The streamlining strategic objective comes with a host of data-related challenges and opportunities, including the following.

1. Making sure traditional system performance data are timely, available, reliable, and consistent

Making optimal investment decisions requires quality system performance data. Minnesota DOT has come a long way in providing this data. The department's base map has been enhanced and tied to the data included in the department's TIS. As a result, it is now possible to map many highway performance variables. New information systems have been built and are saving project managers considerable time and money. A good example is Mn/MODEL, which combines what we know about the physical environment and early settlement patterns to predict the archeological significance of the areas surrounding highway improvement projects.

But a number of issues remain. There continues to be limited integration among data systems. Minnesota DOT has a comprehensive information resource management and planning process. But, a framework is needed for ensuring that investments in information focus on priority needs and gaps. There are also data sharing issues and constraints, particularly when it comes to sharing data beyond the firewall with external partners (MPOs and local governments) and consultants.

2. Addressing new data requirements

A second challenge involves figuring out how to meet all of the new data requirements that are emerging. As part of our *Moving Minnesota* and streamlining initiatives new data are needed on

- System Performance—new data are being requested to track travel times, reliability, and access locations.
- Safety and crash data that go beyond crash rates to focus on how we are moving forward quickly to address high hazard locations.
- Internal organizational process data—probably the most challenging of all. Here new data are needed to track how long it is taking to complete project development activities, where delays are occurring and the causes of delay. A whole new regime of performance measures are evolving around the concept of negative float—for example, the number of days projects are behind in their critical path leading from preliminary design through construction. We want to maintain quality in this process, so data also are needed to monitor plan quality and the effectiveness of streamlining changes in actually reducing program delivery time.
- Asset management data—another new requirement, not necessarily related to streamlining, but critical in understanding how the value of investments are changing over time.
- Customer data—lastly, there are new requirements for data on the priorities and satisfaction of our different customer segments.

3. Moving beyond data collection and reporting

A third challenge has to do with resources and the department's workforce. Somehow we need to find ways to go beyond the production side so that we are adding more value for decision makers through analysis, synthesis, and integration of data from a variety of sources and scenario building. Time is needed to learn from the best practices of others. Underlying this is the need for talented transportation planners and research analysts who can tie the pieces together in credible and compelling ways. This is expected to become increasingly difficult in the job market of the future.

4. Sustaining management support for data and information

A fourth challenge and opportunity area is the need to obtain and sustain management support for data and information improvements and enhancements. In Minnesota, there is always fierce competition for resources. Identifying funding can be especially difficult when data improvements are often

- Complex and difficult to describe;
- Designed to be transparent, i.e., invisible to users;
- Take a long time to complete and require significant resources; and
- Frequently tread on turf and control issues.

CONCLUSION

The preceding information has presented an overview on how data and information are changing business processes and transportation planning activities in Minnesota. There are a number of initiatives underway and a variety of challenges and opportunities on which to capitalize.

In the end, Minnesota DOT staff are working hard to ensure that data programs add value. They are doing this by

- **Treating information as a resource.** There is a comprehensive information resource management planning process in place tied to specific legislative funding requests for information resource projects.
- **Reporting and widely sharing data results.** The department has instituted “performance dashboards” as a means of sharing data and information. Time at quarterly management team meetings is set aside for individual work areas to showcase their performance dashboards.
- **Incorporating data in transportation plans.** Minnesota DOT is in the process of updating its statewide transportation plan. The department also is developing guidelines for the second round of district plans. Both of these efforts will have strong data components.
- **Building better tools.** The department is working on a new location data model that will serve as a central element in an overall data integration strategy. The model will provide stable locations over time so that all legacy systems can be linked to the base map. Data collection and editing is costly. As a result, the department also is working on better ways to sample, model, and electronically edit data so that staff can move into more value-added data analysis activities.
- **Inviting ongoing data stakeholder and user input.** Focus groups, conferences, and market research are being conducted to invite user, partner, and even consultant input.
- **Looking for continuing opportunities to have data “at the table” from the start.** Many new initiatives in the past have gotten launched without data being represented at the table. Throughout the department, data providers and stewards are trying harder to lobby for a place at the table when discussions first start.

Michigan Department of Transportation

RON VIBBERT

Michigan Department of Transportation

Ron Vibbert presented Michigan Department of Transportation's (DOT's) perspective on data management and data valuation, responding to the eight questions as follows:

1. What is the biggest data issue you will be facing in the next 18 months?

There are four major data issues facing Michigan DOT that will need to be addressed within the next year. These issues are the following.

Framework Project

This is the development of our statewide GIS base map and our new linear referencing system. This will be a major cultural and technical challenge as our data migrates and we rollout the new referencing system. Code has been written for this, but there is no data with which to test.

Crash Location and Dissemination

Our crash location systems are antiquated and are being rewritten because of the new referencing system. Existing systems are 30-plus years old and produce locations of questionable accuracy. This will be a multiagency effort.

Asset Management and Local Data Collection

Michigan DOT has a fiduciary responsibility for the condition of the federal aid system, yet we have incomplete data. This is starting to cause us problems, and our legislature needs to be able to determine how well the road system is doing. We anticipate beginning a data collection effort to gather the necessary information to satisfy our fiduciary responsibilities. This is a potential political issue as local transportation agencies do not trust Michigan DOT.

Pavement Data

Pavement data are not stored in a format or location that allows easy access. We are writing routines to consolidate legacy storage methods and formats compatible with current storage methods and designs.

2. How are you preparing for it?

Answers are in the above responses.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

Each of our regions has condition and performance goals set using existing and forecast system conditions, estimates of revenues over time, and the effectiveness of “fixes” that may be applied. These strategies are developed locally using data in our databases, strategies are confirmed, and then results obtained. Additionally, the strategies are developed and recorded in rolling five-year increments, which tends to put a greater focus on the long-term nature of fixes rather than on shorter term quick fixes that may not be optimal in the longer run.

Systems managers’ annual pay for performance awards are determined based on their success in meeting their strategies and system condition performance goals. This forces the use and value of the data used in our processes and increases the awareness of the importance of data quality.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

Because manager’s performance is attached to the data and the conclusions derived from data analysis, data quality becomes more of an operational issue than just something “central office” wants.

5. Better access and visualization tools results in value added for data. What are examples of this in your agency?

Michigan DOT has moved GIS capabilities into each of the seven regional offices and to each of the 35 transportation service centers (1–2 county areas charged with more day-to-day project and maintenance operations). We have found that there is more interest in data quality and more interest in collecting data usable on a day-to-day basis when people can visualize it.

Access and visualization of data are necessary but not sufficient conditions for increasing the value of data. Though GIS maps may be produced easily, do we have people who become more interested in producing the data than in turning those data into information usable for decision-making?

As an issue for consideration, at what point does GIS and the ability to produce maps become the end rather than the means for producing transportation facilities for the public?

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

No. The concern for data quality is higher now. Our increased IT expenditures have highlighted data quality issues. Michigan DOT has become more data driven as we’ve eliminated duplicative data collection and storage—the data we have becomes much more important. Errors in data are identified very rapidly and then efforts are made to correct those errors. Since the primary owners of data have been identified, others depend on them.

7. Should data be treated as an “asset” by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

No. Data are not a transportation asset like roads or bridges. Data instead are an asset to the *agency*, not to the public.

The value of the data to an agency depends on what degree the agency is dependent on data for operations, planning, resource allocation, or to improve or monitor transportation system conditions or value. This doesn't mean we don't need to treat data as an asset, although not as a transportation asset.

8. What other issues do you have with respect ensuring that your data program adds value to the operation of your agency?

How to keep up with and enable people close to operations to collect data as they do work—this applies to maintenance workers as they work on signs, culverts, bridges, etc. One of our hardest challenges is to capture data as they are created rather than “discovering” the data during a field review.

Florida Department of Transportation

ANITA VANDERVALK

Florida Department of Transportation

Anita Vandervalk presented the Florida Department of Transportation (DOT) report with a special emphasis on the leadership and management issues of data collection. Summaries of her responses to the eight questions follow.

1. What is the biggest data issue you will be facing in the next 18 months? Examples may include budget cuts, data access, data needs for new programs (asset management, performance measures), data needs for statewide plans, etc.

The biggest data issues facing Florida DOT can be grouped into two categories: planning office and agency-wide.

In the planning office, two issues will be critical—higher level privatization and resources and priorities.

1. The data offices will be faced with decreased staff support, which will be handled with increased privatization. The traffic data collection program in Florida has been largely privatized for years. The next step of privatization will be “higher level” and will be the privatization of more critical functions such as data analysis. Staff concerns associated with this include discomfort with the lack of control over important program decisions.

2. Regarding resources and priorities, the issue of emphasizing the importance of data at all levels and across all districts is difficult and results in varying commitments to data programs. Therefore, some districts have more resources to expend on data programs than others.

The agency as a whole will be facing three major issues—reorganization, data integration, and resistance to large scale changes.

1. The department is undergoing major reorganization at the district level. The primary data collection centers are moving to other office locations. For example, in one district, the traffic program is moving to the Traffic Operations office, and the roadway data collection program is moving to the District Maintenance office. Variations of this example will be occurring throughout the eight districts. The issues of concern here are the difficulty in maintaining data integrity and customer service due to the program being managed from so many different offices.

2. Data integration is another larger scale issue. Several entities within the Department recognize the need for data integration, and they realize that the technology finally exists to create, maintain, and use data integration tools. Examples of offices include districts, central office, environmental management, planning, and information technology. The problem is that they are all creating or planning their own integration tools when it would be more efficient to plan them together. This problem transcends outside the department to local governments and other state agencies. The typical data integration obstacles, including lack of trust, lack of leadership, and organization, are apparent in the department.

3. Resistance to large-scale changes is the third agencywide data issue. Although the department is in a change environment due to manpower and resource cutbacks and increased emphasis on privatization, there is still resistance to changing the way data are collected. For example, the Planning office is investigating the use of remote sensing for collecting roadway feature data. The improvement has the potential to generate more accurate, useable databases while improving the safety and efficiency of the collection process. Change is being resisted across the eight district offices and in the central office. The typical issues associated with the fear of change are apparent.

2. How are you preparing for it?

In the Planning Office

1. The issues of higher-level privatization are being handled through good project management. Clear scopes and constant communication between department and consultant staff are essential to the success of privatizing data analysis functions. The consultant must become a staff extension and be privy to more information than in the past. They must have sufficient knowledge of department processes in order to make sound judgments regarding the use of data. Good leadership when dealing with consultant and department staff will be critical.

2. Regarding resources and priorities, the key here is to properly and consistently sell the value of data to upper management. This is being accomplished slowly through the development of useful products and the proposal to increase the accuracy of planning level data to serve more customers in the department.

Agencywide

1. As the department reorganizes, it becomes very important for the central data office to establish its role as a policy maker. Since their circle of influence has grown, leaders in the central office must coordinate extensively. Clear data standards must be set and proper training administered to ensure adherence. Follow-up in the way of quality assurance is also important.

2. Data integration is a difficult issue to resolve in a matter of a few months. The approach here will be to operate as a catalyst to bring various data integration interest groups together. Although there is not a defined role for the planning office in this area, it has been acting as a coordinator regarding large data integration issues.

3. Preparing for resistance to change requires patience and a thorough plan that is implemented in increments. The first step must be to obtain buy-in. This will be accomplished through constant communication with key stakeholders. With respect to the remote sensing example above, the plan will be to demonstrate the benefits of the proposed change. Pilot projects will be proposed in several districts which will maximize statewide involvement and allow the data collectors to go through the process of assessing the need for the change.

The bottom line in preparing for data issues is to be a good data leader. A recent article by Tom Peters listed several traits of a good leader. Many of them apply perfectly to the needs of a data manager. They are as follows:

1. Have a dream, strategy, and a plan that is well thought out.
2. Allow for some “mess” while obtaining buy-in for new ideas.

3. Understand the power of relationship and coordinate constantly.
4. Trust one's intuition.
5. Use technology to the fullest extent possible to collect, analyze, and display data.
6. Be energetic in data efforts.
7. Have great stories—this refers to the need to present data in a way that is interesting, not just factual.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

In the Florida DOT, the importance of data is evident through the use of performance measures in decision making. Performance measures are the cornerstone of statewide plans and program management. The following timeline demonstrates the recent history of the use of performance measures and therefore data in the resource allocation process.

1990

Performance measures program was started because of a financial crisis. A system to make better programming decision was needed. Before this, data measures and data collection existed for key operation areas such as pavement, bridge, and maintenance management.

1993

A program and resource plan was developed to document all measures used and how programming decisions were made.

1996

The department adopted short- and long-range transportation plans, which set forth mission, goals, and objectives for 10- and 20-year increments. Data continue to be used extensively to report on the progress of those goals and objectives.

1997

Refinements to the performance measures, in particular mobility, started. This increases the need for accurate, timely data to assess the mobility performance of our transportation system.

2001

Data continue to be a critical component of our performance measures, statewide plans, and program management as we push for even more measures that reflect real-time operations. An example here would be freight measures.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

The increased data analysis, especially related to the performance measures program, has definitely added value to the data program. While developing and refining performance measures, data were constantly being massaged and quality improved as a result. Displaying the data in map format also improved data accuracy.

5. Better access and visualization tools results in value added for data. What are examples of this in your agency?

Increasing the customer base for data is a great way to add value to a data program. For example, the department has been producing a traffic CD for the last 3 years. The customer base for the CD has increased from 50 to 3,500, and the data have improved in quality as a result of feedback mechanisms with customers.

Other access tools include a Data Source book, which includes all available data from the Transportation Statistics Office. It is also available on the website.

Another example of how better access has highlighted the value of data is the department's real-time traffic website. The site is used during emergency evacuation and real-time traffic data are available to indicate congestion along evacuation routes. This has been a very high profile project for the department and has thus improved the value of data programs.

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

The only example that may apply to this question is the fact that Intelligent Transportation Systems are generating such a high volume of data, which results in overlooking the quality if the data are used for analysis.

7. Should data be treated as an "asset" by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

This question could be rephrased to be "Should data be treated as an 'asset'?" This is a difficult question. Data are clearly an asset as the underlying component of all business at the department. However, a value should not be assigned because the data are not a stand-alone item. The department is a policy-driven, data supported agency, which means that good data are a way of life. Florida's asset management program is characterized as a continuous process that links policies with planning, programming, and performance monitoring to determine if objectives are met. So it is a smart way of managing resources, and the data are a critical component of that system. However, data are not an asset to be accounted for.

8. What other issues do you have with respect to ensuring that your data program adds value to the operation of your agency?

In summary, value can be added to data in the following ways:

1. Providing quick turnaround on data requests,
2. Keeping current with policy and decision making needs,
3. Ensuring that good data are a way of life, and
4. Being a good data leader.

REFERENCE

Peters, T. Rule #3 Leadership Is Confusing as Hell. *Fast Company Magazine*, Edition 44.

California Department of Transportation

TREMAIN DOWNEY

California Department of Transportation (Caltrans)

Tremain Downey of the Transportation Systems Information Section at Caltrans presented California's data management efforts, responding to the eight questions as follows:

1. What is the biggest data issue you will be facing in the next 18 months?

Data integration is the biggest data issue that Caltrans faces. Whether it's routine programming, real-time data, status of projects, or performance information (mobility, reliability, safety, etc.), staff and managers consistently analyze interrelated data to help them make better decisions and anticipate and respond to questions. Along with integrated data, developing user-friendly data access and data tools to help convert volumes of data to decisive information are other challenges. Finally, blending together data collected by traditional data collection efforts with data collected via "new technology" presents a third set of challenges. Existing legacy systems and staff accustomed to using these systems remains an obstacle. The desired outcome is customers with access to the right information manipulated with user-friendly data analysis tools.

2. How are you preparing for it?

We are developing a vision or desired state and gaining consensus with data customers and data suppliers. Integrated data allows staff and managers to click on a map to access transportation and land use information for analysis purposes. To a data customer, integrated information might look like [Figure 1](#).



Interstate 8 SD 8.7-11.9
6 Lane Freeway
AADT: 170,000
Peak Hour: 13,700
Peak Hour Op Speed: 39 MPH
Peak Hour Reliability: 90%
Peak Hour Mobility: Meets Target
Now Projects: Rehab.
STIP: No major projects
RTP: Add two lanes
Land Use: Mature Urban

FIGURE 1 Example of integrated transportation and land use information.

Our vision brings five strategies:

- Collect and manage the right data.
- Develop data tools to view, analyze, interpret, and present information.
- Data sets and tools work seamlessly.
- Minimize special requirements for users (training, hardware, software, access rights, etc.).
- Customize information views and queries to help decision and policy makers better answer their questions (e.g., customer knowledge).

This vision integrates improved customer services, data collection and management technologies, and decision processes. Customer knowledge is the key.

We are moving slowly to implement our strategies, focusing on customers whose information needs are well documented and noncontroversial. This customer group is both supportive and closely linked to project selection decision making. Success with this customer will influence resources decisions related to expanded data integration.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

Our watchword: “To become truly effective, data must be integrated into decision making for existing planning and programming processes.” The functional managers for statewide planning, regional transportation planning, and other decision processes are part of our statewide working group in which we look at transportation system performance measures and required data. Representatives of regional agencies and the private sector also serve on the group. We are at the point where we plan on serving as a broker only for data that customers actually use.

Various Caltrans functions collect data (Traffic Operations collects safety and traffic volumes data, Maintenance collects asset condition data, Mass Transit collects transit performance and asset condition data). Frequently, the data collectors also are the initial customers. In the broker role, my function works between the data collectors and various data customers (transportation planning, top management, public information, external agencies, etc.) to provide them with information to do their jobs (customer needs). We also influence data collectors to collect what customers require.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

Data quality and value are a function of use. Decision making is more rigorous because of increased competition for transportation funding and increasing accountability concerns. Increasing value and the need for higher quality data is just a function of the current environment.

5. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency? If so, how are you addressing it?

We find that new technology is making us aware of needs to improve data quality, data collection technology, and how we manage data. For example, we have a Performance Monitoring System (PeMS) that collects and manages real time data. PeMS output is high quality and helps us to identify input data quality issues caused by defective loop detectors, loop detectors turned off, and nonfunctioning loop detectors. The PeMS software includes quality assurance programming to identify and assess data input issues.

We also find that as new technology is implemented staff who are knowledgeable in data output help to identify data quality concerns and determine cause: logical function or data input quality.

6. Should data be treated as an “asset” by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

No. Data are a tool to help evaluate asset conditions and make resource decisions. The key factors for data are data quality and customer access to the right information. However, the systems used to manage and retrieve data are an asset.

New York State Department of Transportation

RON TWEEDIE
Consultant

Ron Tweedie, recently of the New York State Department of Transportation (DOT), reported on the status in New York State DOT.

BACKGROUND INFORMATION

Highway Data Base

Just getting underway. Objective is to develop an integrated, relational database for highway inventory and traffic data. Phase 1 (6 months) will assess the current system and develop an implementation plan. Phase 2 will prepare the computer code and implement the system. The contractor will be conducting some peer reviews of other states, and New York State DOT would appreciate advice on state DOTs to contact.

Continuous Counter Program

Three separate contracts cover the state. All are active in building new continuous counter (CC) sites. The contractor also is taking over maintenance and operation of the old sites. When complete, there will be approximately 150 sites. Payment to the contractor will be on the basis of good data delivered.

WIM Sites

Working with state police on enforcement weigh-in-motion (WIM) sites. They will build and maintain. Starting with the Valcour rest area site (I-87), which will have a load cell, high-speed screening site. The state also is building WIM convertible capability into the new CC sites. Few, if any, of the state's SHRP WIM sites are producing useful data for research purposes.

Local Traffic Counts

The "give away counters in exchange for traffic data" program is going well. Approximately 25 local governments have elected to participate in this very popular program.

International Roughness Index

The 2001 survey is about to begin and this year will cover all state highways. New York State DOT also will continue to conduct the visual rating system although some changes are planned. For example, alligator cracking in the wheel path will receive different consideration than similar cracking elsewhere because the repair strategy is different.

New York also is developing justification for purchase of a vehicle capable of measuring both ride and rutting.

Pavement Management

New York currently is evaluating software capable of structuring a pavement program. They currently have software that can assist in selecting the most efficient program given the critical parameters. However, the program is awkward to use so seldom is productively employed by the regional offices.

COMMENTS ON THE QUESTIONS

1. What is the biggest data issue you will be facing in the next 18 months?

Implementation of the new relational data base contract will be the most challenging task facing New York State DOT over the next 18 months (and beyond). Although approved by the department's Information Management Division it will still require a diligent effort to acquire adequate resources, both financial and personnel, to conduct the work. Continual maintenance of the existing highway and traffic data systems also will be required during the implementation activities.

2. How are you preparing for it?

Aside from the normal tasks associated with preparing for a major data base project, preparation has included working with executive management as frequently as possible to enlighten them on the value of the new data system to support policy decisions. This includes data assessment, evaluation, and presentation to demonstrate value.

3. How are you ensuring that your data are being used in program management and the development of statewide plans?

The basic condition and performance (C&P) data are used to set pavement and bridge goals for the capital program and evaluate progress toward those goals both statewide and by region. The value of the C&P data has been enhanced by a systematic outreach to the regional offices to discuss data needs and evaluate current use. Main office program management is also included in the outreach efforts. The importance of this data in statewide policy decisions and in budget preparation can not be overstated.

4. Better data analysis adds value to data. How is this being accomplished in your agency?

Unfortunately, data analysis often falls victim to budget crunches. Data collection usually takes precedence over analysis. A wiser solution in the face of budget restrictions would be to cut data collection at a rate that would always allow some staff available for analysis. In New York, data analysis has been limited to specific responses to executive management requests.

5. Better access and visualization tools results in value added for data. What are examples of this in your agency?

New York State DOT has been and continues to be a leader with respect to the use of GIS as an analysis, evaluation, and presentation tool. Both the main office and the regional offices are adept in applying this valuable tool. It also is used in interagency applications when data from several disciplines is required for project evaluation. The use of GPS as a spatial analysis tool is also gaining favor.

6. Recent emphasis on information technology and new applications may result in overlooking the quality of input data for these tools. Are you seeing this in your agency?

Data quality tends to degrade when the data quantity overwhelms the ability of the analyst to carefully evaluate the product and advise the user. For example, New York State DOT has found that data from the ITS systems, which could at some locations supplant continuous count data, do not undergo the same rigorous editing process. A strong outreach effort on the part of the data professional is necessary to ensure that data from other sources maintain quality standards consistent with the basic data systems. The insistence on data quality at the outset is particularly critical, because user patience in the face of a decision is notoriously short and data will likely be used regardless of quality.

As a general rule data should be collected once and used many times by different customers. However, there may be situations where it becomes economically advantageous to collect the data twice at different levels of detail rather than attempt to use the “one size fits all” approach.

7. Should data be treated as an asset by DOTs as part of their asset management programs? If so, what steps need to be taken (assigning value to data, etc.)?

Data should be treated as an asset. In fact, data should be considered a department asset with or without an asset management system. This means that data systems and collection activities must face the same budget criteria that other programs do and be evaluated on their merits. If values need to be assigned this can best be achieved by consulting carefully with the users.

Acknowledging data as an asset gives the data programs status within the agency and, at the same time, places a responsibility on the data providers to produce reliable, timely, and cost effective data. It’s a win-win situation.

8. What other issues do you have with respect to ensuring that your data program adds value to the operation of your agency?

Evaluate your data program carefully each year and be willing to sunset unused data programs when they are no longer useful. This will allow you to focus on the higher-priority programs, which support agency goals and add value to agency operations.

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