

Technology and Business Practices that Work

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Prepared by:

Thomas R. Warne, PE
Tom Warne and Associates
Salt Lake City, Utah

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This white paper is one of three white papers commissioned for the State DOT CEO Leadership Forum 2013: Leading the 21st Century DOT. These papers synthesize current literature and research and outline the experiences of select states to provide context for launching discussion at the forum.

Each author interviewed CEOs or top staff from five states, which were chosen based on potential for uncovering interesting experiences related to the forum's theme. The papers were divided into three topical areas: the evolving DOT enterprise: today toward tomorrow; technology and business processes that work; and mission evolution, from facility design and construction to mobility-system management.

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Executive Summary

This report highlights exciting activities in five states today that have potential for implementation in other departments of transportation. The variety is impressive, and the sense of innovation inspiring.

In Florida, deliberate decision-making, technical engineering, and process changes save the state millions of dollars. Florida is also a leader in pushing the envelope on social media and communications strategies. Minnesota is thinking like a private enterprise and sees risk management in ways that even many private sector firms don't. Its Destination Innovation and Ombudsman initiatives create value both inside and outside the agency. North Dakota is an example of how a state DOT has had to "remake" itself and its transportation paradigm to accommodate the transformational experience of the oil shale boon. Not everyone will have an oil shale boon, but the lessons learned by North Dakota's response are informative and useful. Utah is in the business of connecting systems and people and innovating project delivery methods. Don't say that Utah can't connect two different systems together, because the DOT probably can, and the results will be powerful. Utah is also exploring boundaries of transparency and connectivity that are impressive and worth considering. Washington is pre-tolling its SR 520 corridor and getting people to pay for something that they don't even use right now. It is a compelling story of managing capacity in new and impactful ways and getting public acceptance for innovative thinking. In addition, WSDOT's electric highway is a model for other states to follow, and the lessons learned will be useful to all who tread that path.

None of these states can be accused of sitting back and just letting the world go by. Of note is the fact that each of these innovative activities is in place and being used today. They are not being "beta" tested and are certainly a long ways from the drawing board. The good news for other state DOTs is that these innovations can be taken and implemented without further testing or evaluation. They work, and each one has proven results.

Introduction

The challenges facing transportation agencies today are significant. Business as usual is not an option. Agencies must adapt and change, accept and innovate, reorganize and reinvent. While the term “time to market” is operative in the private sector as a measure for staying competitive in fields such as technology and science, state DOTs are facing their own “time to market” issues as they must change to meet the ever-increasing demands being placed on them.

The challenge facing most DOTs is to know what changes are out there, which ones work, and how they can shorten the time and reduce the cost of implementation. This report—*Technology and Business Practices That Work*—was commissioned by the National Cooperative Highway Research Program (NCHRP) under its project 20-24(84). The purpose of NCHRP 20-24(84) is to highlight activities that are already in place in one or more state DOTs and share that information with colleagues in the industry. The research performed for this report sought programs, technologies, organizational activities, and other initiatives that were well beyond the drawing board and fully underway—producing proven results.

In all, five state DOTs were selected for inclusion—Florida, North Dakota, Minnesota, Utah, and Washington. Highlighted in each state are initiatives that are making a difference. While not every one of these initiatives has application among the 50 state DOTs, each one provides a vision of not just the possible but of what is actually occurring and can occur in other states. This report contains something of benefit for everyone in the industry.

Literature Review

Overview

The topic “Technology and Business Processes That Work” couldn’t be more relevant to the leadership of state departments of transportation across the country today. Within the broader overall topic lie a number of sub-issues that add depth and breadth and that contribute to the understanding needed to lead in these complicated times. These sub-issues include:

- Innovating for better, faster, cheaper programs and service delivery
- Focusing on delivering essentials, what customers willingly pay for
- Technology application, productivity, and innovation culture
- Technology transfer, interagency exchange, new idea adoption
- Enterprise risk management, knowledge management
- Performance reporting, accountability, and transparency

The rate of change in the management and execution of the day-to-day activities and functions of a state DOT has rapidly increased over the last few years. Unlike many areas of DOT management, the “science” of adapting to these changes in the sub-topic areas listed above is relatively new, and the literature is largely in a fledgling state. Nevertheless, documentation of efforts and knowledge is now occurring and provides for a foundation for this discussion. What follows is a summary of relevant information that has recently emerged on this topic area.

Literature Review

While this research effort is two-fold in that it deals with both technology adoption and business process improvements, the reality is that relevant reports and studies on them often start with the business process part of this discussion. This point is borne out by the fact that most agencies seek to modify, improve, or otherwise change their business practices before implementing new technologies rather than adopting some new technology and then adjusting their business practices accordingly.

Integrating Business Processes to Improve Reliability (L01)

The Strategic Highway Research Program 2 (SHRP2) was authorized by the U.S. Congress through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). It provided funding for many research projects focused on improving the planning, renewing, and operations of our nation’s highway system. One of the projects completed through SHRP2 was “Integrating Business

Processes to Improve Reliability (L01).” The final report from this project documents many interesting points relating to improving business practices in state DOTs. The authors assert that business process must be divided into two categories in the future—operational and programmatic. Operational process improvements are easier to identify and typically to change. They are sequential in nature and easy to define, and the results are relatively easy to measure.

On the other hand, programmatic process changes are more strategic in nature and sometimes more challenging to implement. They are often enablers of operational business processes. Outcomes are less easily defined. An example cited is a memorandum of understanding that requires the parties to behave and cooperate in a particular way. While it may be intuitive that the agreement will bring net benefits to the parties involved, the direct “cause and effect” outcomes may be more challenging to prove. The authors note that outcomes and successes of programmatic changes are also more challenging to map. In the end, the L01 report says that both types of changes are needed to be successful.

The L01 report detailed a process used for many years by International Business Machines (IBM) called Business Process Modeling Notation (BPMN). The value of this tool is said to be the ability to look at a variety of dissimilar processes in a uniform manner. In their report, they note the following about process mapping:

Observations about process mapping:

- The influences that initially caused the integration of the processes could be grouped into three categories;
- The importance of performance measures and the need to clearly document benefits were evident in each case study; and
- The obstacles to process integration were similar in all case studies.

The three influences that drive the change in processes in organizations are:

- Big directive (top down)
- Event driven
- Needs-based/opportunity-based (grass roots)

The L01 report states that improving a process using performance measurement is not a one-time event or a single point in time but a process that is dynamic and evolving over time. It gives the following seven-step methodology:

1. Influences
2. Define the specific reliability goal

3. Identify and document current business processes
4. Develop change process
5. Assess process
6. Document process
7. Institutionalize process

Perhaps most telling about process change in an organization is the following quote from this report: “Institutionalizing the process translates it into a core process in the organization that can survive changes in management and personnel.”

Institutionalization is the key, but it takes more than simply rewriting a procedure to make a change part of the everyday fabric of the organization. (1)

‘Leading in Lean Times’ Workshop

A workshop was held February 7-8, 2012, at which state DOT leaders gathered to discuss the topic, “Leading in Lean Times.” The NCHRP 20-24 (81) report by the same name documents the discussion and the salient points made during the two days of intense discussion.

The scenarios discussed reflected the pressures facing state DOTs across the country—growing transportation needs, unsustainable funding models, the changing nature of DOT organizations, and political influences resulting in shorter tenures for DOT CEOs.

The workshop focused on the areas of:

- Revenue and financing
- Agency structure and business models
- Workforce management
- Operational costs
- Capital programs
- Process improvements
- Technology implementation
- Communications
- Transparency and accountability
- Managing innovation.

A major focus area of the workshop was technology implementation. It was noted that the siloed nature of the traditional state DOT is a barrier to effectively deploying new technology and achieving the maximum benefit possible from its use. Simple tools for planning, forecasting, and prioritization would greatly improve processes, but the

challenge of “enterprise-wide” implementation can deny an agency the desired outcome. For example, the same basic traveler information collected through a number of portals in a state DOT should be readily shared across the enterprise, resulting in a more overall robust information platform against which to make decisions and operate the agency. This need to learn and integrate information across a broad range of sources, both within and external to the agency, will improve operations and management of key functions and activities. (2)

Risk Management Practices

Risk is an area where more and more agencies are looking to improve their business practices. The report for research project NCHRP 20-24(74) “Risk Management Practices in State Departments of Transportation” looked at this topic from the viewpoint of a large number of state DOTs. The researchers found that only 13 of the states identified themselves as having a formalized enterprise risk management (ERM) program in place. The researchers noted that much of the risk management activity that occurs at a state DOT happens at the project level.

Fundamental to the imperative for managing risk is the following statement from this report:

“While it is impossible to avoid every risk event, CEOs have a responsibility to acknowledge that risk and uncertainty exist and to develop formalized procedures to manage it throughout the DOT enterprise.”

Many state DOTs are experienced with risk management on specific projects or activities within their agency. Taking risk management to the strategic level is the focus of enterprise risk management. Enterprise risk management addresses events and occurrences that can have an impact on an agency in a strategic way—such as its level of funding, public opinion, public confidence, etc. When addressing risk at the enterprise level, an agency will look at how risk factors track across multiple programs and processes. Such a view of risk transcends a single business unit and examines how something might have an impact on one or more other parts of the organization.

A comprehensive enterprise risk management program would include:

1. Executive commitment to enterprise risk management
2. Designation of a risk executive
3. An enterprise risk management culture, which promotes accountability throughout the organization
4. Engagement of stakeholders
5. Transparency of the risk communication process

6. Integration of financial and operation risk management information
7. Use of formal risk assessment methods
8. Constant identification of new risks, and
9. Focus on leveraging risks as opposed to mitigation

This report notes that the two main obstacles to enterprise risk management implementation are competing priorities and insufficient resources. To be successful, the CEO sets the vision and provides the resources to implement and integrate enterprise risk management into the agency.

Another point of interest coming from this discussion is that the states with the most effective enterprise risk management programs cited the following sources—11 were developed in-house, one from another state DOT, and six from outside their agency.

Enterprise risk management principles can be applied to a variety of agency activities, programs, and initiatives including project delivery, financial management, third-party agreements, environmental programs, right-of-way acquisition, public relations, and value engineering. (3)

Technology Reconnaissance, Evaluation and Adoption Method for Transportation Agencies

The NCHRP report titled *A Technology Reconnaissance, Evaluation and Adoption Method for Transportation Agencies* offers many insights into the challenges departments of transportation and metropolitan planning organizations face when adopting new technologies. In addition, the researchers offer a methodology known as STREAM as a solution to moving the decision-making process forward in a deliberate and informed way.

This report notes that technology has the power to change the very nature of how a transportation agency operates, but challenges exist in achieving that outcome due to problems with planning, assessing, and implementing technology opportunities. Other barriers cited included legal issues and funding.

From their research, the authors found that agencies struggle with assessing technologies both because of the volume of opportunities that exist and also because of the time required to do so. Often, the urgency of the problem that needs to be addressed doesn't sync with the time required to properly assess a technology or product.

A significant volume of research is available to transportation agencies, but this study found that many stop short of providing agencies with a comprehensive decision-

making process that would lead to adoption and implementation. The report states: “Challenges to state DOT managers are determining the feasibility of potential projects, assessing the integration with on-going Information technology efforts, and deciding where to deploy resources.”

This report identified a number of shortcomings in the process that agencies use to make decisions and ultimately adopt technologies. They include:

- Agencies perform duplicative studies on products that have already been researched. This is attributed to the uncertainty of the decision-making process and the fact that many studies are not widely distributed if performed solely by an agency.
- Many of the studies performed by individual agencies have methodological shortcomings that render them less than effective as defining resources from which to make decisions.
- Some agencies don't have the internal resources to study technologies in anticipation of adoption, which then results in missed opportunities for implementation of technologies that could prove to be very beneficial in their activities.

The authors of this report recommend the adoption of a specific methodology to facilitate technology decision-making called STREAM (Systematic Technology Reconnaissance Evaluation and Adoption Methodology). STREAM consists of five steps that will lead an agency through the deliberative process of making technology deployment decisions.

The five steps in the STREAM process are:

1. Frame: What DOT functions are targeted for this technology, and how will this technology achieve agency goals and objectives through measurable outcomes?
2. Identify: What are the available technologies, how mature are they, and what are the potential benefits?
3. Characterize: What is the value the technology will bring, what barriers exist to implementation, what will be the cost of deployment?
4. Compare: What are the outcomes and how will they impact the agency? Are there future considerations that might influence the decision or choice of this technology?
5. Decide: Should the agency adopt, monitor, or take some other action regarding this technology?

By adopting a rigorous methodology such as STREAM, agencies will make better-informed technology decisions and thus influence their ability to deliver services. (4)

Institutional Architectures to Advance Operational Strategies

As part of the SHRP2 Reliability effort, project “Institutional Architectures to Advance Operational Strategies” (L06) offers insights into the nature of transportation agencies and how they might be structured to address current operations demands. This study focused on how institutional architecture impacts an agency’s ability to function in today’s demanding world.

A key point made in the study is that it is important to differentiate between institutional architecture, the agency’s technology and business processes, and its systems operations activities. The author suggests the use of the Capability Maturity Model (CMM), which is often used in the software industry to assess the transition that a transportation agency goes through as it changes to an operational entity from the traditional and historical DOT format.

Four steps in the CMM process are articulated in this report:

- Culture/leadership
- Organization/staffing
- Resource allocation
- Partnerships

Ultimately, understanding and using CMM will assist an agency methodically go through the transition required in today’s environment. (5)

Summary

The challenges facing state DOTs as they seek to change their business processes and adopt technologies to assist in their product delivery are significant. In addition, the areas that seem to provide the most opportunity for adoption and benefit are those where the literature and experience seem to be the least mature.

Florida — No Time to Wait on the Recovery

Introduction

The state of Florida has historically been a place where business, tourism, and climate have combined to create a great place to live and where people want to go and either stay or visit on a regular basis. The Great Recession of 2008 hit Florida hard as home prices plummeted and the economy suffered on a number of fronts. Today, the state is climbing back to its former place of preeminence among desired locations for growth and vibrancy and seems destined to achieve its former stature.

For many years, the Florida Department of Transportation (FDOT) was known for its leadership on many fronts. It was using design-build when other states were just thinking about it. FDOT has also been a leader in privatization of agency services such as maintenance of its highways. Public-private-partnerships (PPP) have long been a part of the landscape in the Sunshine State. The recession impacted revenues to FDOT and certainly dampened for a period of time the ability to resolve many of the mobility issues facing the state.

Through all this, however, FDOT didn't just sit back and wait for better times to advance new and important strategic initiatives for improving the services it delivers to the people of the state. In fact, FDOT didn't miss a beat when it comes to leading out and implementing meaningful changes and activities that are benefiting its customers right now.

FDOT is an agency comprising seven districts and the Turnpike Enterprise. Each of the districts operates in a largely decentralized fashion, but important and strategic leadership and initiatives from Tallahassee are an integral part of the overall delivery of the DOT's mission. While this whole report could be dedicated to a detailed review of all of FDOT's initiatives, space permits that a few be highlighted here.

Business and Engineering Processes

- FDOT has an aggressive Value Engineering Program that promotes studies throughout the state during the design phase of projects. In FY 11-12, these studies resulted in 78 recommendations, with a total of \$140 million in savings statewide.
- Coupled with its Value Engineering Program is FDOT's Cost Savings Program, in which contractors can recommend improvements in the construction process. In FY 11-12, these recommendations saved the state \$3.89 million.

- FDOT has implemented a maintenance management initiative in which it scores its roadway system and creates a Maintenance Rating each year. This Maintenance Rating reflects the condition of the roads and roadway features comprising its system. The statewide goal is a rating of 80, which reflects a conscious management approach and a realization that achieving a higher rating doesn't necessarily create a better system of more satisfied customers for the additional investment. For FY 10-11, FDOT's statewide rating was 87. FDOT then took deliberate actions to assess its maintenance budget and reduced its activities in specific areas, saving some \$67 million. These funds were then reallocated to capacity projects in the state.
- Large savings were netted by FDOT as it examined its asphalt mix design process. FDOT pavement design engineers recognized through research and observation that certain of their past requirements were unnecessary for achieving their pavement quality goals. By eliminating these unnecessary requirements, they achieved a savings of approximately \$4 per ton, with a total annual savings to the state of \$16 million.
- Recognizing the dynamic nature of project specifications and the diverse nature of many of FDOT's projects, the DOT decided that printing a new hard copy specification book was not practical or reflective of the potentials that exist in today's technology environment. The 2013 Electronic Specification book has now eliminated the hard copy version that was once used in the state. Savings to the state are \$100,000 per printing.
- Additional pavement design savings were netted when FDOT's engineers further researched and observed the performance of recycled asphalt pavement (RAP). By increasing the amount of RAP allowed in certain mix designs, they have been able to reduce the per ton cost by \$2, resulting in statewide savings of approximately \$5 million. An added benefit is the "green" impact this has on the state as a whole.
- Further savings of \$4.3 million were derived when the pavement engineers examined carefully the thickness of pavement sections for certain projects. Recognizing that "thicker" isn't always better and that deliberate engineering decisions could result in slightly thinner sections on specific roadway types, the designers were able to consciously bring about changes that saved money while maintaining their desired performance criteria.

Social Media

While some states have utilized social media to advance their messages internally and externally, few have taken its use to the levels that FDOT has in recent years. The

depth and breadth of FDOT's venture into social media offers communication venues and an outreach ability that didn't exist even a few years ago. The following is a rundown of what FDOT is doing:

Twitter — Twenty-six accounts exist in the agency, and they are used by each of the districts, Central Office, Safety Office, 511, SunRail, and Secretary Prasad. Tweets keep the public up to date on what is going on in the department and trends that might influence public opinion. Secretary Prasad tweets a couple of times a day and uses his tweets to elevate and stimulate public discussion, to shape the transportation debate, and encourage thought on critical topics in transportation in the state.

Facebook — The agency manages six accounts, including the Public Information Office, Safety Office, US Hwy 331, I-595, and SunRail. Facebook is a popular medium and is a way to share information about recognitions, awards, conferences, and even photos of public and internal interest.

YouTube — Three active feeds allow for video sharing of information that includes news clips, short films, and other public information items. Secretary Prasad is one of the featured presenters as a means for getting important messages out to FDOT's clients/customers.

Wordpress — This site was created as an extension of the agency's newsletter. It is distributed electronically each month via an e-mail "teaser" that alerts recipients of the availability of the latest version. Articles are archived and searchable, and all of this is available on the agency's website for the public to view.

Webinars — This is a tool used by Secretary Prasad to communicate directly with the employees of FDOT. Over 1500 of his 6500 employees tuned in to the last webinar. The webinars are done live, and questions can be submitted anonymously that he answers "on the air." Lasting about 30 to 45 minutes, these webinars offer him a chance to stay connected with FDOT employees and communicate directly with them, in his own words, about the critical issues facing the agency.

Video Podcasts — Introduced by Secretary Prasad, the video podcasts have given him another means for communicating directly with the employees of the agency. He did five podcasts in 2012 and addressed subjects such as the FDOT reorganization and the Florida Transportation Vision for the 21st Century. In 2013 these same podcasts will not only be available to the employees but also posted on YouTube—adding a measure of transparency that is a part of the secretary's philosophy for communication.

Social media is a part of the 21st century world that state DOTs operate in. A state DOT can operate with little regard for its power or influence—or it can do what Secretary

Prasad has done and make it a game-changing tool for shaping transportation thought both inside and outside the agency.

Whether it's innovation or process change or technology, FDOT hasn't waited for the "good old days" to return to propel itself forward in innovation and leadership. Rather, it took advantage of the recession to retool and improve, and it is now leading the way in Florida.

Minnesota — Enterprise Thinking

Background

The Minnesota Department of Transportation has been a leader in many aspects of the transportation world for a long time. Innovative thinking and improvement are not new to the agency. When Tom Sorel was appointed as the commissioner in 2008, he knew that the agency had considered risk on some of its projects, but he realized that it was time to take risk management and apply it at the enterprise level. Sorel's goals for ERM included reducing the risk profile of the agency in all aspects of its business, improving processes, and managing the human capital of the agency better. With this in mind, MnDOT's Enterprise Risk Management program that exists today was born.

Enterprise Risk Management

Establishing Enterprise Risk Management at MnDOT has been a journey since 2008, and there is much to learn from what the agency has done to make it a part of its daily and strategic operations. It was a process that started out slowly and built upon the strengths of the agency while taking the thought process beyond anyplace ever anticipated. The result is one of the most mature enterprise risk management systems in the country among the state DOTs. And yet, for all its progress, MnDOT knows all too well how far it has to go. What follows is a short story of MnDOT's journey.

The transition to enterprise risk management is a multistep process and must start out slowly. MnDOT brought in a specific person with ERM experience to assist with the day-to-day implementation challenges. ERM is not widely deployed in the public sector, so much of what MnDOT did was tailored to the agency's needs and unique objectives.

One of the initial steps was to conduct risk workshops in specific areas of the agency. These workshops were geared toward examining risk in a particular area, but more important, they introduced risk management thinking in a way that started to involve the employees and helped their understanding of the concept and its possibilities. This made them more willing to engage in even deeper and more meaningful activities and considerations on the subject. MnDOT held 60 to 70 of these workshops to start with, covering a range of topics from major interchange construction considerations to what type of software might be used for a particular application. Many employees got their first exposure to the beginnings of where the agency was headed through these workshops.

After the workshops were well underway, it was time to take the discussion to the next level and introduce the concept of risk management from the enterprise viewpoint. The discussion was divided into four areas that would combine into the ERM strategy for the agency:

Programmatic Risk Management — Focused on the overall investment strategies of the agency and how decisions were made, what investments supported the agency's strategic objectives, and how all of the different parts of the capital program contributed to reducing agency risk of not achieving its objectives. It was a discussion that went far beyond specific dollars for a particular project.

Project Risk Management — This area was perhaps the most familiar element of ERM to many of the MnDOT employees. The enterprise risk management discussion took this element beyond the traditional risk thought process and looked at how projects could be built more efficiently, where improvements in delivery methods could be achieved, and how individual projects contributed to the greater whole.

Organizational Risk Management — This area included things that wouldn't allow MnDOT to achieve its strategic goals and objectives. Among them were things such as national and state politics, external and internal policies, and national issues. The DOT realized that some of these influences could be mitigated and others could not, but that they all needed to be recognized in the overall risk profile of the agency.

Operations Risk Management — This area focused on the day-to-day activities of the agency but elevated that thought process to the enterprise level. Even seemingly mundane and routine activities performed without notoriety had an impact on the overall risk management elements of the agency. Getting people to think in this context was an important part of moving ERM ahead at MnDOT.

Some lessons learned and actions taken by MnDOT will help clarify the challenges it faced along its path to a mature ERM program. They include:

- Eventually MnDOT had to create an organizational unit to support risk management. It was filled with an individual who took a "mobility" assignment to shape the discussion from an enterprise perspective.
- MnDOT found that many people in the private sector understand and can apply project level risk management, but far fewer can help with the implementation of it at the enterprise level in a public agency.

- Risk registers were created for various activities. MnDOT developed mitigation strategies based on the outcomes of the risk registers.
- MnDOT created a Chief Risk Officer (CRO) position. This individual works with units within MnDOT to assist them in their risk efforts. They are a part of the Leadership Team and are a part of the commissioner's direct staff. The Chief Risk Officer manages the risk registers. By having the CRO as a part of the commissioner's direct staff, it is high enough in the organization to make things happen.
- MnDOT is in the process of exploring how to integrate ERM into quality-of-life issues for its customers. Using algorithms, the DOT will then be better able to address these issues by adjusting its investments and activities accordingly.
- MnDOT's highest risk area turned out to be pavements. Using market research, the department found out that people can tolerate 5% to 9% poor pavement performance. Knowing this, it could then make informed decisions about its pavement management system to keep Minnesota's highways within that band and at an acceptable level for its customers. With the ERM framework in place, MnDOT knew that pavements lying above the band would mean it was overinvesting. While past philosophy was to improve all roads and maximize performance everywhere, the agency has now adopted an approach in which it is managing to the tolerance level of the people it serves. The decision-making process on pavements was based on market research from having real drivers drive over pavements of all types and conditions and evaluating their tolerance levels. The outcomes are real and have netted the agency financial benefits. It has now adjusted its pavement activity and initiated the Better Roads for Minnesota program, a five-year program designed to keep the system within the band. Now it can use the money saved by staying in the band on other projects around the state. Without doing this, MnDOT would risk spending too much money on pavement.
- Similar to pavements, risk management in the bridge system will help define how much MnDOT should invest in this program.
- Some goals such as safety don't lend themselves to bands.
- It's important to help many of the employees realize that they are currently engaged in ERM types of activities—they just aren't calling it ERM. Creating the connection and understanding of this point is important early in the process.
- ERM will help the agency understand how large it needs to be in the future.
- In the past, the agency responded to challenges by cutting costs, reducing staff, or getting rid of processes. This was all done without regard for the ultimate impact these actions might have on the enterprise risk profile of the agency.

Today MnDOT believes it is better equipped to make informed decisions within the context of its ERM program.

MnDOT believes that success will be in sight when every employee has some type of risk element in his or her annual appraisal. The department is definitely headed in that direction.

Transportation Ombudsman

MnDOT's relationship with its customers is an ongoing concern, and the need to maintain this important relationship is recognized. Tom Sorel wanted to make sure that what MnDOT did respected and recognized this valued relationship—especially when customers had direct contact with the agency. This point was driven home to him by an incident in which an individual had a permit to put six flags on an overpass as a demonstration of patriotism. When the permit expired, MnDOT staff removed the flags, and the resulting backlash made national news. MnDOT was seen as not “supporting our troops,” and a simple action on the part of a small group of employees had a huge impact on the agency's reputation. While the action was correct from a legal and procedural standpoint and in the bounds of past leadership cultures at the agency, it was out of step with the current leadership culture and substantially damaging in the greater context of MnDOT's relationships with its customers. Commissioner Sorel's goal was to help employees realize the grander impact to the agency that went well beyond the specific problem or a legal interpretation.

To help with this problem, a Transportation Ombudsman position was created that reports directly to the commissioner. This person now provides people with a means to access the agency or address problems or issues that they might have with MnDOT. At first the employees were concerned that this person might undermine their efforts to carry out their agency program, but the utility and value of the ombudsman role was soon proven.

This new position is very much in concert with the Enterprise Risk Management initiative and helped restore the credibility of the agency after the collapse of the I-35W bridge. Ultimately this individual became well respected both in and out of the agency. Legislators would contact the ombudsman with their issues, and when matters were raised directly to the commissioner, the ombudsman became a sounding board to ground them before action was taken. In the end, the creation of the ombudsman position was a transformational move for MnDOT.

Destination Innovation

Another initiative started by Commissioner Sorel was a push to establish a culture of innovation, which resulted in a new program called Destination Innovation. To start this initiative, MnDOT used \$30 million generated in project savings, rather than putting that money back into another project, Sorel took the money to “seed” the agency’s innovation program. Using this money, MnDOT was able to fund a variety of innovative ideas that emerged from within the agency.

The Destination Innovation Program is managed from the Stewardship Council, which consists of the senior leaders of the agency. It doesn’t matter who originates the idea—if it is approved by the Stewardship Council, it gets implemented, and one of these senior leaders is responsible for seeing that it happens. The range of ideas spans the full spectrum of DOT activities, including project management plans, ITS technology, roadway technology, and snowplow operations. MnDOT has grown the original seed money by further investment. The benefits transcend the business process improvements involved. MnDOT believes the program enhances employee retention and satisfaction and that the resulting “halo” effect of these improvements benefits the agency overall.

Enterprise Risk Management and its spinoff initiatives such as the Transportation Ombudsman and Destination Innovation Program are all changing the culture and business at MnDOT. ERM is truly a transformational initiative that continues to lead MnDOT to places not possible without them.

North Dakota — Responding To a New World

Introduction

Many states have endured challenges of historic proportions over the years. Some have been caused by natural disasters such as floods along major waterways and hurricanes such as Katrina. Others come from external sources such as financial market conditions or even the expansion of the Panama Canal. North Dakota is a state that ten years ago operated below the radar screen in many ways, and life hadn't changed much in the Peace Garden State in the last few decades.

All that changed in 2008 when a series of events combined to forever alter the path of not only the residents but many who would be temporary visitors to North Dakota. In that year, a report by the USGS estimated that 3.0 to 4.3 billion barrels of undiscovered recoverable oil was located in the Bakken Formation that lies beneath the states of Montana and North Dakota.¹ This information, coupled with new fracking technology, made possible the events that have forever transformed North Dakota.

The oil boon in North Dakota has brought many benefits to the state, including jobs and revenues that would never have been imagined even a few years ago. Recent US Census information shows that while the nation's population grew at an anemic rate of 0.9% from April 2010 to July 2011, North Dakota eclipsed that rate with growth measuring 1.7% during that same period.² North Dakota is now in the league of Texas and Alaska when it comes to producing oil. All this has put an incredible strain on the state's resources, including its transportation system.

While no hurricane has struck North Dakota nor has there been a flood of historic proportions, what has befallen the state is a life-changing series of events that have required the state department of transportation to change the very nature of its business. From its experience comes lessons that each state can learn from to prepare for challenging times ahead—even if the source of their future impacts are not shale oil.

While the oil boon didn't catch the state completely by surprise, the speed with which it took off in 2008 has caused major changes in services of all types, including schools,

¹ [^ "3 to 4.3 Billion Barrels of Technically Recoverable Oil Assessed in North Dakota and Montana's Bakken Formation—25 Times More Than 1995 Estimate". U.S. Geological Survey. April 10, 2008](#)

² <http://quickfacts.census.gov/qfd/states/38000.html>

parks, power generation, water, waste water, law enforcement, and medical. Given the dispersed nature of the well drilling and distribution systems, transportation has become a huge part of the equation for responding to these new demands.

The numbers speak for themselves. Just to drill a well takes 1150 truckloads into the site and the same number out. A drill rig alone requires about 100 truckloads, with half of those being oversize or overweight. Even after the well is in operation, three trucks a day are required to haul away the oil and one to haul salt water to pump back into the well. A well can produce up to 1000 barrels of oil a day to start and have an expected life of from 35 to 50 years.

Initially all of the oil extracted from a well has to be shipped out by truck, although efforts are underway to establish pipelines in many locations. Nevertheless, those wells that are more remote will continue to rely on trucking for their transportation needs.

North Dakota's road needs are not simply a volume issue. Weight is a problem, with heavier loads wearing on roads and highways designed for agricultural uses. Two-lane roads that were once adequate for the normal mobility needs of the residents are no longer sufficient for efficient movement of people and goods. Operational impacts include long trains of vehicles that travel as units to the drilling sites, which are hard to pass. For example, a fracking crew has 13 vehicles that travel in a convoy and that don't accelerate very quickly. All told, NDDOT had to reinvent many of its processes and approaches to its business to address these needs.

The North Dakota Department of Transportation has adopted a number of measures to more fully address the state's mobility needs as well as those of the oil industry. They include:

- The legislature gave it \$226.8 million in additional state transportation dollars and \$142 million for county and township roads—above all other funds that it has historically been given. The challenge has been to spend the additional money within the timeframe of the biennium budget period.
- The governor is talking about a billion dollars for state roads.
- In two years, it has gone from just matching federal aid to a billion dollars in state road improvements.
- The DOT staff had to step up and do more since it did not add personnel.
- The DOT reached out to the consulting industry for assistance where state staff was inadequate.
- Simple projects were done by a student support system, including simple designs for intersections and other more routine work.

- Traffic Modeling-NDDOT had to rethink its traffic modeling process and create a system that was more sophisticated than what it had used in the past. No off-the-shelf product existed, so it had to create its own unique model that addressed the kinds of impacts it was dealing with.
- The DOT is developing the Western North Dakota Traffic Model by working with the University of North Dakota. It will be available for future planning. Many factors are included in the model. Among them are:
 - Industry data on well spacing
 - Location and distances to transload or rail sites for petroleum transport
 - Historic truck traffic patterns based on well drilling, on-going support, and petroleum transportation from the well to the transload facility
 - Weight trends based on historic truck information for different well operational phases
 - Trends in transportation patterns for sand, fresh water, pipes, and other well components to ensure all are properly accounted for
 - Agriculture and manufacturing impacts
 - Impacts and conflicts with missile sites
 - Models of the historic traffic that comes off of the oil production at each site and then ties that to an oil well, and then assign that the number of wells in the area. It then dials that back into the model.
 - The large variety of truck types and weights require that all information is converted to equivalent single axle loads (ESAL).
- The DOT is looking at how it programs dollars to accommodate life-cycle decisions.
- Pavement designs will result in thicker sections to accommodate heavier loads.
- Staff for issuing permits has not been increased—the DOT is doing a lot more work with the same people. It has implemented a self-issue permit system in which a company can buy a book of tickets and fill out its own permit for a particular movement. The next step would be to automate this process and integrate it in planning tools.
- Grade crossing safety improvements have been necessary because of truck impacts. Improvements include replacement of the crossings, signalization, and expansion of quiet zones.
- The DOT added one full-time equivalent (FTE) to the Williston District to assist the four counties most impacted by the shale oil operations with their planning activities. This person serves as a resource to the counties and doesn't do the actual planning for them.

- The DOT is addressing congestion in a progressive manner by going from two lanes to super two lanes (with passing and turn lanes) and then to four lanes on specific routes.
- It is considering truck bypasses around certain communities.
- The state bonded to construct Highway 2 to Williston to four lanes

The lessons learned are many. While other DOTs may never have shale-oil-stimulated growth like North Dakota, important lessons can be taken from North Dakota's experience and applied to many other situations. To the extent possible, getting ahead of the challenges is very important. They won't get easier to solve the longer the agency waits to face them and deal with their impacts. If a current tool, such as North Dakota's transportation modeling system, doesn't work, then find something that will meet the need. Again, don't wait to make the change. It is probably a given that more agency personnel aren't going to be a part of the solution—at least in the near term—so figure out how to reallocate people, utilize the private sector, and make do with who you have.

If people think North Dakota is out of the woods, they only need to realize that the state and the provinces of Manitoba and Saskatchewan sit atop the largest potash reserve in the world.³ Potash is removed in much the same way oil is—through wells. This will impact the three northern-most counties of the state. The North Dakota Department of Transportation is getting ready for Act 2, and it isn't finished with Act 1 of this play. Fortunately, it has the experiences of the past to help it through this next round.

³ <https://www.dmr.nd.gov/ndgs/newsletter/jan.2011/Potash%20article.pdf>

Utah — Connecting Everything

Introduction

The Utah Department of Transportation (UDOT) has long had the reputation for innovating and succeeding at what originally seemed to be impossible. Its string of successes began with the I-15 Reconstruction Project delivered before the 2002 Winter Olympic Games and has continued through its most recently completed success stories of the Mountain View Corridor in west Salt Lake County and the I-15 CORE project in Utah County. UDOT has, over the years, never been shy about trying new things, adopting leading technologies, and making its business practices better. This section highlights some interesting things going on with UDOT that can best be described as an effort to “connect everything to everything else”—from data to systems, systems to people, and people to people.

Technology and Systems

Ten years ago the thought of connecting a series of disparate and sometimes yet-to-be-developed systems into a comprehensive approach to managing projects, assets, information, and people would be a daunting task. Systems didn't talk to systems, programs weren't compatible, and even though the “plug and play” era had arrived in the technology world, it still didn't work that way all the time. Nevertheless, UDOT's leadership adopted an attitude toward innovation that created the path forward that has taken the agency to a national leadership position in this arena today. One step at a time, UDOT created from disparate pieces and systems a truly integrated management approach to its business. A few of these interoperable systems are summarized below:

UGate — A central repository of geospatial data about the state's roadway system including such information as roadway classification, projects in all stages of development and delivery, system condition, assets, feature inventory, and financial information. All information is uploaded real time with minimal manual entry of data.

iMap — A mapping tool UDOT uses to integrate most of the enterprise applications to tie all of its information together. In addition to UGate, information iMap also introduces accident data, permits, material sampling and testing, and other critical data elements.

UPlan — An agency website that contains map-based representations of UDOT data. Some of the included maps are UDOT Pavement Management Map, Utah's Unified Transportation Plan, UDOT Culverts map, UDOT Projects Map, and the Annual Daily Traffic Map.

Roadway Data Collection — This product represents a cross-department collaboration to form a comprehensive inventory of all visible roadway features including system assets and pavement conditions. Other information being collected includes signs, shoulder conditions, barriers, structures, pavement type, surface area, number of lanes, International Roughness Index (IRI), and rutting. It will also include a complete 120-degree photo log and a 3D LiDAR of the complete system.

LiDAR — Still in its early stages of development, the UDOT LiDAR initiative is intended to bring data into the agency's Roadway Data Collection system. Eventually this data will be used to create digital terrain models (DTN) that will be used in design to improve efficiency in engineering and reduce the costs of field surveys.

Integrated Asset Management — Leveraging the Roadway Data Collection system, UDOT is bringing various internal departments and systems together in partnership with existing software vendors to create this comprehensive system for asset management and information.

UDOT Projects — This system was previously known as Transparency in Government Spending (TIGS) and represents a web-based system that gives the public unprecedented access to agency project information including project budgets, funding sources, schedule, pictures, project purpose, and many other data points. This information is integrated with iMaps and is updated automatically, requiring no manual data input.

ePM — UDOT's electronic Program Management system gives internal staff, local government customers, and consultant access to substantial information on the planning, funding, scheduling, and staffing of design projects. This system is integrated with other UDOT systems such as the project scheduling tool, which is MS Project Server 2010.

Contractor Portal — UDOT developed this portal to facilitate communications on projects between its project managers and their contractor counterparts. It manages internal and external communications, manages document and submittal reviews, and tracks "ball in court" accountabilities and responsibilities.

Project Scheduling — UDOT recently implemented MS Project Server 2010 to provide a common toolset for the management of projects through the design phase. This initiative also includes a SharePoint portal where functional managers and project managers can share information, review tasks, and exchange project status information.

Consultant Management System — This is a portal that allows consultants to input their own data into ePM to facilitate more efficient upload of information and more

effective project management. It gives UDOT's consultants unprecedented access into internal information systems.

Electronic Document Control — Utilizing a tool called ProjectWise, UDOT has aggressively pursued a program in which all project files are stored and managed using this tool. Typical storage includes project plans, submittals, correspondence, materials testing, and other project documentation.

While UDOT has made progress in advancing many of its systems in a way that leverages each one to a more powerful contribution, the department doesn't feel it has achieved its vision of a decade ago. In many ways, it sees the power of what it has created—and it gives UDOT a renewed vision for even more integration and tool implementation in the future. One step at a time, UDOT has created the “connections” that many agencies hope to achieve some day.

Management Innovation

Not all of UDOT's efforts in the last ten years have had a technology focus. In a parallel way, it has pursued many management innovations that have helped it deliver on its aggressive capital improvement program during this period.

Some of the noteworthy achievements in this area include UDOT's efforts in alternative delivery methods such as design-build on projects of all sizes and the use of Construction Manager General Contractor (CMGC). Of interest for this report are some of the other initiatives that are making a difference in project delivery efforts. They include:

Construction Estimating — For many years UDOT followed the traditional approach to project costs, estimating by tracking historical bid values for a wide range of contract work items and then applying them to a new project. Its history with this system was similar to other states, and a few years ago it decided it needed a better system. Today all of its project estimates are completed using a production approach. Utilizing estimators who formerly worked in the construction industry, UDOT now creates estimates the way bidding firms prepare theirs. It now tracks well against the bids received and avoids the surprises that often occurred on bid opening day at the agency.

Price + Time — UDOT has transitioned all of its projects to a Price + Time format for bidding. Using this method, a contractor bids both price and time, and the lowest combination wins the work. The contractor with the most aggressive schedule often is the successful bidder. This has resulted in a substantial reduction in construction time, which translates into less impact on the traveling public and reduced costs overall.

Accelerated Bridge Construction — Known in the industry, ABC has been a major innovation that has blossomed into extensive use in Utah. Utilizing this bridge building technique, UDOT's contractors are able to construct bridges adjacent to the freeways they will eventually span and then move them into position in matter of hours. The process saves all of the impacts of overhead construction and improves efficiency for the contractor and safety for their workers, and significantly improves safety conditions for the traveling public.

Public Information Coordinators — UDOT now employs public information coordinators on every project to ensure that critical information is shared with users and stakeholders alike. This transition has occurred over the last decade or more as the agency first assigned public information officers to the four regions, then to major projects and now to all projects. The overall impact is positive, and communications efforts are deliberate and effective.

The UDOT story is one of persistence and perseverance. It's about taking systems, processes, and innovations and connecting them all together. This connection might be within software or management systems, among suppliers and service providers, or with customers and stakeholders. Connecting everything together. That's UDOT's plan.

Washington — A Look to the Future

Background

The Washington State Department of Transportation (WSDOT) has long been a proponent of innovative business practices. Perhaps it's the challenges it faces with geography or with environmental sensitivities or significant congestion or any number of other complexities. In the end, the state DOT has had to adopt and adapt to be successful. While many activities within WSDOT are worthy of emulation, two innovations are highlighted here.

Tolling the Future

In 1994 WSDOT issued a request for proposals (RFP) for possible public-private-partnership (PPP) projects that would improve the state's transportation system. The attraction of private money, paid back with the imposition of tolls, seemed to be the solution to what ailed the state. Six projects were submitted:

1. SR 18 Corridor between I-5 and I-90
2. SR 520 including the Evergreen Point Bridge
3. Puget Sound Congestion Pricing project
4. SR 522 from Woodinville to Monroe
5. King County Park and Ride lot improvements
6. SR 16/Tacoma Narrows Bridge⁴

While the transportation future appeared promising when these projects were proposed, WSDOT ultimately had to decline all six due to public and political pressure. It was a time when it seemed that a "user pay" system for financing much-needed improvement in Washington was at the end of its road. Looking back on those days, it is amazing to see that Washington has now developed a world-class system of managed lanes and tolled facilities that are bringing transportation mobility solutions to the state and much-needed revenue into its coffers. This is a turnaround story of how to implement tolls with high public support and success.

In 2007 the state had no toll roads or corridors. True, some of its bridges required the payment of a toll, but the advent of corridor-wide tolling and managed lanes had not

⁴ <http://www.wsdot.wa.gov/Funding/Partners/History.htm>

come about. Today that has all changed. Six corridors are now authorized for tolling, and three are now underway. The state has found that public support for tolled facilities is much higher when WSDOT is the owner and operator compared to the negative feedback that emerged when the six proposals were received in the 1990s. Support from the governor and legislature is strong and, with each new corridor, the public's acceptance continues to grow.

WSDOT found that managing demand and responding to congestion requires a different approach to implementation of its user-pay system. The impetus to this newfound direction came from the state's 2008 vision—*Moving Washington Strategy*. It is a long-range strategy that has substantial support of state and local elected officials. The vision of managed lanes and tolls in Washington looks to having 300 miles of facilities in place. The numbers speak for themselves.

Current corridors include:

- Hwy 99, the Alaskan Way Viaduct valued at \$3.144 billion, boasts the largest diameter bored tunnel in the world (57.5 ft.) It will be partially funded using variable tolls.
- I-405 and Hwy 167 now have 40 miles of High Occupancy Toll (HOT) lanes where throughput in these highly congested corridors is being optimized by variable tolls.
- SR 520 Floating Bridge where a balanced approach with transit and highway capacity (including new HOV) will net the state and users significant benefits.

Typically, toll projects start charging users when the facility is complete and benefits achieved. In the case of the SR 520 Floating Bridge project, WSDOT implemented tolls on the existing bridge to pay down \$1 billion of the capital expenses through pre-completion tolling. One would wonder how WSDOT could charge for something that had yet to be delivered. The answer is insightful—and comprises a number of WSDOT strategies including:

- An enhanced experience on the existing bridge to include variable speed control and lane control
- Variable tolls based on congestion
- Electronic toll collection where 84% of the users are subscribers to the state's Good to Go system
- A public communications plan that included explaining that early tolls were no different than paying down a mortgage early on a home—a concept people understood and supported.

All this comes from a state where six major toll projects, led by private companies in the mid-1990s, were soundly rejected. Chalk it up to a vision, public trust, agency credibility, and a thoughtful vision. The 2008 vision is now becoming a reality.

Electric Highways

Interest was high in Washington State in 2008 about the impact of greenhouse gas (GHG) emissions. The political leaders were so focused that WSDOT was directed legislatively to advance its thinking and actions regarding the reduction and control of future growth in GHG. This being the case, 2008 marks the beginning of Washington's venture into the electric highway initiative.

Two significant actions are worth noting, as they had a major impact on the direction the state took then and will take into the future. The first was the "2008 WSDOT Alternative Fuels Corridor Economic Feasibility Study." It noted this: "The primary challenge to Alternative Fuels commercialization is how to build a market—simultaneously—for new vehicle technologies, new fuels, and new infrastructure to support them."

A focus of the study was what state DOTs could do to adopt cleaner fuel strategies. Precipitating from this study was an effort to establish alternative fueling stations at selected state rest areas along key corridors. At first it was envisioned that this could be accomplished through some kind of Special Experimental Projects 15 (SEP-15) approval process, but this proved not to be possible. Ultimately, it was the second initiative of 2008 that saw this effort make meaningful steps toward full implementation.

It was in 2008 that Washington joined British Columbia, California, and Oregon by establishing the Pacific Coast Collaborative, which then designated I-5 as the West Coast Electric Highway. The priorities of the Pacific Coast Collaborative are:

- Clean energy
- Emergency management
- Region transportation
- Research and innovation
- Sustainable regional economy

In its efforts to advance its portion of the West Coast Electric Highway, Washington state has learned many lessons. Its first endeavor was to establish two pilot charging stations at rest areas, but it found that establishing and operating these two stations was too expensive. In addition, for the electric highway to be viable it needed to address the "range anxiety" that exists in the heart of every electric vehicle owner.

“Range anxiety” is drivers’ feeling that they will not make it to the next charging station before their vehicle runs out of a charge, and thus inhibits them from venturing long distances from known charging stations.

Recognizing that it could not provide an adequate network within the financial means of the state, WSDOT then sought to engage the private sector in its electric highway initiative. Using a solicitation for a public-private-partnership, it offered \$995,000 as seed money to encourage the private sector to invest. Six proposals were submitted, with AeroEnvironment being the successful team. Today WSDOT has 12 stations operating along I-5, US 2, and I-90, providing a viable network for electric vehicle owners and dispelling the “range anxiety” that existed in the past. The private sector owns and operates the charging stations and provides other amenities to entice use and improve the experience.

The West Coast Electric Highway is a model for other states to emulate as they advance their efforts to deliver services for alternative fueled vehicles. Consistency is the key to the current and future success of the electric highway. When viewed from the corridor perspective, four elements benefit from the ongoing regional collaboration among the four governmental entities:

- Equipment specifications
- Highway signs
- Branding and marketing
- Capitalizing on the unique electric vehicle driving experience

In addition, the evolution of the “fast charge site” criteria also adds to the regional value that the electric highway offers. These criteria are:

- Located within ½ mile of a highway interchange
- Safe and convenient access
- Parking spaces
- Restrooms and drinking water
- Shelter and lighting
- 480V 3-phase electric power supply
- Customer amenities (food, traveler information, etc.)

No one at WSDOT feels that the agency is at the end of its lessons-learned process—rather, a clear understanding exists that much more is yet to be learned and applied. The good news is that clear progress has been made, and it is in the right direction. The value of partnerships with the private sector is evident.

What is also clear is that any other state engaging in such an initiative can fast forward past some of the early days of WSDOT's electric highway efforts and save the time, money, and efforts of that early period in its deployment.

Conclusion

Many good and innovative initiatives are underway among state departments of transportation. The value of sharing these innovative ideas with one another is self-evident. This report has highlighted five states and their efforts to respond to the changing demands that are occurring in the transportation world today. Of note is the fact that each of these states has chosen to lead out, to be progressive, to proactively face its challenges head on and implement solutions that had previously been thought to be impossible.

Each of the programs or initiatives shared in this report represents a “real-time” success. They are working, the results are tangible, and their value obvious. That said, each of these states knows there is much more to do. There is no sense of “having arrived” in these DOTs, but rather they are looking forward to the future and how they might yet improve more.

It would be naïve to assume that any of these initiatives could be adopted into another DOT without some effort and modification. Nevertheless, in each case these states have done the heavy lifting and proven the concepts such that the road to implementation is even shorter for those that are to follow.

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