Transportation Asset Management Case Studies

Presented by

U.S. Department
of Transportation
**Federal Highway
Administration**

COMPREHENSIVE TRANSPORTATION ASSET MANAGEMENT

The Ohio Experience

Dayton Ohio, home to the Wright Brothers and the birthplace of aviation, provides inspiration to the reconstruction of the I-70 & I-75 interchange.

FRONT COVER PHOTO:
The Maumee River Bridge is a cable-stayed structure built to replace an existing draw bridge on a busy Interstate freight corridor. This innovative signature structure incorporates an illuminated central pylon capable of displaying customizable themes that enhance the Toledo skyline.

A comprehensive, fully integrated Transportation Asset Management System weaves together information on all asset inventories, condition and performance databases, and alternative investment options.

Source: *FHWA Asset Management Primer*

Note From the Director

The challenges facing the transportation sector today are numerous. Many of our Nation's highways are aging and in need of rehabilitation. Congestion is increasing at an alarming rate. Consumers are asking for – and expecting – to be kept abreast of how DOTs are managing their assets and planning for the future even as increasing demands and limited funds increase the complexity of those tasks.

One tool that is proving invaluable in addressing these issues is Transportation Asset Management (TAM). TAM is a strategic approach that strives to provide the best return for each dollar invested by maximizing system performance, improving customer satisfaction, and minimizing life-cycle costs.

TAM endeavors vary from State to State and include efforts in the areas of data integration; economics in asset management; the utilization of Highway Economic Requirements System – State Version (HERS-ST); life-cycle cost analysis (LCCA); preservation; and pavement and bridge management, among others.

Because we at FHWA believe that transportation agencies work more efficiently when information on one another's successes is shared, the Office of Asset Management is continuing its series of TAM case study reports begun in 2002. I trust that this case study will help you meet the increasingly complex challenges confronting your agency today.

Julius "Butch" Wlaschin
Director, Office of Asset Management

Note to the Reader

The TAM case study series is the result of partnering between State departments of transportation and the Federal Highway Administration's (FHWA's) Office of Asset Management. FHWA provides the forum, and the States furnish the details of their experiences with asset management.

For each case study, FHWA representatives interview State transportation staff and compile the information, and the State approves the resulting material. Thus, the case study reports rely on the agencies' own assessment of their experience. Readers should note that the reported results may not be reproducible in other organizations.

Rehabilitating existing roads while maintaining increasingly high levels of traffic requires innovative solutions such as night paving.

Executive Summary

In 1879 Cleveland became the world's first city to be lighted electrically when Charles Brush set up arc lights on the city streets. From that day forward, the Buckeye State, as Ohio is called, has worked to promote diversity and innovation and has become a leader in agricultural production and a number of industrial/commercial ventures.

And innovation is not limited to the private sector. The Ohio Department of Transportation (ODOT) has demonstrated its commitment to this concept by stepping out of the shadows and reengineering itself in order to provide the citizens of Ohio with the best return on their investment.

The task was a daunting one. By the mid-1990s, ODOT had 7,800 employees; agency operating costs rising at an average rate of 5.7 percent; and 24.68 percent of its multi-lane pavement in need of immediate rehabilitation. The Interstate construction boom had ended, and the organization's centralized structure was not conducive to asset management.

After a thorough self-assessment, ODOT began a reengineering process that would breathe new life into the organization. VISION 2000, as ODOT management called it, was a groundbreaking philosophy for the department. It said that an agency must continually reexamine itself in order to achieve excellence and meet the demands of its customers.

Based on that philosophy, ODOT redefined its mission, values, and goals. The agency decentralized, organizing all operations under three core functions; giving the districts authority over their own project budgets; and making the Central Office responsible for policy and guidance. It worked with the Ohio General Assembly to establish the Transportation Review Advisory Council (TRAC) and provide a more objective means for selecting new capacity projects. With this framework in place, ODOT turned its focus to its project-delivery and data warehousing systems, developing cutting-edge programs for managing system assets more effectively. Finally, ODOT developed an Organizational Performance Index (OPI) that tied accountability to performance at all levels of the organization, empowering employees, making asset management a team effort, and establishing ODOT as a nationally recognized leader in the field of innovation.

AGENCY FACTS

A Cabinet agency, ODOT was created by the Ohio General Assembly in 1905 with just four employees and an annual budget of $10,000. Today, ODOT has 5,666 employees and a biennial construction budget of just over $2 billion.

ODOT's director sits at the helm of the agency, with assistant directors overseeing three key functional areas: business management, transportation policy, and field operations. A deputy director manages each of the department's 12 districts. And, in a groundbreaking move in the late 1990s, ODOT worked with the State's 88 counties to do away with county superintendents and establish county managers who operate from the appropriate district office.

ODOT's mission is to provide a world-class transportation system that links Ohio to a global economy while preserving the State's unique character and enhancing its quality of life. The agency's values include customer focus, people, continuous improvement, integrity, agility, and data-based decision-making. Its goals consist of transportation safety; economic development and quality of life; efficient, reliable traffic flow; system preservation; and resource management. These goals and values are key to maintaining the 10th largest road system in the Nation. (The State's roadways are ODOT's key transportation asset.)

ODOT has established three categories for its expansive road system: 1) Priority, which comprises Interstate and four-lane divided highways; 2) Urban, which consists of State highways within municipalities; and 3) General, which are primarily two-lane highways across the State. The Priority system consists of 12,782 lane miles. While it comprises just 26 percent of the State's lane mileage, the Priority system handles 56 percent of the State's total vehicle traffic and 77 percent of the total truck traffic. By comparison, the Urban system contains 6,013 lane miles; the General system, 30,100.

In addition, ODOT has maintenance responsibility for 14,152 of the State's 44,153 bridges, with ODOT-responsible bridges accounting for more than 67 percent of the State's total bridge deck area. The depart-

ment also oversees nearly 150 highway rest areas and 13 travel information centers and offers assistance to hundreds of airports and heliports, 6,000 miles of railroad track, 400 miles of navigable waters, and more than 50 public transit systems. Employees in 88 county garages and 120 outpost facilities work to keep motorists safe throughout the year.

Central Office Hilltop Complex, Columbus, Ohio.

SETTING THE STAGE

What Did Ohio Have?

By the 1970s, ODOT had developed a centralized, bureaucratic organizational structure that had begun weighing the agency down. This trend continued into the 1990s, by which time ODOT had 16 divisions, 42 bureaus, and 7,800 employees – and agency operating costs rising at an average rate of 5.7 percent. Unless the department took action, it stood to annihilate the DOT's capital budget within a few years.

And ODOT faced additional challenges. By 1996 the percentage of pavement on Ohio's multi-lane freeway system rated as needing repair had reached 25 percent, and the percentage of multi-lane pavement rated fair to poor or very poor and in need of immediate rehabilitation had risen from about 10 percent in 1986 to 24.68 percent in 1996.

ODOT's primary pavement preservation tool was a pavement condition rating (PCR) system similar to that used by the USDOT. (See table below.) While the PCR ratings were helpful to pavement engineers, the information wasn't being used as an effective planning and budgeting trigger. As pavement conditions worsened and budgets tightened, ODOT began to search for a new way of doing business.

Pavement Condition Rating (PCR) Ranges			
PCR Group	*PCR Range*	*Condition*	*Typical Description*
6	90 - 100	Very Good	Stable; no cracking, patching or deformation. Excellent riding qualities. No treatment would improve the roadway at this time.
5	75 - 89	Good	
4	65 - 74	Fair	Generally stable, though minor structural weaknesses may be present. Riding qualities are good. Distress characteristics may include deformation with rutting depths up to 3/4", noticeable thermal cracks or longitudinal cracks appearing in wheel paths.
3	56 - 64	Fair to Poor	
2	40 - 55	Poor	Areas of instability, with marked evidence of structural deficiency. Riding qualities can range from acceptable to poor. Distress characteristics may include rut depths greater than 3/4" or alligator cracking that requires patching. Structural requirements may range from structural overlay to replacement of entire pavement structure.
1	< 40	Very Poor	

What Did Ohio Want?

ODOT knew its existing structure and processes needed a major overhaul. ODOT management wanted to 1) decentralize the department by reengineering the organization from top to bottom, and 2) develop a more accurate transportation asset management system that would prepare the department for the 21st century. To accomplish that ODOT needed to revamp its system preservation and project-delivery processes and develop an effective performance measurement tool.

How Did Ohio Get There?

ODOT made the decision to decentralize the organization in 1994 and unveiled VISION 2000 in January 1995. This groundbreaking restructuring plan was "designed to change the corporate culture of the department, improve quality, increase efficiency, and enable ODOT to meet the demands of its customers by the year 2000." (Source: "What is VISION 2000?", Ohio Department of Transportation VISION 2000, http://www.dot.state.oh.us/Vision2000/V2000.HTM.)

The plan was simple. The Central Office would no longer manage the districts' plans and projects; instead, each district would assume responsibility for its own project budget so it could better respond to local needs. The Central Office would establish policies and long-range goals; monitor performance measures; provide quality assurance; and oversee statewide multi-modal planning efforts.

ODOT viewed a streamlined organizational structure as key to this reengineering effort and consolidated the agency into three core functions (business management, transportation policy, and field operations), with an assistant director heading each area. Making this change reduced the number of divisions by 6, the number of bureaus by 15, and the number of staff reporting to the director by 8. ODOT also eliminated a layer of management between the director and the 12 district deputy directors.

ODOT FUNCTIONAL AREAS – VISION 2000

Business Management – includes fiscal management, human resources, business services, and computer operations.

Transportation Policy – encompasses engineering policy, engineering support systems, planning activities, multi-modal assistance programs, and real estate.

Field Operations – supports the 12 district offices and serves as the districts' liaison to the Central Office.

As part of its corporate restructuring, ODOT asked the Ohio General Assembly for – and received – a temporary exemption from civil service restrictions in order to move people to where they were needed. The agency created a career professional category with accountability for middle managers. This effort complemented the department's biennial business plan, as the biennial goals could be articulated in staff's annual performance plans/evaluations. As ODOT Director Jerry Wray testified before the Ohio House of Representatives' Transportation and Public Safety Committee on February 14, 1996, making these changes was essential to becoming a leaner, more efficient organization:

> Our old table of organization, which dates back to the early 1970s, was highly centralized. It was created in the era of [the] interstate construction building boom, when a centralized structure made more sense. The role of ODOT has changed in the past 25 years. Almost all of the interstate system has been completed. The old structure, still in place, makes it difficult to implement the changes we need to meet the expectations of our customers today. Those expectations include quicker response time, faster plan development and review, increased maintenance of an aging infrastructure and more local participation in decision-making.

ODOT demonstrated its commitment to meeting customer expectations by redefining the agency's vision, values, and goals and then developing strategic initiatives that quantified those priorities. As a result, the county manager position was created, and all ODOT employees were trained in quality assurance.

In addition, at ODOT's request, the Ohio General Assembly established the TRAC in 1997 to provide a more objective means for selecting new capacity projects.

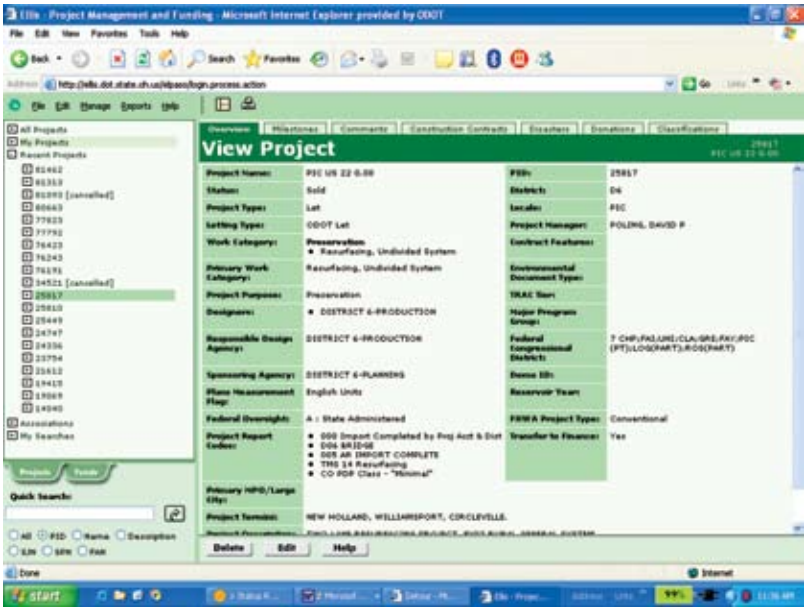
The TRAC consists of the ODOT director and eight appointees with experience in transportation, business, and/or economic development. Six members are selected by the governor; one by the president of the Ohio Senate; and one by the speaker of the House. When it requested that the TRAC be established, ODOT made the commitment to budget for system preservation first and consider adding capacity only after the other bills were paid.

With these changes in place, ODOT was able to focus on its next major task: developing system preservation and project-delivery processes that would become the hallmark of the department's asset management

program and enable ODOT to achieve a steady state condition. The department had a number of data reference systems in place for pavements, bridges, and so forth, but the databases weren't compatible and things were slipping through the cracks. ODOT addressed this concern by developing a geographic information system (GIS)-based program, the Base Transportation Referencing System (BTRS). The BTRS provides an official log of all highway latitude and longitude locations at a hundredth of a mile and consolidates the department's various referencing systems using a 14-digit naming convention for each route in the State. The BTRS logpoints file is used to integrate various information systems for pavements, bridges, and safety as well as project development and road inventory. It allows data warehouses to combine data within and among the agency's various information systems.

The district multi-year work plan has also proven to be a vital part of ODOT's asset management process. This district-driven document uses the GIS system to show multiple years of pavement and bridge preservation efforts. Pavement histories and degradation formulas predict upcoming needs. Projects are identified up to a 10-year planning horizon with the goal of maintaining all assets at acceptable levels into perpetuity.

Another key component to developing a more efficient project-delivery system was tying engineering functions to financial management and performance, says Transportation Systems Administrator Leonard Evans. It took ODOT three years to develop its project management system, Ellis, but the results were worth it. The web-based program not only helps the districts manage their workplan project lists based on funding needs and current allocations, but it allows project managers to track the projects from the time the study area is defined to when construction is complete, benchmarking key milestones and tracking performance throughout the process. By identifying trends and revisiting project planning triggers, ODOT has been able to utilize quantifiable targets such as PCR thresholds to blend pavement management concepts into the project selection process.



This screen gives an overview of a project in Ellis: A project is referenced by a Project Identifier called a PID and a project name. The PID for this project is 25817.

Although the department had developed a fairly detailed TAM system, it had not yet achieved the steady state it was seeking. "We needed to achieve a steady state so that the preservation budget would be consistent and we could sustain that for perpetuity. Constant adjustments are needed to address outside factors, such as the recent increases in construction costs and changes in degradation due to weather and traffic." says Evans. Performance measures proved to be key to that process.

WHERE IS OHIO TODAY?

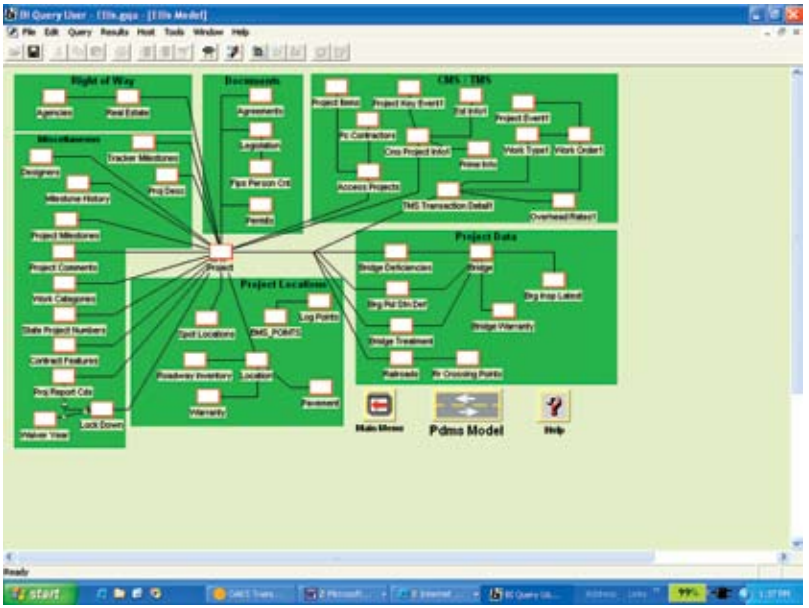
ODOT has made significant advances in asset management since the unveiling of VISION 2000 twelve years ago: overall, system condition deficiencies have been reduced by 66 percent for roads and 80 percent for bridges since 1995.

While a great deal of that progress is attributable to the efforts outlined above, the development of the department's performance model has played a fundamental role in managing system conditions. It took the department several years to create the OPI, but the performance measures capture ODOT's belief that asset management is based upon accountability for all areas of operation. The districts and the core areas of the department report on their progress in meeting their OPI goals, all of which are outlined in the department's biennial business plan.

For example, ODOT staff rate the state roadways annually using a 100-point PCR. Priority system pavements are considered deficient when the PCR falls below 65 points; Urban and General system pavements, when the PCR dips below 55 points. (Note: The PCR threshold for the General system will be 60 points beginning in 2009.) Using this information, the department established a FY 2008 district and statewide goal for acceptable pavement conditions on the Priority, General, and Urban systems at 90 percent, with interim goals from 2004 to 2008 helping to advance toward this steady state condition.

ODOT has established similar benchmarks for bridge conditions, providing progress markers that will help achieve a steady state of minimal system deficiencies. According to the "ODOT Business Plan 2006 & 2007," the FY 2008 goal "is to keep general appraisal ratings at or above 96 percent acceptable, floor conditions at or above 95 percent, wearing surface at or above 96 percent and paint conditions at or above 89 percent acceptable." (Source: "System Conditions: Statewide Bridges – ODOT Statewide Bridge Summary," ODOT Business Plan 2006 & 2007, http://www.dot.state.oh.us/BusinessPlan0607/SystemConditions.pdf.) And the plan doesn't stop there; it details similar performance expectations for every aspect of core operations, including legal counsel, construction, contracts, equipment, facilities, finance, information technology, plan delivery, quality and human resources, roadway safety and mobility, and traffic engineering. With the performance of every employee measured against these goals annually, asset management really is everyone's business. It's a team sport, Evans says, and one that was made

reality by VISION 2000. "The department went through a major explosion in the 1990s, and VISION 2000 was monumental in making this happen. We've come a long way in 12 years, and we're looking forward from a statewide perspective."



ODOT captures and brings together a host of information pertaining to projects. This is done via a warehouse that is accessible to all users. There are various levels of queries already generated for the users. These can be run by clicking a button. Additionally, all ODOT users are trained on the use of the warehouse so they can run their own queries.

WHAT HAS OHIO LEARNED?

Reengineering the department and establishing a comprehensive asset management program has taught ODOT several lessons.

First, it is key to articulate expectations to people, and the most effective way to do that is through performance measures. Establishing the OPI and using this performance-based managerial system to inform key career professionals was a groundbreaking move, but it has served ODOT well.

Second, it is vital to tie engineering functions to the financial management process and track projects accordingly, as ODOT does through Ellis.

Third, establishing the TRAC assisted greatly with asset management by providing a forum for ranking new capacity projects, as did making the commitment to achieve a steady state condition, address system preservation first, and discuss new capacity projects only after all bills are paid.

Ohio's highways are very diverse, ranging from scenic two-lane highways to urban Interstates through America's heartland.

WHAT'S NEXT?

ODOT continues the work begun under VISION 2000 with the advent of new strategic initiatives and performance measures each biennium.

One of the more exciting initiatives underway is a public safety project from the statewide GIS group to develop a location-based response system that will connect local road inventories with the 911 emergency response system.

ODOT is providing guidance and support for this interagency initiative, which is gathering data utilizing ODOT's 14-digit naming convention. The system not only gathers basic roadway GPS information but also includes each discrete address location to facilitate routing of emergency vehicles. Once the data is collected, the road inventories will be integrated into ODOT's Base Transportation Referencing System. From there lessons learned from safety analysis and asset management can be shared with local agencies on their systems as well.

This is a best practice in the Nation, Evans says, and one of many that the department hopes to be involved with.

A wall along I-75 incorporates scale images of the Wright Brothers' historic flight. The length and elevation of the flight match the original 1903 milestone.

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