

A WORKING TSMO PARTNERSHIP BETWEEN IOWA DOT AND IOWA STATE UNIVERSITY'S INSTITUTE FOR TRANSPORTATION - CELEBRATING SIX YEARS OF SUCCESSFUL COLLABORATION

By: The Iowa Department of Transportation

IN THIS CASE STUDY YOU WILL LEARN:

1. The Iowa Department of Transportation (IOWA DOT) was one of the first in the nation to establish an active partnership with an academic institution.
2. The agency and the DOT work together to establish real world TSMO solutions on an almost daily basis.
3. In developing strategic and technological solutions, the partners are redefining industry workforce needs.



BACKGROUND

The Iowa DOT was one of the first in the nation to integrate TSMO into its operations. In 2013, the agency established the Office of Traffic Operations to focus on ITS, work zones, emergency management, data management, analytics, and traffic incident management. At the same time, and based on a long 20-plus year partnership, the DOT contracted with the Iowa State University's Institute for Transportation (InTrans) to provide research and support.

Iowa DOT has top down leadership support for operations and TSMO activities, with a great deal of effort going into understanding needs and integration opportunities. Because of that, the partnership between the agency and InTrans was natural. As of FY 2017, 42 people, mostly faculty and students were engaged in supporting the Iowa DOT in this collaboration.

It's a Roll Up Your Sleeves and Get to Work Effort

InTrans works with Iowa DOT staff daily from across the Operations Bureau's five offices (Operations, Traffic and Safety, Maintenance, Construction and Materials, and Motor Vehicle Enforcement). In addition, Hawkins meets with the Iowa DOT Operations Bureau on a

monthly basis. The InTrans traffic and operations team meets internally on a weekly basis and then with the DOT formally on a monthly basis. The contract is managed through these meetings as well as at the project and task levels. InTrans also provides quarterly updates.

At InTrans, students, faculty and staff support the DOT to generate not only practice ready solutions for the DOT but also scholarship, discovery, and implemented innovation. InTrans finds that doing



InTrans works with Iowa DOT staff daily offices

small, practically applied projects for the Iowa DOT leads to qualifications that compete at the regional and federal level. Even prior to the DOT's TSMO plan and service layers, InTrans saw that it could help the Iowa DOT navigate data, provide best practices for identifying and managing large data sets, facilitate data quality, streaming, cloud computing, and leverage innovation in a rapidly changing space.

Working Within Iowa DOT's Service Layers

The TSMO efforts are focused in five service areas: workforce development, traffic management, cooperative automated transportation (CAT), traffic incident management (TIM), and intelligent transportation systems (ITS).

Another area related to data management is ease of access to information. A lot of what InTrans does is make information accessible. If organizations are going to be more data-driven, they need data to be easily accessible. As an example, the Iowa DOT

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Sample of a TIM Plan Sheet

has thousands of TIM plans which were PDF maps that contained access links to traffic incident management routes and alternative routes. InTrans built an interactive map allowing single-click access to critical information. Another example is the use of tools such as Tableau to help users understand relationships among data. InTrans also works to improve the quality of data, ensuring its usefulness and accuracy.

EXPANDING THE ACADEMIC STREAMS

Academically, InTrans faculty are a part of Iowa State University's Civil, Construction, and Environmental Engineering (CCEE) Department with a traditional curriculum for civil infrastructure, roads, traffic signals, structural analysis, pavement materials, etc. However, effectively managing statewide traffic operations requires some new skill sets and this is where we saw some opportunity. Our team now consists of both civil, mechanical, and computer engineering students working together to manage large sets of data, work with high performance computing clusters, vast amounts of streaming data, computational processing, machine learning, performance reporting, and visualization. We are offering specific courses covering coding and these essential next generation transportation professional skills to our students who are then getting advanced degrees, and working in our industry as well as going to work at high-tech companies such as Amazon Web Services, Nvidia, and Microsoft.

LOWERING THE RISK

The annual plan was agreed upon but the detailed scopes were established as needs arose. This approach lowered the risk for both sides and left room to zig and zag according to discovery and what makes sense for both groups to pursue given what the Office of Traffic Operations was facing. The DOT also hires consultants for short term projects, and often, InTrans provides information on data

sources, data downloads, calculations, or other services on behalf of the DOT to their consultants. This arrangement has proven beneficial when the Iowa DOT wants InTrans to support TSMO efforts for internal and external partners such as Motor Vehicle Enforcement, Iowa State Patrol, and other groups.

While TSMO isn't identified as a specific curriculum, InTrans integrates the practice into projects and courses being taught by faculty. InTrans has created a set of tools that it has introduced into the classroom. One example is Tableau, which is data visualization software that helps engineers make decisions based on data. In addition, faculty engaged in working with InTrans have modified some graduate courses to use these tools and implement some operations related skills such as coding, data management, etc. An example is the course in traffic engineering which has been revised to incorporate new content on data alongside the more traditional basic traffic flow and control concepts.

Students in these classes also work with the live streams of data coming from the DOT. This requires students to understand the architecture of the ITS system to correctly interpret and process the stream data. They also must work with quality issues that arise with the data and the practical applications of using this information.

THIS IS A WORKFORCE ISSUE

This collaboration has helped to identify future workforce needs such as basic code writing to fetch or manipulate data, working with data feeds at one minute frequencies, understanding data architecture, cloud management, and so on. That applied research is then taken by Iowa State University faculty back to their classes to show students what's being done and why there's a need for it, and provide more formal training along these lines. The potential benefits for these student careers and our industry is significant.

There is a need, and our research support efforts create the demand, for transportation students to have a different set of skills to be leaders in our industry. This includes understanding streaming data sources like INRIX and HERE which is on a one minute frequency with varying segmentation and data quality aspects; knowing how to fetch and calculate massive data sets which are coming at you like a firehose; and in being comfortable with resulting accuracies, tools to relate performance with crash experience, and in thinking about how all this relates to connectedness and autonomy.

The Iowa DOT has a broad and considerable focus on TSMO training. They are looking to create a certain level of competency,



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understanding of operational (TSMO) concepts, understanding of roles, and impact to different areas within the agency. Ultimately it is not the term "TSMO" that identifies actions it is more than just the way they do business, with an operational mindset.

OUTCOMES, OPPORTUNITIES, AND CHALLENGES OF THE COLLABORATION



Faculty, Student, and DOT Staff Development Through Exposure to TSMO Related Areas

The Iowa DOT's continued focus on operations led to a reorganized Operations Bureau which includes not only Traffic and Safety, Operations, and Maintenance, but also Construction and Materials as well as Motor Vehicle Enforcement. The bureau has established a TSMO strategic plan, programmatic plan along with eight service layers which include discussion and analysis of opportunities and challenges, existing conditions assessment, gap analysis, recommendations, and a more detailed five-year service layer plan cost estimate for each service layer. Staff training is a key component within the 5-Year TSMO Program Activities, Policies, and Procedures.

There is some learning process along the way in terms of what TSMO is and how it affects a specific topic such as work zones. Both the DOT and the university are working every day in areas related to TSMO including measuring and monitoring performance, work zones, mobility (congestion, delay, reliability, travel time, etc.), data management, quality, alerting, and safety. InTrans supports DOT to address needs and gaps and is providing tools and research in these areas.

On behalf of the Iowa DOT, InTrans personnel attends national conferences on operations and digital infrastructure and freight with an eye on connected and autonomous vehicles as well as TSMO. In one case, InTrans personnel were part of a national committee that's moving work zone data to a new level. In addition, InTrans serves the DOT through participation on the TSMO Steering Committee and related sub-committees.

OUTCOMES AND LESSONS LEARNED

This is a true collaboration. Everything InTrans has done in terms of data, equipment, and performance has fed into the same channels as TSMO.

The Iowa DOT was one of the first to establish a TSMO program with formal service layers and documentation which defines what TSMO is, what areas to focus on, gaps, etc. While other organizations may view TSMO as a checkbox for compliance, the Iowa DOT is changing the culture of how they are organized and operate.

InTrans helps with Innovation and advanced capabilities, but at the same time, it gets insights into the Iowa DOT's needs and gaps. As a result, InTrans has expanded technically with tools in areas such as law enforcement and better understanding crashes beyond what would have been done in the past.

One area where InTrans greatly benefits the Iowa DOT is integration across its different offices. The individual offices are focused on their projects and objectives and work with other offices as needed. InTrans, however, has the ability to work with each individual office and yet take a higher-level view. InTrans can see how data are used across DOT and by external users like DOT consultants.

As an example, InTrans developed a motorcycle crash tool for Traffic and Safety to interactively explore crashes with unlimited searches and spatial map display. The tool was presented to Motor Vehicle Enforcement who were challenged to consider how such a tool might help their daily efforts. This quickly evolved into a Heavy Truck Crash Tool with similar functionality yet custom filters for MVE and Iowa State Patrol district boundaries. These data are updated monthly with the goal being daily.



A similar effort is on-going in winter maintenance where InTrans is developing real-time tools based on AVL data feeds integrated with other roadway, operations, and infrastructure data.

InTrans staffing includes professional and scientific staff along with faculty and students, from undergraduate up through postdoctoral, and even visiting scholars. InTrans now has five principals who are supporting DOT (none are full-time) with three of these being faculty who have from five to ten students mostly engaged in operations and related activities.

FURTHER INFORMATION

NOCoE Knowledge Center: <https://transportationops.org/knowledge-center>

Iowa State University's Institute for Transportation (InTrans) Website: <https://intrans.iastate.edu>