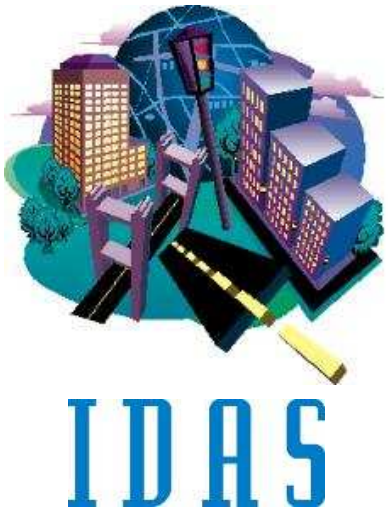
Introduction

The National ITS Program has been involved in the development of several key traffic analysis software systems, with the government playing a variety of roles. Sometimes the government directly sponsors the development and maintenance of the software. Sometimes the government partners with private vendors, which then integrate new algorithms into their existing product lines. Other times, the government is heavily involved at the outset, then transfers responsibility for the software to an Open Source community. The public investment has produced software that meets the needs of transportation professionals, resulting in a wide variety of public benefits, such as better decision-making and more responsive traffic signal operations.

Below are profiles of three software systems and the return on investment that the public has experienced.

ITS Deployment Analysis System (IDAS)

The Problem



Transportation planners use software models to get answers to key questions about the future, such as: "What benefits can I expect if I make this particular investment?", "Will those benefits outweigh the costs?", and "Which scenario would give me the most value for my money: doing a lot, doing only a little, or doing nothing?“ Most models, however, forecast using average conditions, such as a typical weekday with good weather and no traffic incidents, and ignore the extreme cases, such as a holiday weekend with a severe snowstorm and multiple crashes on the freeway. Intelligent Transportation Systems (ITS) and other operational improvements excel at tackling those extreme conditions, making the bad traffic days more like the average. So the tools that many transportation planners use to determine benefits and costs often miss the benefits offered by ITS and improved operations.

The Opportunity

ITS Deployment Analysis System (IDAS) (idas.camsys.com) was developed to address this need. IDAS estimates the benefits and costs of over 60 different types of ITS technologies and operational improvements, either working individually or in combination with each other. IDAS operates as a post-processor to travel demand models. In other words, transportation planners take the outputs of their travel demand models and input them into IDAS. IDAS then outputs the benefits and costs of ITS and operational improvements under all types of conditions, from typical to extreme. The benefits estimated include reduced travel time, reduced delay, reduced crashes, reduced costs, increased throughput, and increased travel time reliability. U.S. DOT sponsored the development, maintenance and support of IDAS, which is available for purchase for $795 through the McTrans Center for Microcomputers in Education (mctrans.ce.ufl.edu).

IDAS (continued)

The Results

IDAS has been used successfully in dozens of studies nationwide (see table), including analysis of both ITS and operational improvements, as well as more traditional capacity and freight improvements.

Nathan Masek of the Mid-Region Council of Governments in Albuquerque, NM used IDAS to evaluate the costs and benefits of individual ITS projects, and the results were surprising: a benefit-to-cost ratio of 10:1 for large projects, compared with 2:1 or 3:1 for smaller projects. He said that IDAS "**provided us a clear, comparative mechanism to evaluate benefits of projects that aren't necessarily apparent or considered in the normal project programming and prioritization process**."

Subject of Evaluation	Location(s)
Alternatives analysis for a Long Range Plan (LRP)	Hampton Roads, VA; Minneapolis-St. Paul, MN; Tucson, AZ
Benefits of full regional ITS deployment	Cincinnati, OH; Seattle, WA; Tucson, AZ
Existing transportation management centers (TMCs)	Cincinnati, OH (ARTIMIS); Phoenix, AZ (AZTech)
Freight/goods movement	Seattle, WA
High-occupancy vehicle (HOV) operations	Minneapolis-St. Paul, MN
ITS system, pre-deployment	Ann Arbor, Detroit, Flint & Lansing, MI
ITS costs for a strategic deployment plan	Kansas statewide; Missouri statewide
Major Investment Study (MIS)	Long Beach, CA (I-710); St. Louis, MO (I-70)
Ramp metering	Dade County, FL (I-95)
Temporary ITS in a work zone	Lansing, MI (I-496)
Tolling as part of congestion management	Kansas City, MO

Adaptive Control Software-Lite (ACS-Lite)

The Problem

A significant portion of traffic delays on arterial streets is the result of outdated signal timing that is not versatile enough to respond to normal variations in traffic conditions. Most cities operate their traffic signals on fixed timing plans and do not have the resources to update their signal timings according to the recommended standard of every three to five years. Several products on the market offer adaptive control software (ACS), where signal timings change minute-by-minute based on current conditions. However, many cities are reluctant to adopt ACS because of complexity of the software and intense communications and detection needs that all add up to higher operations and maintenance costs.

The Opportunity

U.S. DOT saw the need for a middle ground in traffic signal timing: low-cost, easy-to-use software that would with work equipment that most cities already have; and the result is ACS-Lite (www.ops.fhwa.dot.gov/acs_lite/index.htm). But the U.S. DOT took a non-traditional approach to addressing this need, developing the ACS-Lite software in partnership with the private sector and academia. Four vendors – Eagle/Siemens (www.siemens.com), Econolite (www.econolite.com), McCain (www.mccaintraffic.com) and PEEK (www.peektraffic.com) – are licensed to integrate ACS-Lite into their existing product lines. These vendors will sell the ACS-Lite-enhanced software as well as provide ongoing user support.

ASC-Lite (continued)

The Results

Each of the four ACS-Lite vendors has performed a test of the system, and results are available from two. A test of the Econolite ACS-Lite system at nine intersections along Hamilton Road in Gahanna, OH resulted in:

- 0.1% less delay
- 17% fewer stops
- 4% less fuel consumption
- **Daily benefit of $340**
- **Annual benefit of $88,500**

A test of the Eagle ACS-Lite system at eight intersections along State Route 6 in Houston, TX resulted in:

- 35% less delay
- 24% fewer stops
- 7% less fuel consumption
- **Daily benefit of $2,221**
- **Annual benefit of $577,648**

Photo credit: IStockphoto International, Inc.

Considering that the cost of these systems is around $5,000 to $10,000 per intersection, users of ACS-Lite should recoup their investment very quickly.

Eager to experience these kinds of benefits for themselves, about a dozen cities have expressed interest in deploying ACS-Lite. For Kirk Houser, Traffic Engineer for the City of Tyler, TX, not only did ACS-Lite enable him to better understand the system's performance, it also allowed Tyler's traffic signal network to respond to variable conditions and reduce delay, which surveys indicated was city residents' Number 1 concern. "**The traffic plans we had in place were pretty good, but it has always been difficult to time a system when it comes to variables like holiday and weekend traffic. ASC-Lite plans for those factors very well. It updates timing once every five minutes, instead of every five seconds… and costs a fraction of the full system cost.**"

Next Generation Simulation (NGSIM)

The Problem

Operation of roadways is growing more and more complex. Today's transportation professionals are faced with evaluating many diverse and comprehensive solutions to address congested transportation facilities. Instead of simply deciding how many lanes to design for a new freeway or how long the turn bays should be at a traffic signal, practitioners are now required to analyze such complex strategies as ramp metering, adaptive traffic signal control, complicated weaving patterns, multimodal corridor management plans and congestion pricing. Traffic simulation analysis tools can help evaluate these complex solutions by modeling real-world transportation networks on a system-wide scale that is difficult with more traditional methods. It is critical these traffic simulation tools be accurate and trustworthy, so that they can be used to make sound investment decisions.

NGSIM (continued)

The Opportunity

U.S. DOT began the Next Generation Simulation (NGSIM) (ngsim.fhwa.dot.gov) program in a new role of market facilitator that manages public resources in a focused way. The goal is to influence and stimulate the commercial modeling market by fostering an environment of public-private coordination. This new role has resulted in a unique public-private partnership between the U.S. DOT, transportation consulting companies, university researchers and commercial simulation software developers. U.S. DOT is not developing software, but instead is fostering conditions under which the software is developed by private vendors. The government's role is one where a core of open behavioral algorithms has been developed, along with supporting documentation and validation data sets, that describe the movement and interaction of multimodal travelers and vehicles within the roadway system.

Four core algorithms (freeway lane selection, cooperative/forced freeway merging, arterial lane selection, and oversaturated freeway flow) and four data sets (I-80 in Emeryville, CA; U.S. 101 and Lankersham Boulevard in Universal City, CA; and Peachtree Street in Atlanta, GA) have been developed under NGSIM.

The Results

Commercial software developers are showing great interest in NGSIM. PTV (www.vissim.us), Traffic Simulation Systems (www.tss-bcn.com) and Quadstone (www.paramics-online.com), developers of the traffic simulation models VISSIM, AIMSUN and Paramics, respectively, have incorporated the freeway selection algorithm into their products on a test basis and validated the algorithm, meaning that the results of the simulation can be trusted as an accurate forecast. Over the coming year, responsibility for continued development, maintenance and support of NGSIM will be transferred from the government to an Open Source community. In an Open Source community, software is distributed to a community's members, with membership open to all interested individuals, many of whom contribute to the development, maintenance and support of that software. NGSIM's many developers and users applaud NGSIM's transition to an Open Source environment and see it as key to making the software even more useful. Nagui Rouphail, director of the Institute for Transportation Research and Education at North Carolina State University, says that NGSIM "**represents a model public-private partnership that has yielded demonstrable benefits for both the public and private sectors.**"

Conclusion

Playing a variety of roles, each appropriate to the individual situation, U.S. DOT has been instrumental in the development and widespread use of software systems that makes it easier for transportation professionals to do their jobs. This, in turn, makes it easier for them to fulfill their mission of improving the quality of life for the traveling public.

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