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Integrating the End User Into Infrastructure Systems: Directions in the U.S. Intelligent Transportation Systems Program

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ABSTRACT

This article analyzes the role of Intelligent Transportation Systems (ITS) in providing user-oriented information services to surface transportation travelers. Drawing upon a loose analogy to the airline reservation system, the article describes the means by which ITS could enhance an active role by the user in the transportation system. Preliminary evidence from demonstration projects around the country is reviewed with an emphasis on the role of users in producing and using information about traffic conditions, traveler information and emergency services. The author closes with recommendations for creating a next generation of ITS systems that more strongly feature user-based elements akin to the airline reservation and yield management systems.

THE PROMISE OF INFORMATION INTENSIVE SYSTEMS

Robert Crandall, the former Chairman and CEO of American Airlines, once remarked that his Sabre information system was one of the most important advances in travel over the last thirty years. While no doubt laced with the same self-confidence that propelled him to transform an industry, the comment is not without merit: the Sabre system served as the information system that facilitated discounted flights, costumer loyalty (e.g. frequent flyer) programs, and new hub-and-spoke service designs that translated the concept of yield management into reduced fairs and increased service.

Besides an anecdote on Mr. Crandall's business acumen, the explosion of the information dimension of the airline travel business has an important message for infrastructure system designers—the consuming public is ready to take charge of its transportation choices. But, just as the Sabre information system needed to be in place before the benefits of yield management could be realized, the challenge for surface transportation professionals is to create timely, useful, reliable, and interpretable information systems that the consumer can use to guide their choice of mode, time and route of travel.

Over the last decade, the U.S. Intelligent Transportation System (ITS) program has positioned itself as the provider of information systems for surface transportation system users. Consequently, transportation planners, policy makers, engineers and service providers associated with ITS need to consider how these systems can best accommodate the needs of various end users of the nation's highway, transit, pedestrian, and bicycle systems. Within the wide array of technology-based services that constitute the ITS program, the main concern here is how travelers obtain and use "advanced traveler information services" such as real-time information about travel and traffic conditions. Using a loose analogy with the air travel system as a point of comparison, this article draws upon recent user-related ITS research findings to suggest a next generation of information system design and use.[1]

THE INFRASTRUCTURE-CUSTOMER CONNECTION

As initiated in the late 1980's, the original vision of ITS foresaw a strong public sector role in creating a consumer information platform. For example, the landmark plan for the federal program, *Mobility 2000* (1990), articulated the vision for a publicly supplied information system that would feed "value added" private sector traveler information services. Over the last decade this vision has been tested, and a major lesson from demonstrations and deployments is that *the relationship of the consumer to the infrastructure is more complex than at first envisioned*. This is true in terms of both the direction of the information flow between the infrastructure and the customer, and the perceived value and use of this information across consumer groups.

Starting with the direction of the information flow, several early field demonstrations have provided important hands-on experiences with getting accurate and reliable information about transportation system conditions (U.S. DOT, 2000). During the mid-1990's, perhaps the most visible demonstration was the TravInfo project in San Francisco. TravInfo sought to create a state of the art public-sector led platform for providing multi-modal information to travelers. In this highly visible case, the public sector information system became hampered by institutional and technical limitations in being able to deploy a publicly financed and managed traffic sensing system in a timely matter (Yim and Deakin, 2000).

These limitations in traffic system deployment have led to an interesting change in the flow of information. As a result of the TravInfo demonstration experience, the Metropolitan Transportation Commission is now evaluating new *public-private partnerships in the production of traveler information*, including data emitting from wireless probes. That is, the consumer is moving to be a part of the information production, not just consumption. A similar though perhaps less stark pattern is occurring throughout U.S. metropolitan areas. Through cell-phones, call-ins and probes, the travelers and the cars they are in are emerging as an active part of the surface transportation information system.

BROADENING THE CONSUMER VIEW

While traveler information market studies have consistently revealed a modest "willingness to pay" for broad based travel information, this belies the utility the information has for those who receive it (Lappin, 2000). For example, in the model deployment initiative in Seattle, several different users were identified and different travel information sources were highly valued and used by these groups (Jenson, et al, 2000). There is a continuing interest, for example, in television-based video feed information services for those who infrequently use computer technology, and on the other hand, there is high interest and use of web-based information among the facile internet users who in this case tended to be younger.

Findings from Seattle and other sites point the way to a more detailed understanding of market niches for traveler information, including what I would dub the "flexible traveler". The flexible traveler is perhaps the unsung hero of the transportation system. The flexible

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traveler has not been studied closely, but might provide an important ingredient to bringing "yield management" to transportation systems. The flexible traveler is one who, as the name implies, could and indeed would change their travel time if he or she could have a more reliable (and quicker) transportation. The Washington, D.C. demonstration uncovered that ATIS systems were as useful for improving the reliability of service as they were for improving the timeliness of service (Wunderlich, et. al, 2001). While the transportation-telecommunications literature has closely examined the impact of telecommute programs, the impact of flexible commute arrangements is arguably as important if not more important to smoothing out "spikes" in travel demand.

FLEXIBLE YET DEMAND PREDICTIVE SYSTEMS

A common thread woven through these trends, market research studies, and demonstration projects is the emergent transformation of the transportation system from something that is industrial in its organization—a concrete, asphalt and steel system that uninformed consumers travel in predictably inefficient ways, to something which is understood and used in a manner that is highly dynamic, end user specific, demand responsive, and information intensive. That is, the new surface transportation system is becoming more like the consumer relationship with the air travel reservation system today.

Of course, economists have long argued that pricing provides the simplest and hence preferred mode to convey information about demand relative to supply. When demand increases relative to fixed supply (e.g., peak-hour capacity), the price rises and when demand falls relative to supply, the price will correspondingly fall. Travelers accept that when they assess their air travel choices—price sales occur off peak and price premiums occur during business days. Yet, for most parts of the United States "congestion pricing" or "value pricing" remains an untried option. Where Electronic Toll Collection (ETC) has been introduced, however, it is providing demonstrable savings to users. For example, the evaluation of New York's E-Z Pass program found widespread technology acceptance among users (though there have been some problems with regard to customer support) (Vollmer, 2000). It is not surprising, therefore, that this E-Z Pass system is becoming a de facto standard for the middle Atlantic states as some seven states now use the E-Z pass system.[2] These and related systems around the country are setting the stage by providing transactional platforms for a more dynamic and information-based transportation system.

DEVISING EMERGENCY USE PARTNERSHIPS

The transportation system must function safely as well as efficiently, and these twin objectives have an information analogy: information systems are needed to facilitate rapid response to emergency situations throughout the transportation network. It is instructive to note that the advent of private sector telecommunications and cellular service has played a pivotal role in bringing the safety information network online. Between 1990 to 2000, the percent of 911 calls from mobile devices exploded from 20,000 to 120,000 *per day* (Comcare, 2001). The role of mobile telematics in detecting travel hazards and providing safety services has become substantial, and a consortium has arisen to promote innovative services through a transportation-health care partnership.

Indeed, the advent of the new e-911 mandate (for being able to determine location based on cell-phone call) will usher in a new era of mobile related emergency service. The recent demonstration in Minnesota of Mayday Plus demonstrates the possibilities for enhancing access to emergency services. This demonstration, conducted over the last two years, integrated cellular communications, Global Positioning Systems (GPS) satellite technology and a special emergency response communications system installed at Mayo Clinic and Minnesota State Patrol emergency dispatch centers. The Mayday Plus system successfully provided authorities with automatic collision notification, and information such as location and crash severity from in-vehicle devices. (Castle Rock Consultants, 2000).

Beyond this demonstration, operations such as the ComCare Alliance have created new institutional alliances to help ensure critical services are delivered within the narrow "golden hour" between an accident and the onset of medical services. With a large percent of fatal accidents occurring in rural areas, the new e-911 requirements provide an important tool for delivery of these critical safety services. Moreover, they highlight the innovative types of partnerships needed to deliver ITS across a broad range of users. In this case, it involves a new form of interorganizational system (IOS) partnership with healthcare providers, emergency service providers, and the state police (Horan and Schooley, 2002).

DIRECTIONS TO THE NEXT GENERATION

A new 10-year ITS Program Plan is being developed by the U.S. Department of Transportation. In the current version of this plan, the importance of the end user is explicitly recognized. The relevant section states the ITS program should focus on: "providing effective, end-to-end, seamless, multi-modal transportation services for people wherever they live, work, and play regardless of age or disability…and helping make travel time more productive, by flexibly enabling more travel choices for more people"(ITSA, 2000). The challenge is to deliver a system that will indeed produce this seamless experience.

Even the prescient Robert Crandall could not have foreseen the extent to which consumers would take control over their travel choice. The Sabre system was originally designed for the travel agent. But, of course, the World Wide Web changed all that, making the travel agent one of the many functions to be "disintermediated". In the spirit of these times, the Sabre system gave birth to Travelocity, which has since become a shining star in the otherwise darkened sky that constitutes the e-commerce galaxy. Among those enterprises that continue to shine, a fundamental principle is the dedication to a consumer focus, alternatively termed mass customization (e.g. Dell), personalization (e.g. Amazon), or, more generally, customer relationship management (CRM).

For the transportation professionals generally and the ITS program specifically, the corresponding challenge is to devise and execute an information system that can satisfy the individual traveler and affect overall system choice and performance. The lesson from CRM approaches (and the longer history of customer-centric management models) is that information systems can allow for both highly tailored relationships with customers while generating overall system efficiencies. This begs the development of a more flexible transportation management network that can respond to personalized information and choice.

While ITS has increasingly allowed information to be available to consumers, it has not achieved the level of user acceptance and use as the air travel reservation system enjoys.

However, there is abundant reason to believe that information about choice enhances system efficiency. In surface transportation, choice has been constrained due to a number of policy, market and technological circumstances. However, there are an increasing number of modal options being pursued in metropolitan areas—transit, light rail, car sharing, and e-commuting. The role of the ITS system should be to access choice of these modal options, and this should include priced travel options, as well as alternative- time travel options.

In short, what is needed is a strategic approach that uses information to integrate users as an active feature of the infrastructure system. In the future, is it not conceivable to think that information will become as important to all travel constituents as it is currently to the commercial delivery business such as Fed-Ex—where the information about where the package is, is as vital as the actual location of the

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package? The next generation of ITS can and should be deployed to better plan, manage, and disseminate information on behalf of the user of the surface transportation system.

ENDNOTES

1 For a more complete discussion of this cross-industry comparison, see Horan and Reany (2001). An earlier version of this article appears in the research summary publication of the Transportation Research Board, *TR News, (January/February, 2002)*.

2 The states are Delaware, Maryland, Massachusetts, New Jersey, New York, Pennsylvania and West Virginia, see http://www.ezpass.com/interagency.shtml#i

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