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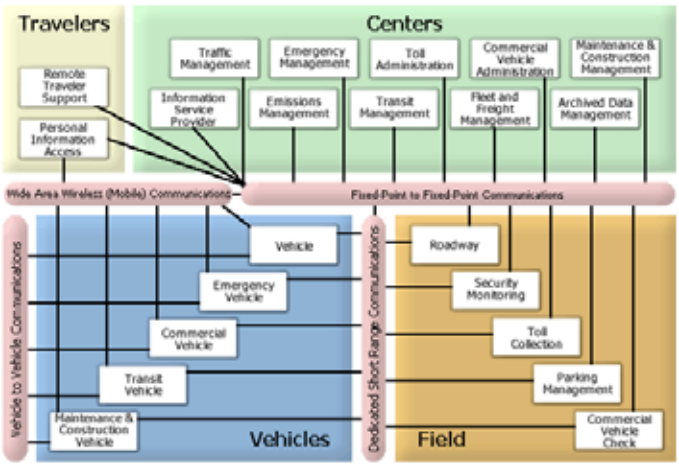
Regional ITS Architecture



ATAC is assisting the North Dakota Department of Transportation (NDDOT) and the state's three metropolitan planning organizations (MPOs) in Bismarck-Mandan, Fargo-Moorhead and Grand Forks-East Grand Forks with the development of regional Intelligent Transportation Systems (ITS) Architectures.

The Federal Highway Administration (FHWA) issued an ITS Architecture conformity rule that requires all states and metropolitan areas which have used federal funds to finance ITS projects to develop regional ITS Architectures by April 2005. A set of minimum requirements identified by the FHWA must be met by regions affected by the rule.

What is an ITS Architecture? It is a roadmap that can be used to plan future ITS, define system requirements, coordinate agency roles and integrate functions across jurisdictional lines. To aid in the development of these architectures, the FHWA has provided a common framework called the National ITS Architecture. An interactive architecture development tool, Turbo Architecture, was developed by the FHWA to assist regions in customizing the national architecture to suit their specific needs, circumstances and operational goals.

The effort is guided by a project management group consisting of MPO, NDDOT, FHWA and ATAC staff. Also involved in the process are agencies from each region which own, operate or maintain ITS technologies plus area stakeholders impacted by the operation of the systems.

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Travel Demand Model Support Agreement Extended

In addition to supporting travel demand modeling for metropolitan areas across North Dakota, ATAC has been working on refining these models and providing training to local agencies. An agreement to provide that support was extended to 2006.

"The ultimate goal of the travel demand modeling support program is to develop a resource for transportation planning suited for small to medium sized urban areas," says Ayman Smadi, ATAC director. "We want to give transportation planners a decision-making tool that provides responsive and accurate answers while minimizing their investment of resources."

Partners in the agreement with ATAC include:

- The North Dakota Department of Transportation
- The Bismarck-Mandan Metropolitan Planning Organization
- The Grand Forks-East Grand Forks Metropolitan Planning Organization
- The Fargo-Moorhead Metropolitan Council of Governments

ATAC specialists will work on refining models to make them more accurate for local conditions. They will also incorporate new technology and techniques into the models and provide training to transportation professionals.

"As a university center with ties to local, state and national transportation professionals, ATAC is uniquely positioned to serve as a neutral source for modeling expertise and advice," Smadi says.

In its role as a support center, ATAC helps metropolitan areas select and develop models and customize them for their use. Specialists advise planners on how to best structure the model and what data to use to obtain the most accurate results. They also compare results from the model with traffic counts and other field data to ensure accuracy.

ATAC staff are also experts at collecting data and advising traffic planners on how to collect data that will be most useful in modeling systems. They also stay abreast of technical developments such as new, upgraded or enhanced software.

In some cases, ATAC staff will assist partners with special studies focusing on specific areas or travel corridors or major construction projects.

"We take our role as a support center very seriously," Smadi says. "We want to be flexible in our service to help our partners get the most out of their investment in these modeling systems."

Bringing Technology Home

ATAC often serves as an advanced technology scouting service for local transportation professionals.

"Our staff frequently attends conferences and trade shows to meet new vendors and stay abreast of new technology," says Kate Miner, an associate research fellow with ATAC. "When we see technology with potential for application in the region, we try to arrange meetings or demonstrations."

The center hosted demonstrations of the Smart Zone portable traffic management system in Fargo and Bismarck in the summer of 2003. The system, marketed by ADDCO, Inc., of St. Paul, Minn., is a portable traffic management system. It collects traffic data via sensors, monitors traffic flows using video cameras, and updates drivers with real-time information using a dynamic message sign.

The center also facilitated demonstrations by OFS Communications, a fiber-optic technology company that NDDOT employees had seen at the ITS America trade show. Representatives from OFS explained the capabilities of various fiber-optic products, criteria for selecting them for ITS applications, outlined construction and design issues, and offered suggestions on what to look for in contractors.

Jonasson Oversees Grand Forks Traffic Improvements

When Dan Jonasson goes to the Ralph Engelstad Arena or the Alerus Center in Grand Forks, he's usually not there to cheer on UND athletics or sing along with Tim McGraw. As Grand Forks' traffic engineer, he's there to watch traffic with an eye toward improving its flow.

"I have monthly meetings with the staff there to review events and decide what traffic plans to put into place," he says. "We developed several plans to implement, depending on the level of expected traffic."

Since the venues were opened in 2001, improvements have included a dynamic message sign on DeMers Ave. to provide traffic direction. Also, overhead changeable signs on DeMers can convert one of the through lanes to a left turn lane to help traffic leaving the centers.

The activity at the Alerus Center and the Ralph Engelstad Arena are only part of the challenges of managing traffic in a growing city. "The biggest challenge we face is continued rapid growth in the southern areas of the city, particularly congestion along 32nd Ave," Jonasson says.

"We work with our planning department and developers when they submit the site plans to try to maintain adequate spacing and limit the access to our arterial roads that carry traffic in this area. Typically, developers would like an access road for every business and a signal everywhere there is an access point. The challenge is to convince them that limited access benefits them as well as the public by providing good traffic flow for the growth in this area."

The rapid growth in the area is also straining federal funding to the city. "Federal funds are used to build some of the new collector roads and arterial roads. This takes federal funding away from our other roads in the city that badly need repairs. It's a challenge to balance programming of projects to cover both ends," he says.

NDSU's Advanced Traffic Analysis Center has provided help in improving traffic flows in the city, Jonasson notes. With funding from the Grand Forks-East Grand Forks Metropolitan Planning Organization, the center helped the city coordinate traffic signals along South Washington Street and developed a regional plan for implementing intelligent transportation systems. The center is also evaluating safety for traffic and pedestrians near Century Elementary School. "We've been very happy with the studies ATAC has done," he says.

Jonasson recently moved back to his hometown of Milton in southeast Cavalier County. He commutes the 90 miles to Grand Forks each day. He holds an associates degree in civil engineering and surveying technology from the North Dakota State School of Science in Wahpeton. He worked for Interstate Engineering in Jamestown for seven years on NDDOT and city road and bridge projects.

In 1998 he went to work for the city of Grand Forks, maintaining the LANDCADD computerized planning network for its engineering department. A few months later he was promoted to traffic engineer.

One of Jonasson's first big projects was to install video detection equipment to control the traffic signals in the city. Grand Forks and Minot installed some of the first video control systems for traffic signals in the state. "Now, video detection is the standard for the city," he says.

Previously, signals were controlled by electric loops in the pavement that detected traffic. "With loops we had a high failure rate. They couldn't withstand the freeze-thaw extremes. We were cutting new loops into intersections every year at a cost of $10,000 to $25,000. With video, we don't have any of that expense and inconvenience," Jonasson says.

The video systems are also more flexible. "We can move the detectors to where they need to be if we have a construction project that requires us to shift traffic. We can also dial them up and look at traffic flow from the office and make adjustments. If there's a complaint, we can dial up the camera and look at what's going on. They save us a trip to the field quite often."

In addition to his responsibilities as a traffic engineer, Jonasson also helps plan and coordinate all NDDOT projects within the city.

With ATAC Help, Travel Demand Model Helps Smooth F-M Traffic Flow

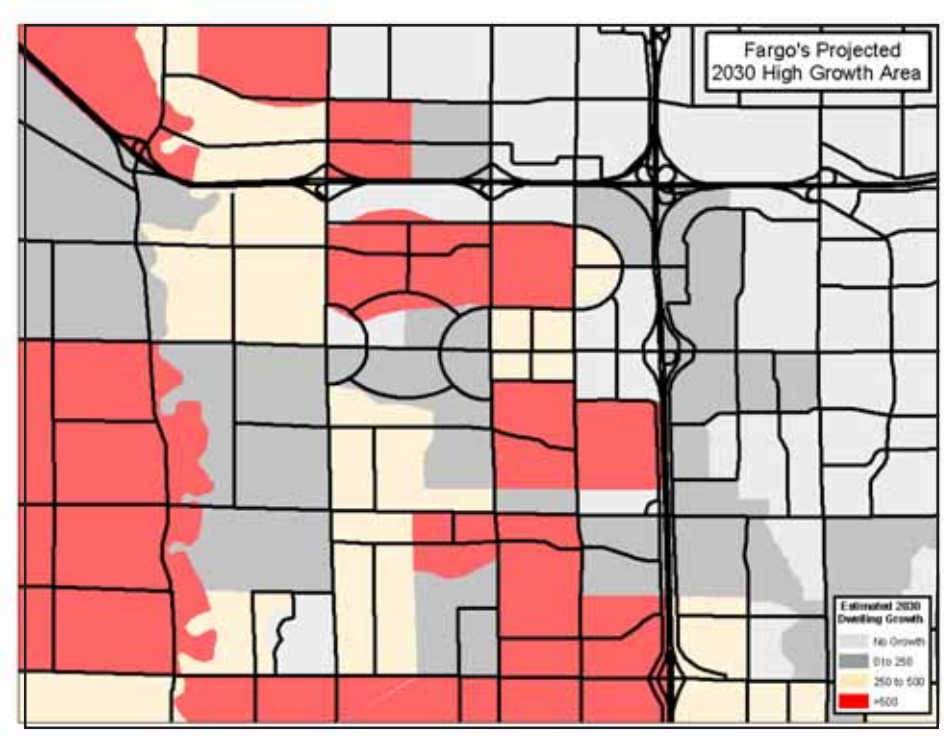
Rapid growth often comes with growing pains. That's been the case in the Fargo-Moorhead area as planners work to develop a transportation system to support increased mobility needs and sustain economic development in the area.

Future traffic flow will be improved and current detours and delays would be worse if not for the efforts of ATAC. Since the fall of 2001, ATAC specialists have been supporting the Fargo-Moorhead Metropolitan Council of Governments' (F-M Metro COG) planning efforts with a travel demand model, a complex computerized model that predicts the future demand placed onto the roadway system due to changes in socio-economic and land use characteristics.

Planners use the model to examine "what if" questions to set priorities for building or upgrading streets. "The model allows planners to evaluate proposed changes in the transportation infrastructure before they are implemented," explains Jerilyn Swenson. For example, the model can be used to look at lane closures during construction, street widening or the addition of turn lanes, and view how it impacts the transportation system.

"The model helps communities understand their transportation problems and develop successful strategies for dealing with those problems," Swenson says.

ATAC worked with local planners to evaluate the previous F-M Metro COG's model and developed a list of improvements to address its limitations. The old model could use only a limited number of files for input and was difficult to customize for growth and changes in area.



ATAC researchers evaluated several commercially-available modeling programs and choose the best one to incorporate into the updated Fargo-Moorhead travel demand model.

"The current model is much more reflective of the growth in population and economic activity that we're seeing in the area," Swenson says. The model includes more than 375 traffic analysis zones – areas denoted by land use such as residential, commercial, retail, industrial, etc. – and incorporated the ability to estimate the number of trips between those zones.

A peer review was conducted by consultants hired by the F-M Metro COG to evaluate the new model and found it to be well ahead of models used by similar sized cities. They also made suggestions on how the new model could be improved. ATAC specialists integrated those changes into the current F-M Metro COG's travel demand model.

The model is currently being used to guide long- and short-range transportation planning in the four cities within the F-M Metro COG. Planners use it to help identify and prioritize transportation improvements in the area and examine policy changes and their effect on the transportation system. The model can also help identify areas of public concern and assess environmental and economic impacts of current traffic patterns on planned changes.

It can also be used to conduct smaller, more detailed analysis of specific areas. Researchers are looking at how to improve traffic flow on 52nd Avenue in South Fargo as the city expands south. The model can also be used to estimate the extra delay or cost impeded to motorists from construction. Those estimates can be used to set contractor incentives or disincentives for the project.

ATAC Supports North/West Passage Program

Interstate highways seamlessly link the nation, but there can be some rough transitions at state lines in terms of the technology that helps drivers along the way.

ATAC is working to smooth out those transitions as part of the North/West Passage coalition. The goal is to unify Intelligent Transportation System (ITS) components along I-90 and I-94 nationwide. Currently, Minnesota, North Dakota, and Wisconsin have been actively participating in the pooled fund study. ATAC has been a part of the project since March of 2003.

"Differences in technology, approaches and politics are primary challenges," says Kate Miner, ATAC associate research fellow. "ATAC is involved to provide a non-partial evaluation of systems and technology," she says.

Differences between states include inconsistencies in traveler information relating to traffic management and weather related incidents, communication protocols, and lack of common systems.

Coalition partners identified nine projects to study. The projects range from integrating the states' 511 traveler information systems to installing communications technology to control an automatic de-icing system on the Red River Bridge between Moorhead, MN, and Fargo, ND.

ATAC is preparing a "lessons learned" document for the coalition. In the document ATAC staff will examine two different ITS systems used in the cooperating states for road condition reporting and identify strengths and weaknesses of each system. Professionals involved with ITS will be able to use the document to guide future ITS use. "The document will allow all states to build on each other's experiences," Miner says.

Similarly, ATAC has developed a Web site for the coalition. Project reports, meeting minutes and other information are posted there. "The Web site facilitates the sharing of information among members and will allow non-members to follow the coalition's progress," Miner says. The address for the Web site is www.nwpassage.info

Members of the coalition provide funding for the projects and the group hopes to expand beyond the initial three states to provide nationwide unity along I-90 and I-94. "These issues will continue to be important into the future as technology changes and new applications are developed." Miner says. Washington, Wyoming, Idaho, Montana and South Dakota have expressed interest in the effort.

ATAC Helps Develop Bismarck-Mandan ITS Plan

ATAC's influence on travelers will be felt into the future in the Bismarck-Mandan area. With sponsorship from the Bismarck-Mandan Metropolitan Planning Organization, ATAC helped develop an Intelligent Transportation System (ITS) Plan for the area. The Bismarck-Mandan area, being required to develop a regional ITS Architecture by April of 2005, chose to develop a strategic document to coordinate ITS initiatives which would then support the development of the regional architecture.

To guide development of the plan, a stakeholder group was assembled and included staff from city and county traffic engineering, public works, emergency management, city fire departments, law enforcement, areas of special interest, elected officials, private citizens, etc. The members provided input regarding difficulties in the transportation system through group discussion, input forms, e-mail and phone responses.

ATAC analyzed the responses received by the group to determine which transportation needs could be resolved through the use of ITS. The targeted needs were matched to specific ITS technologies, locations of deployment were identified, resource requirements for implementation were researched and agency champions for each project were addressed.

Swenson Wins Intelligent Transportation Systems Essay Contest

Jerilyn Swenson was one of two students selected as winners in the ITS America Student Essay Competition.

The competition is designed to encourage student interest and future participation in the development of intelligent transportation systems. Swenson won for her paper responding to the question: "Which ITS technologies are the most important to integration of mobility, safety and security, and what are the best current implementations of these technologies?"

The two winning essayists, Swenson and Virginia Tech student, Tushar Awar, presented their winning essays at ITS America's 14th Annual Meeting and Exposition, April 26-28, 2004, in San Antonio, Texas. They received transportation, hotel accommodations, complimentary registration, and up to $150 in expenses to attend the meeting.

The winning essays were published in the meeting proceedings' CD-ROM.

Welcome Back Shawn!

Shawn Birst, associate research fellow, was on a temporary leave from ATAC for military duty. Birst, a Sergeant in the Army National Guard, was deployed to Iraq until April 2004. He resumed his duties at ATAC in May this year. Birst's primary work is in the areas of traffic operations, traffic safety, and traffic data collection.

ATAC Staff Additions

Kate Miner joined ATAC in December 2002 as an associate research fellow. Miner's primary responsibilities include improving traffic operations through analysis and use of simulation software; supporting Intelligent Transportation Systems (ITS) planning, deployment, and evaluation; and assisting with instruction of classes sponsored by ATAC. Currently, Miner is focusing on the development the Regional ITS Architecture for North Dakota and streamlining dynamic message sign operations across the state.

Miner received her bachelors degree in civil engineering from NDSU in 1999. Prior to her position at NDSU, she worked for Moore Engineering, Fargo, N.D. and the North Dakota Department of Transportation as a traffic engineer in the Fargo District. While working on ITS projects, Miner is pursuing a masters degree in civil engineering with a transportation option and expects to be completed in 2004.

Jerilyn Swenson joined ATAC in July 2004 as an associate research fellow. She began work with ATAC in early 2002 as an undergraduate research assistant. Swenson's main responsibility is the design and maintenance of metropolitan transportation models. Swenson is key in the updating of network and socioeconomic information and the generation of specific traffic scenarios requested by clients. She performs model runs, analyzes the resulting data, and creates maps and data summaries for ATAC's clients. She has been involved with several long-range transportation planning projects and is currently working on various projects for the

F-M Metropolitan Council of Governments and the NDDOT. Swenson received her bachelor's degree in civil engineering the Spring of 2003 and is currently pursuing a master's degree.

Marcie Phillips, project support coordinator, joined ATAC in September 2003. She supports ATAC researchers working on the development of ITS plans and ITS architectures by acting as a single point of contact with project partners. She organizes stakeholder groups and relevant committees, sets up meetings, assists in collecting data, and coordinates the review of project material by researchers and stakeholders. Phillips is also assisting with the development of web pages for these projects.

Md. Ahsan Habib was hired as a full-time research assistant in September 2003. He began work with ATAC in 2001 as a graduate research assistant while pursuing a master's degree in computer science. Habib's work has primarily focused on system engineering. He is an expert in software development, as well as GIS and has developed several interfaces which have enhanced existing transportation analysis software used by researchers. Habib recently worked on system requirements for the Bismarck-Mandan ITS Strategic Plan and is working extensively with the development of ITS architecture for four North Dakota regions.

Habib earned a B.S. in computer science and engineering from Bangladesh University of Engineering and Technology in 1998 and a M.S. in computer science from NDSU in 2003.

Graduate Research Assistants

Jason Baker started at ATAC in 2002 as an undergraduate research assistant. His work focuses on data collection procedures and traffic analysis using simulation programs. Baker's primary interest is the analysis of traffic volumes through the use of traffic simulation programs to determine optimal traffic signal intervals. Baker was involved with data collection and analysis for the Moorhead Train Detection Project and is currently working on two NDSU traffic studies pertaining to parking, access and pedestrian issues. Baker received a bachelor's degree in Civil Engineering the Fall of 2003. He is currently pursuing a master's degree at NDSU.

Andrew Paulsen has been with ATAC since 2002. His work involves projects requiring electrical and computer engineering solutions. Paulsen has been primarily responsible for the develop-ment of an innovative Controller Interface Device (CID) which creates a connection between traffic controllers and traffic simulators. He is currently developing an embedded computer system and is in the process of writing the firmware and software necessary for its operation. Paulsen received his bachelor's degree in electrical engineering in the Spring of 2003 and is currently pursuing a master's degree at NDSU.

Khaled Shouman started work with ATAC in 2001 while acquiring his masters degree in civil engineering. His research has focused on the use of accurate traffic volume data, separating "right turn on red" movements from "through traffic" counts in order to effectively customize traffic detection device designs thereby ensuring their optimal operation. Shouman acquired a master's degree in civil engineering the Fall of 2003 and is currently pursuing a Ph.D. in transportation and logistics.

Mohammad Smadi has been with ATAC for more than four years. As part of his master's research he developed a knowledge-based expert system for an adaptive signal control. Mohammad has been involved in several software development projects and is assisting with system engineering for the Regional ITS Architecture development in North Dakota. His involvement with the current project includes the design of various ITS systems and identification of requirements and components necessary for the successful operation of the systems. Mohammad received his master's degree in computer science the Fall of 2001 and is currently pursuing a Ph.D. in software engineering.

Amber Alert Support Program

ATAC's expertise in Intelligent Traffic Systems – dynamic traffic management systems that often rely on high-tech, high-speed communication – is being put to use to help locate lost children.

A key component of "Amber Alert" systems is the use of dynamic message signs and other traveler information systems along the highway to relay descriptions of children, suspects or vehicles involved in possible abductions. "Accomplishing that is more difficult than it sounds," says Ayman Smadi, ATAC director.

Communications systems between traffic officials and law enforcement officials are not always compatible and updating traveler information systems with Amber Alert information in a timely fashion may be difficult. Also, there are not standards for Amber Alert messages for traveler information systems – where messages should appear, how long they should appear and how they should be worded.

ATAC researchers are examining current communications and data flows between the North Dakota DOT and law enforcement agencies and between NDDOT and its eight districts. The researchers will also assess the agencies' current use of traveler information outlets such as the Internet and dynamic message signs.

ATAC Completes Bismarck School Grounds Inventory

Bismarck traffic engineers will use data collected by ATAC to improve safety around schools in that city. ATAC researchers Dana Johnson and Jason Baker and a student from Bismarck State College created an inventory of objects on school grounds, such as signs and trees, and recorded their locations with global positioning technology. The locations were entered into a geographic information system database which engineers will use to conduct a city-wide school safety study.

UGPTI's Miner Earns Professional Engineer Designation

Kate Miner, associate research fellow at the Advanced Traffic Analysis Center, recently passed an exam to earn the designation of professional engineer.

"The designation will give me added credibility with clients and allows me to take broader responsibility for our projects," Miner says. Engineers who take the exam must have worked at least four years under the direction of a professional engineer. Miner's work at ATAC focuses on Intelligent Transportation Systems, technology-based systems employing traffic surveillance, electronic signs, signal timing and other tools to improve traffic flow and safety.

This newsletter is published by the Advanced Traffic Analysis Center to provide information about its research and services.