A1D09: Committee on Statewide Transportation Data and Information Systems
Chairman: Ronald W. Tweedie, New York State Department of Transportation

Data, Data, Data—Where's the Data?

MARTHA J. TATE-GLASS, *California Department of Transportation*
ROB BOSTRUM, *Kentucky Transportation Cabinet*
GREG WITT, *Kentucky Transportation Cabinet*

Transportation is changing throughout the nation. More people need to reach multiple destinations and achieve multiple objectives in one trip. Many of these trips cross jurisdictional and modal boundaries. In major urban areas, existing and new users are making increasingly complex trips that put higher demands on the transportation infrastructure and services. For example, travel to jobs, shopping, medical facilities, educational institutions, entertainment, and other neighborhoods requires seamless transitioning from one mode of travel to another.

These demands require a major new transportation strategy that responds to the issues facing each state and the nation for the next 20 to 30 years and well into the new millennium. Transportation leaders understand that this new strategy must include all aspects of the nation's vital infrastructure—air, water, housing, education, and more. The strategy must include an intergovernmental approach for accommodating growth in already heavily populated urban areas. This would involve a partnership with private entities and officials who make land-use decisions. Finally, the strategy must address the needs of an aging but active population.

Accurate, reliable, and readily available data is the essential tool for making this new transportation strategy a reality. Transportation professionals must find better ways to meet federal, state, and municipal needs for modeling, data systems, traffic counts, and performance measuring. The first step must be more reliable data. However, this will be a "tough sell," because data is more elusive than blacktop.

Many of the points in this article echo the poignant statements of Alan Pisarski, the 1999 TRB Distinguished Lecturer, made in his speech at the TRB Annual Meeting in January 1999 (*1*).

DILEMMAS OF TRANSPORTATION DATA COLLECTION

Transportation leaders have established little guidance regarding what data to collect, in what detail, precision, and frequency, or even for what reason. The most important aspects of transportation are time and cost. Yet little or nothing is known about these two factors. For example, think of performance measures without time or cost elements. Transportation data collection is literally a moving target. It is difficult to think of instances where it has been measured well. The single exception may be the airline industry — air travel is certainly the most data intensive transportation industry—but it also has problems.

The cost-benefits of transportation data have not been established. Officials who invest in a data collection program are probably investing in something from which they will derive no benefit. They are generating a bequest to their successors.

Large-scale statistical programs take lots of time and money. Most programs or agencies don't have the money to sustain the needed data programs. Most programs do a bad job of justifying the need for data expenditures.

But being “irrelevant” is a delicate concern. Gauging relevance is like sitting around the campfire: too far from the policy “flame” brings the risk of irrelevance and being frozen out; too close carries the risk of being singed.

The key to solving this dilemma is the anticipation of data needs. Transportation statistics programs, like most other statistics programs, are approximately five percent statistics and ninety-five percent logistics. These programs are complicated exercises in organization and planning. But the most central professional aspect to these efforts is not the statistical skills involved nor the logistical capabilities, but the ability to anticipate the policy and planning data needs of the future: What policies will be significant? What planning horizons matter in the future?

When policy issues arise for the U.S. Department of Transportation (DOT), metropolitan planning organizations (MPOs), state DOTs, or the private sector, it usually is already too late to begin data collection. They cannot respond, “Hold on for a year or so, we’ll be right back!” When a policy question arises, data professionals usually can answer in

- Three minutes, if it’s on the shelf;
- Three hours, if a little searching is required;
- Three days, if some manipulation is required;
- Three weeks, if a computer program is involved;
- Three months, if major data processing is required; or
- Three years, if new data collection is required.

In other words, transportation professionals are forced to work with what they have in the data “cupboard” when a policy issue arises. Therefore, all policy will be made with the extant statistical data set. That must be the goal of all design.

Following are the experiences and discoveries of two states, Kentucky and California, that took a comprehensive look at the need for transportation data.

KENTUCKY’S DATA COLLECTION ENHANCEMENT EFFORT

Kentucky transportation professionals are assessing their state’s needs, issues, policies, and gaps with regard to data. They are aggressively pursuing video logging and other technology-oriented, data-enhanced collection efforts.

Accurate and complete information is essential for today’s fast-paced decision-making processes. Technology has responded to the increased demand for information by providing sophisticated database management that includes visual and spatial analysis tools. These computerized tools demand better data content and accuracy. Just as the highway infrastructure is necessary to meet the demands of transporting people, goods, and services, a data infrastructure is required to support transportation planning. If data is treated like an asset, the rewards will follow in such areas as productivity and accountability.

Many factors are involved in highway data collection. For example, safety must be considered as field personnel collect data in the presence of the traveling public. There are also a variety of physical characteristics that must be observed over a large expanse of highways. In an attempt to capture more roadway features in one pass, Kentucky has proposed spreading the use of video logging throughout its transportation agency, as follows:

- Pavement conditions, Division of Operations;
- Roadway features inventory, Division of Operations;
- Traffic signs and signals inventory, Division of Traffic;
- Bridge maintenance system, Division of Operations;
- Roadway characteristics inventory, Division of Planning;
- “Rideability” index, Division of Operations;
- Passing zones, (possibly), Division of Operations; and
- Digital mapping references on data features, enterprise-wide.

In addition to better descriptive data, videotaped record and digital photographs could provide visual inspection capabilities in the office. Using a computer, it is possible to simulate driving on every highway throughout Kentucky. Digital photographs for geographic information systems (GIS) will enhance digital mapping analysis efforts. In summary, new technologies provide the following benefits:

- An asset management tool;
- Safer data collection methods;
- In-office data collection;
- An enhanced GIS;
- In-office view of all state highways; and
- One enterprise-wide database.

Additional future data issues identified by Kentucky include:

1. **Performance measures**. Training and retraining is essential to this area. The mobile work force creates an employee retention problem. Changing technologies make training critical to any new data initiative. This training needs to be updated continuously.
2. **Intelligent transportation systems (ITS) data integration**. ITS planning should become a standard part of all highway projects, similar to right of way and other line item aspects of project development. ITS will require serious quality control efforts to handle the enormous amount of data generated. Released data probably should have a standard disclaimer about its accuracy. Also at issue is what piece of data represents the average, and who is responsible for the data. For example, if a newspaper requests information about data at a given point, what should be used? A random day, perhaps?
3. **Data access**. Privacy issues already emerging with truck data will continue to arise. TRB and the Federal Highway Administration (FHWA) need to address this issue aggressively, to make the fullest use of the available technology. For example, transponders could be used universally on truck fleets; however, there is no political will to mandate it.

4. **Data quality**. Expert programs must be pursued aggressively. But these programs have been slow in developing. The amount of data generated is increasing geometrically, and the quality of the data is suspect. It is essential that data be “tagged” with information showing the source (e.g., the equipment or the collection team), the statistical level of confidence, and the availability of archival data. Data quality has great potential as a new training program in engineering schools.
5. **Modeling and traffic simulation**. A clearinghouse should be established for data used for statewide and regional planning efforts such as statewide traffic models. Interjurisdictional data currently is difficult to obtain and compare. A national database could solve this problem. The database could contain such attributes as volume data, vehicle classification data, origin-destination data, and employment data. The tool-kit approach is better than the one-size-fits-all approach represented by FHWA’s decision to promote the new model TRANSIM, which may or may not be a good tool for demand modeling.

Kentucky concludes that with leadership from key states and case studies showing how data collection and management have saved large sums of money, it will be possible to implement forward-looking ideas. The political barriers are more severe than the technological barriers.

CALIFORNIA’S EFFORT TO MEASURE SYSTEM PERFORMANCE

California, along with several other states, has undertaken an effort to develop transportation system performance measures that will provide a systematic approach to planning and decision making. Transportation policy makers recognize the need to consider improved system management options before more costly capital expansion projects are developed. However, decision makers are hampered by a lack of tools designed for system analysis. The 1998 Updated California Transportation Plan addressed this handicap by affirming the system approach and calling for performance assessment at the total system level (*2*).

California State Senate Bill 45 of 1997 split authority between the state and municipalities with regard to transportation improvement program funding. But the bill also made it possible for the regions and the state to suggest projects to be funded at either level of decision making. In effect, California can recommend projects at the regional level, and the regions, in turn, can recommend projects for state funding. The process requires a consistent method for comparing projects and programs. System performance measures provide some of the tools for making these comparisons.

The question remains as to what system performance measurement will do. Performance measurement is a standard management function that will enable managers and other stakeholders to determine if their goals and objectives are being met. A sound performance measurement framework involves three key components:

1. A clear direction or purpose, often enunciated as a vision;
2. A simple set of metrics based on readily obtainable data; and
3. Routine, readable reports.

The purpose of performance measures and indicators is to show where a project stands and what the next step should be. Performance measures and indicators provide a benchmark for comparing performance against best practices, identify opportunities for improvement, and guide resource allocation. The measures and indicators must be understandable to government officials, planners, and the public. The information or data provided should be obtained at a reasonable cost and with reasonable effort. Finally, the measures must be reported regularly so that the progress of transportation projects can be continually monitored.

Performance measurement can assume perspectives as rich and diverse as the transportation system itself. Total system performance depends on subsystem performance from such individual modes and programs as transit, highway, inland waterway, rail, airport, and shipping. The system works well when these subsystems and individual components execute well. There are different levels at which the transportation system and subsystems can be measured:

- **System outcome**. System outcome performance is focused on the benefits and costs accruing to society from a transportation system. Outcomes represent the values that society deems important but are often difficult to measure directly, thereby requiring indicators that can be measured using available output. Outcomes may be positive or negative. For example, a positive outcome of a rail construction project may be the reduction of traffic congestion. A negative outcome may be noise and the localization of air pollution around train stations.
- **Organization.** Organizational performance is the assessment of how well an agency or entity provides its service. Organizational performance is linked to system performance. If every organization and service provider performs well, the system will work better.
- **Individual mode or program**. Individual mode or program performance is clearly linked to system outcome performance. Moving from outcome performance to individual mode performance requires a greater need for detailed information. However, the added detail does not detract from the usefulness of each level of performance measurement. Using public transit as an example, it is important to know how many riders are utilizing each route within a transit authority's domain so that line managers are able to allocate resources to meet travel demand. Data collection for such an analysis may require the use of extensive surveys and line-by-line rider counts. Therefore, this degree of detail would be more appropriate at the state rather than regional level, where the cost of collecting such information would not likely be justifiable.

Desired Outcomes of a Performing Transportation System

The transportation programs that ultimately deliver services to foster mobility are designed to produce results benefiting society. In getting results that society values, there must be continuing vigilance to avoid unwanted side effects.

Nine transportation system outcomes have been identified; they fall into one of two categories: (a) system effectiveness and efficiency; or (b) system responsibility.

The outcome category of system effectiveness and efficiency focuses on providing reliable and cost-effective mobility and accessibility and on contributing to a strong economy. The outcome category of responsibility focuses on ensuring that those key deliverables are provided without unwanted consequences.

As some stakeholders have commented, there might be too many outcomes and some might overlap. However, the outcomes represent different regional and interregional priorities for decision makers. Some regions might focus on only a subset of the outcomes.

California recognizes that some of these outcomes cannot be used consistently for both system performance monitoring and forecasting. This becomes evident when specific measures and indicators are reviewed and evaluated. A list of the system performance outcomes under evaluation follows; though interrelated, the outcomes are not prioritized.

Effectiveness & Efficiency

- **Mobility and accessibility—**Reaching desired destinations with relative ease, within a reasonable time, at a reasonable cost, and with reasonable choices.
- **Reliability—**Providing reasonable and dependable levels of service by mode.
- **Cost-effectiveness—**Maximizing the current and future benefits from public and private transportation investments.
- **Customer satisfaction—**Providing transportation choices that are safe, convenient, affordable, comfortable, and meet customers' needs.
- **Economic well-being—**Contributing to California's economic growth.

Responsibility

- **Sustainability—**Preserving the transportation system while meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- **Environmental quality—**Helping to maintain and enhance the quality of the natural and human environment.
- **Safety and security—**Minimizing the risk of death, injury, or property loss.
- **Equity—**Fair distribution of benefits and burdens.

A continually evolving "state of the system" report is critical to the success of the California initiative. Once again, data is key. System data on all modes, regions, markets, and other aspects of state transportation will be critical.

TRB's Role in Data Collection

As states from Kentucky to California prepare for transportation in the new millennium, it is important that TRB remains in the forefront. The findings of TRB's 1997 Spring conference—Information Needs To Support State and Local Transportation Decision Making into the 21st Century—were landmarks in the effort to address transportation data needs (*3*). Those findings must guide future efforts. The content and the methodological and institutional improvements listed in the conference findings will provide state transportation officials with the data and technology for remaining effective at their jobs.

CONCLUSION

The future of data in transportation decision making lies along one of two divergent paths. One perpetuates a greater reliance on good, high quality, statistically relevant, timely, and useful data for decision making. This comes at a high cost that often outweighs the near-term benefits. The other path, and the one often followed for budget reasons, leads to a "data-free analysis zone" in which decisions are made without the benefit of sound data.

The customer deserves the best. Data professionals must lead the transportation industry along the right path.

REFERENCES

1. Pisarski, A. E. Transportation Planning, Policy, and Data: Inextricable Linkages. In *Transportation Research Record 1660*, TRB, National Research Council, Washington, D.C., 1999, pp. 5–14.
2. *1998 California Transportation Plan, Transportation System Performance Measures, Final Report*. California Department of Transportation. 1998.
3. Information Needs To Support State and Local Transportation Decision Making into the 21st Century. Proceedings of a Conference. Irvine, California, 1997.