OHIO AUDITOR OF STATE
KEITH FABER

Ohio Department
of Transportation

Performance Audit

February 25, 2021

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To the Governor's Office, General Assembly, Director and Staff of the Ohio Department of Transportation, Ohio Taxpayers, and Interested Citizens:

The Auditor of State's Office recently completed a performance audit for the Ohio Department of Transportation (ODOT or the Department). This service to ODOT and to the taxpayers of the state of Ohio is being provided pursuant to Ohio Revised Code §117.46 and HB 62 of the 133rd General Assembly. This report contains the recommendations from the second phase of our audit, completing the work previously released in 2019. The review was conducted by the Ohio Performance Team with additional expert analysis provided by the Kercher Group. This report provides an independent assessment of selected areas of operations in relation to industry standards and recommended or leading practices.

This performance audit report contains recommendations, supported by detailed analysis, to enhance the Department's overall economy, efficiency, and/or effectiveness. This report has been provided to the Department and its contents have been discussed with the appropriate staff and leadership within the Department. The Department is reminded of its responsibilities for public comment, implementation, and reporting related to this performance audit per the requirements outlined under §117.461 and §117.462. In future compliance audits, the Auditor of State will monitor implementation of the recommendations contained in this report, pursuant to the statutory requirements.

It is my hope that the Department will use the results of the performance audit as a resource for improving operational efficiency as well as service delivery effectiveness. The analysis contained within are intended to provide management with information and in some cases, a range of options to consider while making decisions about their operations.

This performance audit report can be accessed online through the Auditor of State's website at http://www.ohioauditor.gov and choosing the "Search" option.

Sincerely,

Keith Faber

Keith Faber
Auditor of State
Columbus, Ohio

February 25, 2021

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Ohio Department of Transportation | Phase 2
Performance Audit Summary

AUDIT SCOPE AREAS

- Key Performance Indicators
- Fleet Management
- Capital & Expenditures

- Bridge Management
- Pavement
- Maintenance Management

- Overhead Costs
- Strategic Business Intelligence

MAJOR TAKEAWAYS

Overall, ODOT lacks a strong, consistently applied, Department-wide approach to the use of data and information needed to make strategic decisions. We found common themes with data-driven decision making throughout the Department:

- ODOT lacks a FHWA compliant Bridge Management System which could be used for cost/benefit analysis.
- ODOT's maintenance management practices lack the level of data integration common in peer states.
- ODOT is unable to conduct unit cost analysis on basic maintenance activity.

STRATEGIC BUSINESS INTELLIGENCE

Conclusion: ODOT has historically collected the data needed to effectively manage its offices and divisions but has not taken a department-wide approach to strategic data management. The lack of a consistently applied, department-wide approach to strategic data management could make it difficult for ODOT to sustain progress into the future.

Recommendation 8.1: ODOT should enhance its business intelligence capabilities to allow Department leadership to manage organizational strategy with quantitative inputs, using data to drive key business decisions.

KEY PERFORMANCE INDICATORS (KPI)

Conclusion: Tracking KPIs will allow the Department to collect critical data that will allow for the optimization of projects and workload based on Departmental goals and objectives. Incremental changes can lead to significant operational gains, whether they be in the form of cost savings or increased functionality and ability to perform critical highway and bridge maintenance.

Recommendation 1.1: ODOT should implement performance monitoring through the use of well-developed performance indicators and key performance indictors applied at the appropriate level. Developing and managing appropriate performance measures could lead to efficiency improvements across all areas of ODOT's operations.

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FLEET MANAGEMENT

This area was analyzed in prior audits. Rather than implement the recommendations from those prior audits, ODOT has removed policies and procedures and left the fleet management decisions entirely to the Districts.

Conclusion: We found that within several categories of vehicles, disposal age varies significantly from District to District, and sometimes within the same District. While ODOT's Central Office indicated that District Officials were best suited to make decisions related to fleet replacement, the variation in disposal age which exists indicates that this is not the case.

Recommendation 2.1: ODOT Fleet Central Office should implement policies for the replacement of fleet and equipment for ODOT Districts. The policies should be supported by a data driven methodology, and should identify when districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary. Finally, ODOT should take care to make sure the policy covers all pieces of equipment, including all sizes of vehicles, mowers, and equipment with small engines, such as weed whackers.

CAPITAL & EXPENDITURES

Conclusion: ODOT uses both state and federal bonds for a variety of projects. The use of bond funding can be a useful tool and allows the Department to complete major projects in a timely manner. Further, because inflation related to construction costs often outpace regular inflation, using bond funding can reduce the overall expense related to projects. However, the Department could improve the use of bond revenues through strategic decision making.

Recommendation 3.1: The Department currently uses bond funding for routine maintenance expenses, which is can result in unnecessary interest charges. ODOT should reserve bonding for projects with a long useful life.

Recommendation 3.2: The Department should require debt affordability studies to gauge when it can afford to take on new debt prior to pursuing new bond issuances.

Issue for Further Study: Ohio may have up to $1.2 billion in outstanding highway bond debt at any given time. As of FY 2020, there was approximately $200 million in unused bond capacity. While there are many factors that the Department needs to consider before undertaking a project, ODOT should research if there are opportunities to take full advantage of the statutory borrowing limit and therefore finish more construction projects in a given year.

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BRIDGE MANAGEMENT

Conclusion: Federal regulations set minimum standards related to bridge condition and maintenance. These regulations include the frequency and standards for bridge inspections. We found that Ohio's bridges are maintained in a safe and effective manner and that the cost per square foot is lower than peer states.

While ODOT is presently maintaining bridges in an effective manner, we found two areas that could result in increased efficiency and potential cost savings.

Recommendation 4.1: ODOT should implement and support a successful Bridge Management System (BMS) installation that meets the Federal Highway Administration (FHWA) minimum documented standards (23 CFR 515.17).

Recommendation 4.2: The General Assembly should revise ORC §5501.47 to remove the requirement that ODOT conduct annual inspections of all bridges and instead adopt a risk based methodology for bridge inspection, consistent with peer states and federal guidelines that allow for a risk-based 24-month inspection cycle for some bridges.

PAVEMENT

Based on information available from 2019, we determined that the condition of pavement maintained by ODOT is in-line with peer averages. However, the Department is doing so at a higher cost per mile compared to peers.

Conclusion: ODOT does not collect or deploy data in a manner which allows the Department to optimize pavement management practices. We identified three key areas for improvement in relation to this process.

Recommendation 5.1: ODOT collects data manually, which may not be as accurate or as effective a method as automatic data collection. ODOT should develop an efficient and effective pavement data collection plan consistent with best practices.

Recommendation 5.2: ODOT should adopt best practices for pavement projections. The Department currently fully projects expenditures five years in advance, and partially expenditures projects for up to 10 years. Moving to a longer time frame could improve pavement optimization.

Recommendation 5.3: ODOT should conduct a study to optimize project selection at the district level, including the maximum percentage match between PMS project recommendations and the timeframe Districts have to complete the projects.

MAINTENANCE MANAGEMENT

Maintenance activities represent a significant portion of ODOT's annual budget. However, the Department was unable to provide the data necessary to conduct unit cost comparisons. That is to say, ODOT could not tell us the cost to perform similar maintenance activities across Districts. Critical data needs to be maintained in a manner which allows for the effective management and monitoring of operations.

Conclusion: ODOT's current system maintenance management system, EIMS, is built on an industry-standard system that has been used successfully in peer states, but ODOT is not currently fully utilizing its existing technology. The Department recognizes the importance of an MMS but is currently pursuing the purchase of a new system rather than fully implementing the system they already purchased. An effective MMS would allow for the collection of data that could be used to conduct unit cost analyses to better allocate resources.

Recommendation 6.1: The Department should explore every opportunity to optimize their existing system before committing to the purchase of something else. And adopt best practices to leverage the existing maintenance management system tools, including better integration with the Department's other IT systems and use in work planning.

Recommendation 6.2: ODOT should ensure the maintenance management system captures the costs of maintenance activities and allows analysis of the most economical means for conducting highway maintenance.

Recommendation 6.3: ODOT should restart, strengthen and enhance the Maintenance Condition Rating (MCR) program.

OVERHEAD

As identified in Phase 1 of this audit, ODOT does not conduct cost/benefit analyses related to the use of outsourced labor. This may result in additional expenses related to labor and was further reviewed in the current audit.

Conclusion: The Department uses overhead calculations in other areas of operations, but not when determining the financial impact of contracted labor. Further, these decisions are left to District management with limited guidance from the Central Office.

Recommendation 7.1: ODOT should develop a standardized methodology for applying overhead to insourcing and outsourcing decisions, and assist the various departments in their application of appropriate cost-benefit analyses.

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Introduction

Roadways are the critical arteries for transportation in the United States. In Ohio, we have the fifth largest interstate system in the country, the second largest bridge inventory, and the sixth highest vehicle miles traveled. In addition to routine passenger travel, our state roadways also see a significant amount of freight traffic. With more than half of the country's population within a day's drive of Ohio, our state is often a hub of activity for the shipment of goods.

Taking care of the roadways you drive on is a joint effort between the Ohio Department of Transportation (ODOT or the Department), Ohio's counties, and local governments. ODOT alone maintains more than 43 thousand miles of highway lanes and more than 14 thousand bridges; these roads and bridges are valued at $116 billion and is one of the Ohio's largest assets. Keeping these roadways and bridges in safe and navigable condition is an important, costly, and year-round job. ODOT employees are tasked with duties ranging from mowing along highways in warmer months, to clearing snow and ice in the winter, to overseeing large construction projects to ensure compliance with building plans and federal regulations. This work requires specialized equipment and vehicles, a significant number of workhours, and sophisticated technology systems.

Kercher Group, Inc.

AOS contracted with Kercher Group, Inc., experts in state DOT operations, for their expertise in pavement, bridges, and management.

We worked jointly with Kercher to conduct numerous interviews with key representatives from each area analyzed in this report.

Data was gathered with cooperation from ODOT in order to conduct meaningful analysis. This information was shared with ODOT and revised based on data-driven input.

Kercher delivered four technical memos to OPT which were used to inform recommendations made in this report. The full memos can be found here: OPT 2021

In 2019, the Ohio General Assembly passed House Bill 62 (HB62), the state transportation budget, which increased the gas tax in order to provide ODOT with additional revenue to carry out its mission. This was the first increase in the gas tax in more than 14 years. As a part of the legislation, ODOT was required to undergo several reviews of efficiency and effectiveness including a performance audit conducted by the Auditor of State's Ohio Performance Team (OPT).[1] The first phase of this audit was released on December 31, 2019. The second phase of this audit was conducted between March and October of 2020 by OPT in cooperation with the Kercher Group. The Kercher Group is a transportation consulting firm hired by OPT to bring in outside expertise on highway management and DOT operations.

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[1] Performance Audits are conducted according to Generally Accepted Government Auditing Standards, see **Appendix A** for more details.

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> ⚠️ # NOTE TO REPORT USERS:
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> This performance audit was conducted during a state of emergency due to the COVID-19 pandemic. Our analysis was based on current agency operations, with an emphasis on the most recent fiscal year completed, FY2019-20, and the current fiscal year in progress, FY2020-21. The report does not account for the changes that have occurred and will occur from the unanticipated disruption caused by the pandemic.

Department Overview

ODOT is a cabinet level agency and is run by the Director of Transportation who is appointed by the Governor. The Department is staffed by more than 5,000 regular employees who work to ensure the safe and easy movement of people and goods from place to place on Ohio's roadways. In order to accomplish this task, ODOT is allocated more than $3.5 billion annually, which primarily comes from state and federal gas tax revenues.

Department Structure

The Department has three levels of organization – the Central Office, District Offices, and County Garages. The Central Office is located in Columbus and provides leadership for the entire Department through the efforts of the Director of Transportation. In order to support the Director, Central Office personnel includes the assistant directors of business and human resources, field operations, transportation policy, and the chief of staff. In addition to overall leadership and direction, the Central Office also supports the Districts by providing human resources, information technology, finance, legislative affairs, communications, planning, and facilities and equipment management.

ODOT District Map
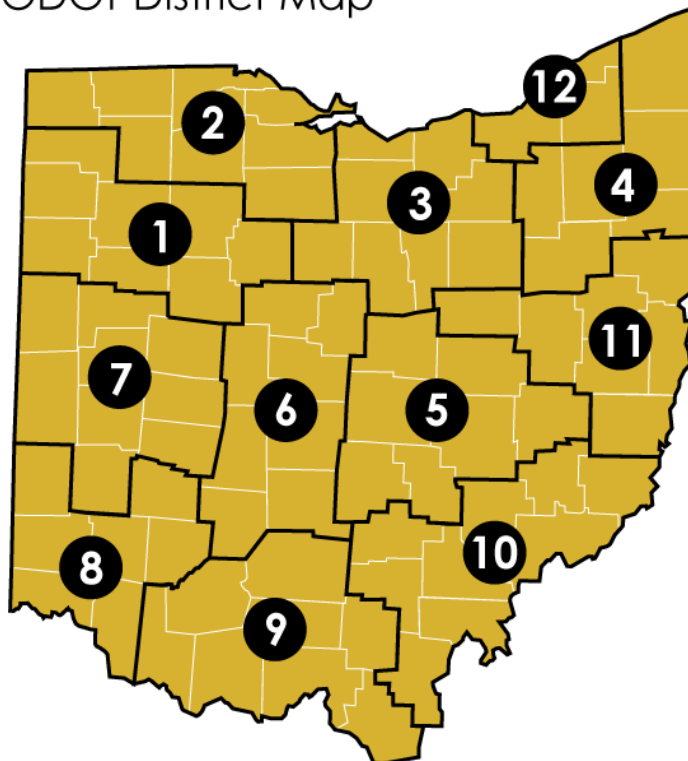
While the Department does have a distinct hierarchy of divisions and offices, work is done in a largely decentralized manner. There are 12 District Offices throughout the state and management decisions are generally left to the discretion of District leadership. These decisions include determining when to salvage or purchase new vehicles and equipment, when to hire consultants or permanent employees, and what projects are completed on an annual basis. While the Districts work with the Central Office to plan and prioritize construction projects, District team members are responsible for the planning, engineering, construction, and maintenance of the state transportation system in their regions.

Each of Ohio's 88 counties also has a County Garage where equipment is housed and maintained. Operational decisions may be made at the county level, particularly in regards to staffing needs. The County Garages work with Central Office and Districts to conduct maintenance activities on roadways within a given county.

Department Finances

The majority of funding for ODOT comes from the state and federal gas taxes. In 2019, the General Assembly increased the gas tax in order to provide additional revenues to ODOT. The Department is expected to receive an additional $476 million in funding annually based on the tax increase.[2]

In addition to tax revenues, the Department is able to generate funds through the issuance of bonds. Bonds are a type of debt instrument; the purchaser of a bond loans money to the agency and in return, the agency repays the principal plus interest over time. Bonds allow governmental entities to obtain debt at market rates that are typically lower than other financing alternatives, and allows investors to obtain stable returns on investments.[3] Article VIII, §2m of Ohio's Constitution (Article VIII) allows the Treasure of State to issue State Highway Bonds for highway improvements. Furthermore, Article VIII allows for a combined total of $1.2 billion in outstanding State Highway bond debt in a given year. In addition, Article VIII allows the state to issue up to a maximum of $220 million per year in new Highway Bond debt, plus any unissued debt from the previous year.[4] As of 2020, the state had $1 billion of outstanding highway bond debt, or 83.6 percent of the legal limit.

Between FY 2015 and FY 2019, the Department's revenues were relatively consistent, with a spike occurring in FY 2018 due to an increase in federal GARVEE bonds. The chart on the following page identifies the amount and source of revenues over the five year period. While

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[2] While the Department anticipated additional revenues due to the increased gas tax, reductions in travel as a result of the ongoing pandemic have led to lower than expected tax revenues; as of November of 2020, gas tax revenue is down $154 million below projection.

[3] ODOT relies on two types of bonds for revenues, State Highway Capital Improvement (HCAP) and Grant Anticipation Revenue Vehicle (GARVEE). See **Section 3: Capital and Expenditures** for more details.

[4] For example, if the state issues $200 million of the $220 million maximum this year, the state would have $20 million in unissued debt from this year, so next year the state could issue $240 million, subject to the total maximum.

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state funding, which is comprised of gas tax revenue decreased, ODOT's dependence on bond funding increased.[5]

ODOT Revenue FY 2015 - FY 2019
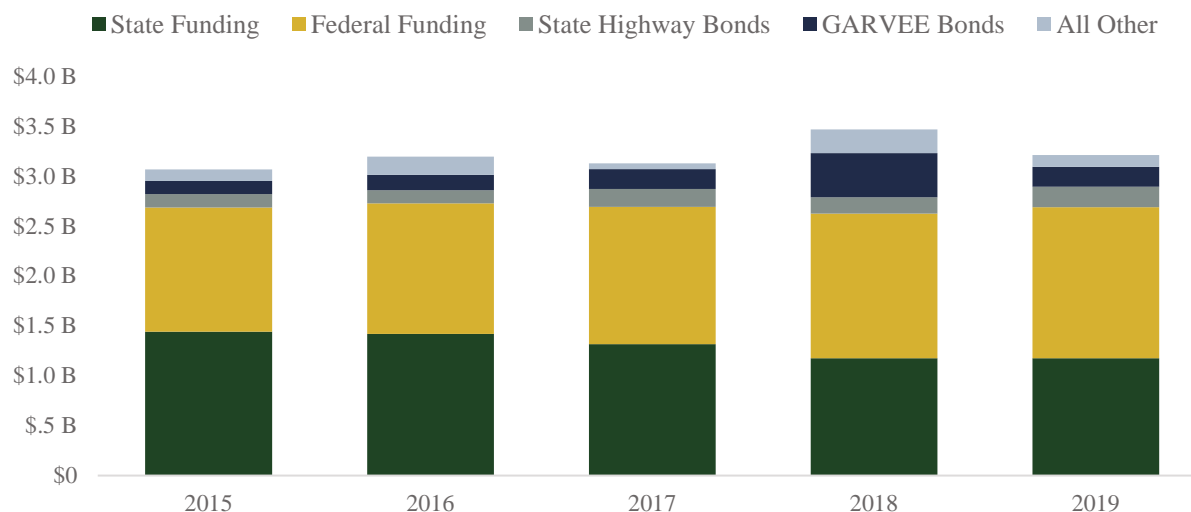
Source: ODOT Financial Statement

On average, ODOT expended $3.2 billion per year during the same time frame, with 71.5 percent of the spending dedicated to capital programs, which include all bridge and pavement projects, including new construction. An average of $1.3 billion was spent on preservation of pavement with an additional $392 million dedicated to new construction. These two programs account for nearly 75 percent of capital programs expenditures with the remaining allocated to federal projects, emergency projects, the state infrastructure bank, planning, aviation, and public transit. The remaining expenditures are primarily operating expenses which include salaries and benefits of ODOT employees. A chart outlining Department expenditures over the past five years is on the following page. While expenditures have increased slightly over the period, the pattern of spending primarily on capital programs has remained consistent.

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[5] State funding is the net state gas tax revenue minus refunds and transfers, Local Share, State Agency Draws, and State Bond Debt Retirement, Public Private Partnership, and state match for GARVEE bonds; state funding is inclusive of Other ODOT Income, and GRF funding for aviation, rail, and transit. In total, the state gas tax accounts for 93 percent of ODOT's funding.

ODOT Expenditure FY 2015-19

Legend: ■ Total Operating ■ Capital Programs ■ All Other
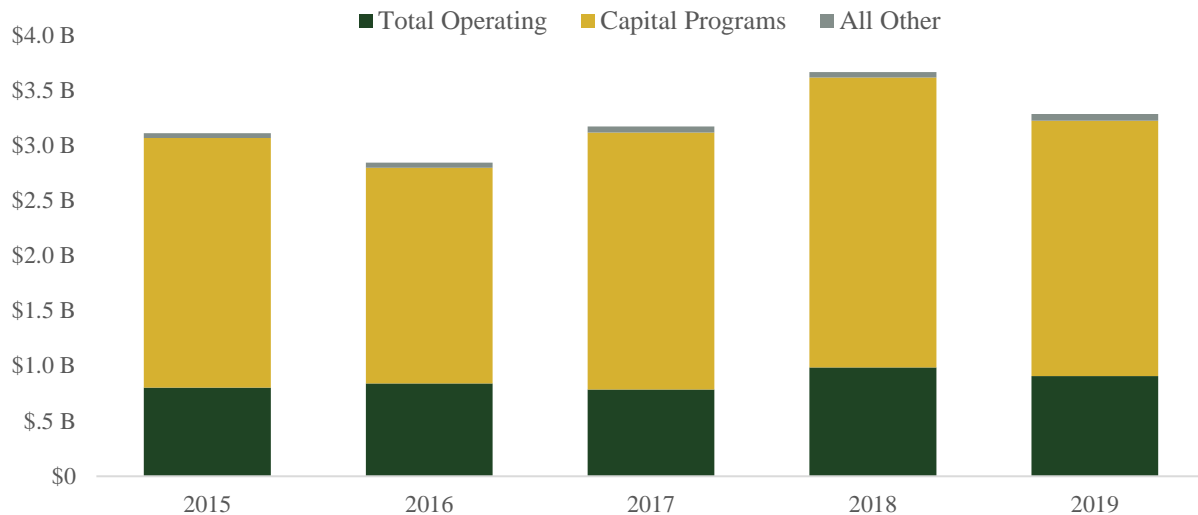
Source: ODOT

The Department identifies projected future revenues for planning purposes. Of note, due to the gas tax increase which was passed as part of HB 62 in 2019, the Department anticipates an average of $1.7 billion per year in gas tax revenue, which is an average increase of $400 million over the 2015-19 of $1.3 billion; however, it should be noted that revenue is currently undeforming projections by about $154 million, due to reduced gas tax revenue related to reduce travel during the pandemic.

Projected State and Federal Revenue

Legend:
■ State Motor Fuel Tax   ■ Federal Motor Fuel Tax
■ Other Federal Revenue   ■ State Bonds
■ GARVEE Bonds   ■ Other State Revenue

Source: ODOT
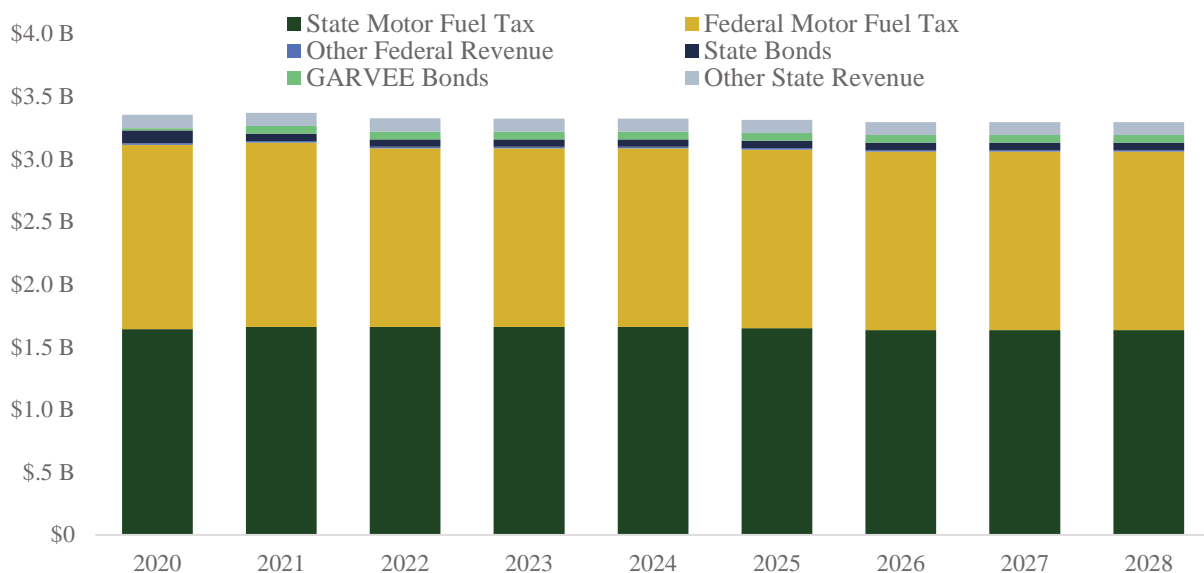
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Department Operations

The Department's mission is to provide safe and easy movement of people and goods from place to place. In order to accomplish this mission, thousands of employees work on both routine maintenance and care of roadways and bridges as well as new construction and major rehabilitation projects. From plowing snow in the winter and mowing grass in the summer to repairing potholes or to inspecting bridges to ensure safe infrastructure, ODOT employees are working to keep Ohioans moving.

While the Central Office is responsible for large scale strategic planning, many, if not all, of the daily decisions relating to work is done at the District or County level. These decisions include how internal staff are deployed, when contractors should be hired to supplement the work force, or what projects should take priority for maintenance work.

ODOT's daily operations can be broken down into three major areas:

- **Operations** – Includes the cost of support functions such as central office, all department payroll, and routine maintenance including guardrail repair and snow removal. In total, between FY 2015 and FY 2019, operations expenditures averaged $865 million per year, or about 26.9 percent of all expenditures.
- **Capital Programs** – Includes the cost of major road and bridge repair and new bridge and highway construction. In total, between FY 2015 and FY 2019 the Department expended an average of $2.3 billion per year on the capital program, or 71.5 percent of the Department's total expenditures. The bulk of this audit will focus on preservation activities for pavement and bridges, which at an annual average of $1.3 billion represent about 41 percent of overall capital expenditures and are the largest single expenditure in the category.
- **Grant and Loan Programs** – Includes grants and loans to local governments for aviation and transit projects. Between FY 2015 and FY 2019, the Department expended $52 million on grants and loans, or 1.6 percent of the Department's total expenditures.

Transportation Asset Management Plan

Most state DOTs receive significant funding from federal sources, as such, state DOTs must meet certain requirements to report on their efforts to maintain their assets to the federal DOT.

Under the Moving Ahead for Progress in the 21st Century Act (MAP-21) (signed in 2012) and the Fixing America's Surface Transportation (FAST) (signed in 2015) state DOTs are required to develop a Transportation Asset Management Plan (TAMP) which:

- Reports progress on safety, asset condition, congestion reduction, system reliability, freight movement, environmental sustainability, and reducing delays;
- Reports on the condition of bridges and pavement; and,
- Meet minimum conditions for bridge and pavement management systems.

The scope areas analyzed in this report largely coincide with the areas reported in the TAMP. In addition, much of the analysis in this report was informed by the same data sources ODOT uses to create their annual TAMP.

The Department is subject to a variety of state and federal regulations regarding the safety of roadways. Some of these regulations identify specific requirements that must be maintained,

such as the allowable time interval between bridge inspections. Some funding, particularly at the federal level, may be tied to specific activities such as completing certain projects and adhering to federal standards.

Data and Information Systems

Each of the core activities within ODOT has a number of unit costs associated with them; whether it is the cost of gasoline for a tractor mowing the median of a highway or the component expenses of asphalt needed to make necessary repairs. The Department has numerous systems to collect important data on these activities.

Proper data collection, management, and analysis is critical for an agency attempting to make strategic business decisions. After the passage of the state gas tax increase in 2019, ODOT committed to reducing expenditures by $100 million dollars. To date, the Department has identified $30 million in savings through this process. Our audit identifies several additional areas for improved operations which can help to achieve the goal of reducing overall Departmental expenditures. In addition, our audit identifies several areas where the Department can improve data collection, which can help ODOT validate and sustain cost savings into the future.

Audit Overview

This performance audit, initiated in March of 2020, allowed OPT to work collaboratively with ODOT and the Kercher Group. As a part of the performance audit, OPT worked with Department leadership in order to identify areas for review which would result in recommendations that could assist ODOT in achieving its mission in an efficient, effective, and transparent manner. The performance audit reviewed the following scope areas:

- **Pavement**: Compares ODOT's pavement management practices to peer states and recognized practices;
- **Bridges**: Compares ODOT's bridge management practices to peer states and recognized practices;
- **Maintenance**: Compares ODOT's maintenance practices to peer states and recognized practices;
- **Fleet**: Examines ODOT's use of data in fleet management;
- **Overhead**: Compares ODOT's method for overhead cost calculations to leading practices; and,
- **Strategic Information**: Analyzes ODOT's collection and use of data for strategic decision making.

Summary of Recommendations

OPT has conducted four previous audits of ODOT dating back to 2011. Several of the areas reviewed in this audit have been addressed in prior audits as well. The recommendations identified in this report, if implemented, will assist ODOT in making necessary operational

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decisions in order to meet the Department's internal goal of reducing expenditures by $100 million:

- **Recommendation 1.1:** ODOT has developed standard performance measures for some major public-facing activities but currently lacks measures for key internal support functions. ODOT should implement performance monitoring through the use of well-developed performance indicators and key performance indicators applied at the appropriate level. Developing and managing appropriate performance measures could lead to efficiency improvements across all areas of ODOT's operations.
- **Recommendation 2.1:** ODOT lacks a centralized policy that governs the cycling of fleet and equipment. ODOT Fleet Central Office should implement policies for the replacement of fleet equipment for ODOT Districts. The policies should be supported by a data driven methodology, and should identify when Districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary. Finally, ODOT should take care to make sure the policy covers all pieces of equipment, including all sizes of vehicles, mowers, and equipment with small engines, such as weed whackers. Actively managing fleet operations based on an optimized usage plan which minimizes expensive maintenance costs and maximizes resale or salvage value of vehicles and equipment reduces lifecycle costs of vehicles and promotes effective, efficient, and transparent use of government resources.
- **Recommendation 3.1:** ODOT has occasionally used bond funds for operations as opposed to projects with a long useful life. ODOT should reserve bond funding for those projects with a long useful life. Doing so ensures that sources and uses of funds are matched in an appropriate manner, and only projects with benefits that outweigh the cost of borrowing are financed as such.
- **Recommendation 3.2:** ODOT does not have a policy which requires a debt affordability study before the issuance of new debt. ODOT should require debt affordability studies to gauge when ODOT can afford to take on new debt. Debt affordability studies can help ODOT further optimize its use of debt and therefore make better use of limited resources.
- **Recommendation 4.1:** ODOT currently lacks a Bridge Management System (BMS). ODOT should implement and support a successful BMS installation that meets the Federal Highway Administration (FHWA) minimum documented standards (23 CFR 515.17). Without a BMS the Department risks suboptimal decision making and could have a difficult time sustaining current progress with bridge management. The Department projects spending over $300 million per year on bridge maintenance, repair, and preservation over the next decade, so even a 1 percent improvement in efficiency could result in $3 million in annual savings, which, at $2.31 per square foot, could be used to maintain over 1 million square feet of bridge deck each year.
- **Recommendation 4.2:** ODOT currently conducts annual inspection of all bridges. This is a more frequent interval than what is required by federal law. The General Assembly should revise ORC § 5501.47 to remove the requirement that ODOT conduct annual inspections of all bridges and instead adopt a risk based methodology for bridge inspection, consistent with peer states and federal guidelines that allow for a 24-month inspection cycle for some bridges. Bringing ODOT's bridge inspection guidelines in-line

with federal guidelines will save an average $9.8 million in annual bridge inspection costs at the state and local level.

- **Recommendation 5.1:** ODOT currently has a manual process used to collect pavement data. Peer states typically use either a fully automated system or a hybrid between automation and manual data collection. ODOT should develop an efficient and effective pavement data collection plan consistent with best practices. Manual data collection could result in inconsistent data collection, which could lead to suboptimal decision making. In turn, this could make it more difficult for the Department to sustain its current progress with pavement management.

- **Recommendation 5.2:** ODOT currently fully projects future pavement expenditures for five years, whereas best practice states use much longer projection periods. ODOT should adopt best practices for pavement projections. By optimizing the time horizon of pavement projections, the Department may be able to select more cost effective treatment options.

- **Recommendation 5.3:** ODOT currently requires Districts to match 75 percent of the projects identified by the central office using the pavement management system (PMS). Districts report having little issue hitting this metric, suggesting that the 75 percent match might be too low. ODOT should conduct a study to optimize project selection at the district level, including the maximum percentage match between PMS project recommendations and the timeframe Districts have to complete the projects. Calculating the optimal percentage of project selections that can be expected could lead to additional savings or better long term decisions related to project planning.

- **Recommendation 6.1:** ODOT is not currently fully utilizing its existing maintenance management software. In addition, the Department is considering the purchase of a new system despite never having fully implemented the existing system. ODOT should adopt best practices to leverage the existing maintenance management system tools, including better integration with the Department's other IT systems and use in work planning. The lack of data available throughout the course of this audit with respect to maintenance activities implies the Department is incurring risk of misallocating maintenance resources. In addition, the lack of data on unit costs of maintenance activities makes it difficult for the Department to make efficient decisions related to the use of outside contractors.

- **Recommendation 6.2:** ODOT does not currently capture unit cost of common maintenance activities. The Department should ensure the maintenance management system captures the costs of maintenance activities and allows analysis of the most economical means for conducting highway maintenance. This will allow the Department to have all relevant facts before making resource allocation decisions**.**

- **Recommendation 6.3:** The Department has stopped using its maintenance condition rating to measure performance in maintenance. ODOT should restart, strengthen and enhance the Maintenance Condition Rating (MCR) program. A maintenance condition rating will help the Department monitor performance and in doing so further optimize a major functional operation**.**

- **Recommendation 7.1:** ODOT does not currently use an industry standard methodology to calculate the cost of overhead for the purposes of management decision making.

ODOT should develop a standardized methodology for applying overhead to insourcing and outsourcing decisions, and assist the various departments in their application of appropriate cost-benefit analyses. Between FY 2015 and FY 2019, ODOT spent approximately $105 million on consultant services annually. If a one percent savings could be realized by ODOT through optimizing the agency's decision making processes, the Department could realize more than $1 million in annual savings.

- **Recommendation 8.1:** ODOT currently collects data and information on its performance, but does not always use that data in a consistent manner for management decision making. ODOT should enhance its business intelligence capabilities to allow Department leadership to manage organizational strategy with quantitative inputs, using data to drive key business decisions. The areas which were examined in this audit represent more than $1.3 billion in annual spending. Improving the efficiency of these programs by even small margins can result in millions of dollars of savings. The full impact of this recommendation is dependent on how well ODOT is able to implement strategic business decisions and change throughout the Department.

- **Issue for Further Study—Use of Debt:** According to Article VIII, §2m of the Constitution of the State of Ohio, the state can issue debt equal to up to $220 million per year for highway construction and maintenance, and the state may have a balance of up to $1.2 billion in outstanding highway bond debt at any given time. As of FY 2020, a total of $1 billion in outstanding debt had been issued, meaning there was a total of about $200 million in unused bond capacity. In recent years, construction costs increased an average of 3.5 percent each year, whereas general inflation increased an average of 1.9 percent each year. Due to the annual increase costs of construction, completing a project sooner will generally make the entire project less expensive. While there are many factors that the Department needs to consider before undertaking a project, ODOT should research if there are opportunities to take full advantage of the statutory borrowing limit to make the best decisions available to them based on the current set of economic factors.

Key Performance Indicators

A **Key Performance Indicator (KPI)** is a measurable value that demonstrates how effectively an organization is achieving **important** objectives. These measures help to determine an organization's strategic, financial, and operational achievements. KPIs allow an organization to understand how well it is progressing towards its mission and goals. These metrics provide a guidepost that allows organizations to make decisions related to personnel and operations in order to advance internal progress to meeting benchmarks. Getting the right metrics are especially important given ODOT's relatively decentralized structure.

In the 2020 NewVantage Partners annual executive survey of big data and artificial intelligence, approximately 25 percent of large enterprises report there is still no single point of accountability for data within their organization, reflecting the decentralized ownership of data within business units. One reason that ODOT seeks improved KPIs is to better allow high-level decisions makers to monitor performance across relatively decentralized offices, departments, and functional areas.

Background

In the 1990s, ODOT began to develop Critical Success Factors (CSFs) as a way to measure performance in key areas of ODOT's operations. Early CSFs were assigned to areas for which an industry standard measure of performance already existed, for example, the Department has a goal that the average bridge in the state should have a general appraisal (GA), which is an industry standard measure of bridge quality, of at least 6.8 on a 9.0 point scale (see **Section 4**). Over time, CSFs that were found to be less useful were discontinued, such as the maintenance condition rating (MCR) (see **Section 6**), while CSFs that ODOT leadership have found useful were consolidated into Safety, Construction, System Conditions, and Operations. Overall, current CSFs are focused on public-facing activities.

In 2020 the Department sought to dive deeper into performance measurement by developing key performance indicators (KPIs), which would focus largely on internal operations. The effort to create KPIs was spearheaded by the Assistant Director of Field Operations and ODOT's Chief of Staff. KPIs would focus on measures effecting internal users (turn-around times for reports, managing social media / communications, operational target response times, etc.).These measures would provide data for greater decision-making capacity, to better set goals throughout the organization, and better manage interconnectedness of ODOT operations.

ODOT leadership worked with representatives from districts, divisions, and offices to identify key metrics for ODOT's functions. One example, which is fairly representative for the specific KPIs proposed, is that the Office of Contract Sales proposes that a contract which needs to be renewed should be renewed within seven business days after the office receives the request. In this example, the KPI would be days to turnaround a contract renewal and the goal would be seven days. KPIs are still under development and are designed to drive internal performance,

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with the goal of using the tracked data for decision making processes. To date, the Department has collected 118 suggested metrics that may be further developed into KPIs.[6]

What We Looked At

In order to understand how the Department measures success, we reviewed the KPIs that have been internally developed by ODOT. We compared these metrics to peer states and both academic and industry standards in order to determine the effectiveness of each KPI.

Why We Looked At This

A clear understanding of performance and success is critical to decision making. If an agency does not know where it wants to go, it is difficult to determine the best path to take. KPIs, when properly identified and tracked, provide the roadmap to an agency seeking to make strategic business decisions and attempting to maximize efficiency, transparency, and effectiveness.

In particular, over the course of several audits of ODOT, our office has found gaps in the amount and types of data which are collected. Setting appropriate KPIs can help the Department to track meaningful data which will assist in future decision making.

What We Found

We found that ODOT has historically used CSFs to monitor performance and that CSFs have primarily been focused on more public facing metrics, such as snow and ice removal times. As previously mentioned, this information is tracked, but is not used for decision making purposes in every area. While ODOT is currently developing KPIs, they are seemingly overly broad and lack specificity to allow for meaningful data analysis and decision making.

In order to assist ODOT in the development of KPIs that will be useful over a long term, we identified one recommendation:

- **Recommendation 1.1:** ODOT has developed standard performance measures for some major public-facing activities but currently lacks measures for key internal support functions. ODOT should implement performance monitoring through the use of well-developed performance indicators and key performance indicators applied at the appropriate level. Developing and managing appropriate performance measures could lead to efficiency improvements across all areas of ODOT's operations.

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[6] See **Appendix B** for a full list of operational areas with developed KPIs.

Recommendation 1.1: KPI Development

ODOT has developed standard performance measures for some major public-facing activities but currently lacks measures for key internal support functions. ODOT should implement performance monitoring through the use of well-developed performance indicators and key performance indicators applied at the appropriate level. Developing and managing appropriate performance measures could lead to efficiency improvements across all areas of ODOT's operations.

Impact

Developing and managing appropriate performance measures could lead to efficiency improvements across all areas of ODOT's operations, and should drive improvement efforts across the Department.

Methodology and Analysis

We reviewed ODOT's internally developed KPIs to peer state metrics and both academic and industry standards. We then used these comparisons in order to determine the effectiveness of the Department's existing KPIs.

Defining objectives related to project or program success prior to implementation is an important aspect of being able to monitor performance. One such way of identifying success is the SMART criteria.[7] SMART is an acronym which states that objectives or goals should be:

- **Specific:** Target a specific area for improvement;
- **Measurable:** Quantify or suggest a progress indicator;
- **Assignable:** Specify who will do a task;
- **Realistic:** State what results can be achieved given available resources; and,
- **Time-related:** Specify when results can be achieved.

In addition to SMART criteria being used to generally evaluate objectives and program success, there are several characteristics of KPIs which have been identified by scholars. In particular, KPIs should be:

- **Sparse:** The fewer KPIs an organization has, the better;
- **Drillable:** Users can drill into details of the KPI;
- **Simple:** Users understand the KPI, which clearly indicates the action required by staff;
- **Actionable:** Users know how to affect outcomes and have a significant impact;
- **Owned:** KPIs have an owner and can be acted on by the CEO and senior management team;
- **Referenced:** Users can view origins and context of the KPI;

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[7] Doran, G. T. (1981). "There's a S.M.A.R.T. way to write management's goals and objectives". Management Review. 70 (11): 35–36.

- **Correlated:** KPIs drive desired outcomes and encourage appropriate action (KPIs have been tested to ensure that they have a positive impact on performance);
- **Balanced:** KPIs consist of both financial and non-financial metrics;
- **Aligned:** KPIs don't undermine each other;
- **Validated:** Workers can't circumvent KPIs;
- **Regulated:** KPIs are measured frequently, possibly daily or weekly; and,
- **Distributed:** KPIs are measures that tie responsibility down to a team.

SMART Criteria

We reviewed the 118 KPIs that are under development by ODOT under the scope of SMART analysis. KPIs were scored on a scale of 0-5, with a point being given for each of the SMART criteria met. For example, if a KPI was found to be specific and measurable, it would be given a score of 2.

Given the number of KPIs, we determined an average quality score by ODOT Central Office Division. As seen in the chart below, most Divisions had an average score between two and four, indicating that on average the KPIs were missing at least one and up to three of the SMART criteria.

Central Office Average Quality of KPIS by Division
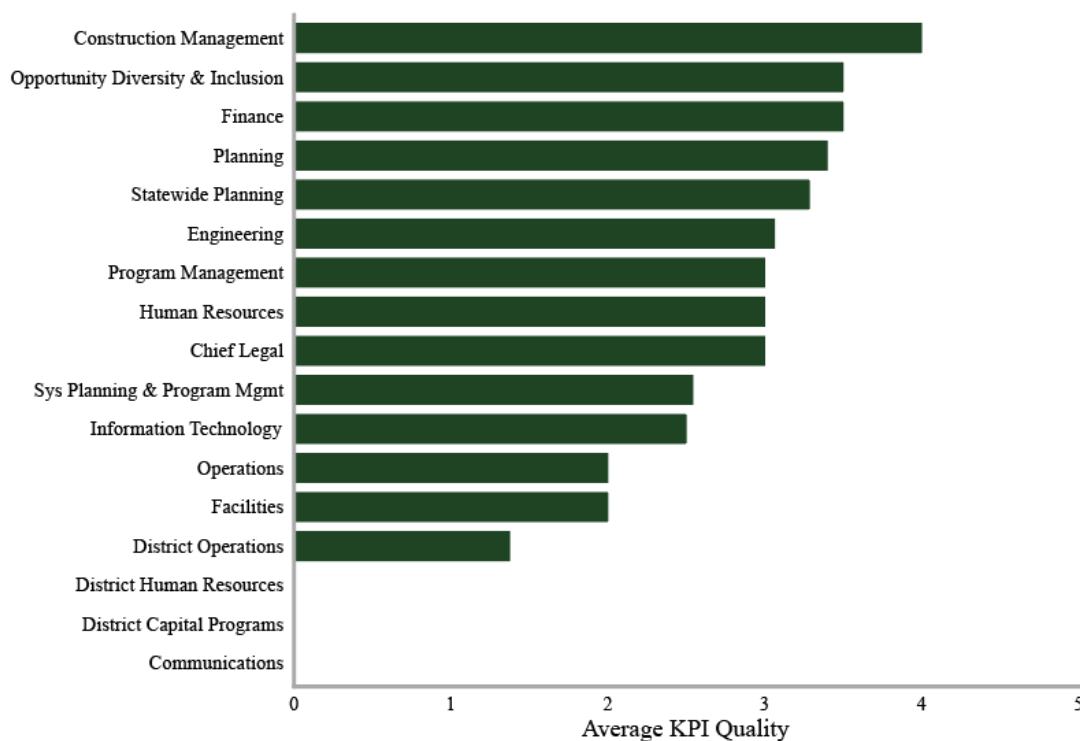
Source: ODOT

We found that the KPIs were most often deficient in the time-related and assignability metrics. The District Offices had lower average KPI scores based on the SMART criteria. Within the

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District Offices, most KPIs were specific. However, we found issues related to time, measurability, assignability, and the realistic nature of KPIs. Additional information regarding KPIs can be found in **Appendix B**.

KPI Development

With more than 100 KPIs, the Department does not maintain a sparse list. As the number of KPIs increases, the identified key nature of the indicator is diminished, and the KPI becomes simply a performance indicator.

KPIs should be developed to identify core data that can be used for strategic decision making and drive outcomes across the Department. These indicators can be leading and used for future performance; lagging and used to identify or measure the outcome of past projects; or diagnostic and meant to determine the current health of existing processes or activities.

Conclusion

ODOT is not presently developing KPIs. Instead, the Department has identified an extensive list of performance indicators which can be used to drill down into the key concepts or opportunities for data collection.

The Department should develop and track KPIs in order to collect critical data that will allow for the optimization of projects and workload based on Departmental goals and objectives. Incremental changes can lead to significant operational gains, whether they be in the form of cost savings or increased functionality and ability to perform critical highway and bridge maintenance.

Fleet Management

ODOT lacks a centralized policy that governs the cycling of fleet and equipment. ODOT Fleet Central Office should implement policies for the replacement of fleet equipment for ODOT Districts. The policies should be supported by a data driven methodology, and should identify when districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary. Finally, ODOT should take care to make sure the policy covers all pieces of equipment, including all sizes of vehicles, mowers, and equipment with small engines, such as weed whackers. Actively managing fleet operations based on an optimized usage plan which minimizes expensive maintenance costs and maximizes resale or salvage value of vehicles and equipment reduces lifecycle costs of vehicles and promotes effective, efficient, and transparent use of government resources.

Background

ODOT owns and maintains a fleet of approximately 16,000 items including vehicles, equipment, and heavy machinery. The Department acquires hundreds of new fleet items and spends approximately $43 million annually on those purchases. The management of such a large fleet is no small task, and has been the subject of three previous performance audits by OPT. In the past we have reviewed such issues as fleet usage and optimization, alternative fuel sources such as biodiesel or compressed natural gas, fleet cycling, and most recently in 2019, equipment leasing and renting.

Why We Looked At This

During our 2019 performance audit, which focused on equipment leasing and renting, we identified variation in age at trade-in for equipment within the same category. While this issue was noted in the 2019 audit, it was not part of the audit scope and was not analyzed. Instead, we included the issue as an objective in this audit so that it could be fully investigated and analyzed.

Fleet Lifecycle

Lifecycle management of fleet is an important aspect of operations. This process accounts for an item's total operating costs and takes into account more than just the initial price of the equipment. The additional factors, including maintenance and repairs, provide a more accurate understanding of the cost of ownership. Thorough tracking of data relating to fleet management allows an organization to understand when items should be replaced and can result in long-term cost savings.

The primary metric used to determine vehicle costs for fleet cycling is cost per mile (CPM). The formula below shows how a CPM is calculated.

$$\frac{\text{Fuel Cost} + \text{Maintenance Cost} + \text{Depreciation}}{\text{Annual Miles Driven}} = \text{Cost Per Mile (Owned)}$$

What We Looked At

We reviewed the Department's fleet disposal practices. This includes a review of practices by fleet category on a District level and a historic review of fleet cycling practices. We also

interviewed Central Office officials in order to determine what policies and procedures were in place regarding fleet management, with a particular focus on fleet cycling.

What We Found

ODOT's fleet is divided into 232 categories, which include vehicles and pieces of equipment ranging in size from semi-truck and trailers to riding mowers. While variation in disposal practices between categories is to be expected, within each category there should be consistency in replacement practices. However, we found that there is wide variation in regards to when fleet items were disposed of within several common categories. We found that not only were certain items disposed of with limited consistency across Districts, but that within individual Districts there was inconsistency from year to year regarding the age of disposal for fleet items.

Our research identified that ODOT does not have an existing policy regarding fleet replacement and leaves decisions to District managers. We identified one recommendation that will allow ODOT to more efficiently manage fleet and optimize decisions related to vehicle and equipment disposal:

- **Recommendation 2.1:** ODOT Central Office should implement policies for the replacement of fleet and equipment for ODOT Districts. The policies should be supported by a data driven methodology, and should identify when Districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary. Finally, ODOT should take care to make sure the policy covers all pieces of equipment, including all sizes of vehicles, mowers, and equipment with small engines, such as weed whackers.

ODOT's Fleet

Fleet is a term used to describe cars, trucks, and pieces of equipment that ODOT uses to support its statewide mission. ODOT's fleet encompasses 232 categories that range in size from passenger cars and SUVs to large dump trucks used for snow plowing, semi-trucks used to haul large trailers, and equipment including everything from small mowers up to large backhoes and Earth movers.

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Recommendation 2.1: Fleet Management

ODOT Central Office should implement policies for the replacement of fleet and equipment for ODOT Districts. The policies should be supported by a data driven methodology, and should identify when Districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary. Finally, ODOT should take care to make sure the policy covers all pieces of equipment, including all sizes of vehicles, mowers, and equipment with small engines, such as weed whackers.

Impact

ODOT typically spends between $35 and $52 million annually on new fleet and equipment purchases. These funds are spent at the District level with minimal oversight from the Central Office. Ensuring fleet cycling is occurring based on an optimized usage plan which minimizes expensive maintenance costs and maximizes resale or salvage value of vehicles and equipment will allow the Department to make purchases effectively, efficiently, and transparently.

Background

OPT has conducted several performance audits of ODOT which included analysis related to various aspects of fleet management. Within some of these reports we identified concerns relating to fleet cycling and have made previous recommendations regarding this issue.

During OPT's 2015 performance audit, OPT recommended disposal ages for several categories of vehicles and recommended that ODOT should adopt optimized fleet cycling guidelines that promote the most financially efficient operation of the fleet. Further, in the official response to that audit, ODOT explained that "ODOT will revamp its vehicle and equipment cycling practices to make sure that vehicle lifecycles are optimized." Our analysis shows that ODOT did not accomplish this goal.

Our 2019 audit highlighted areas of concern related to fleet cycling practices within the Department. We determined that this issue was significant and conducted additional analysis for the purposes of this report.

Methodology and Analysis

Our review included the identification of existing policies and procedures related to fleet management and an analysis of fleet disposal practices within each District. The District review was conducted in a manner which allows for comparisons across Districts as well as a review of each District's individual practices over time.

In 2015, OPT released an audit which provided ODOT with guidance on when specific categories of fleet should be replaced. This analysis was done at the request of the Department as they identified that their existing policies at the time did not account for variation in the types of vehicles maintained in their fleet. Our recommendation, which was based on actual cost of ownership by fleet category, identified the optimal age or mileage for vehicle replacement within

several categories. We identified approximately $1.4 million in annual cost savings if the proposed cycling models were fully implemented.

For purposes of this analysis, we revisited the fleet categories identified in 2015 to determine if ODOT had implemented any process changes which would result in disposal of vehicles based on our recommendation. We found that the Department has not implemented polices that would allow for lifecycle optimization based on our previous recommendation. Further, while ODOT previously had internal processes in place surrounding fleet replacement, these policies have been abandoned in recent years and the decisions relating to fleet replacement have been left to the discretion of District managers.

As seen in the chart below, the Districts are not disposing of vehicles in accordance with our optimized recommendation. Additionally, the variation in median disposal age from District to District indicates that they are not using standard guidance on disposal practices.

Median Age in Years of Vehicles when Disposed of by District FY 2017-2019

		District											
Vehicle	**Optimized Age**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1/4 Ton SUV	4	-	16	-	-	18	-	-	-	-	-	-	-
1/2 Ton SUV	5	-	15	-	1	16	16	-	-	-	-	-	-
1 Ton Pickup	4	18	20	12	14	14	20	-	20	25	12	20	11
1/2 Ton Pickup	5	13	17	13	13	15	16	14	14	14	15	16	15
3/4 Ton Pickup	5	13	14	14	8	12	16	-	15	13	14	22	13
Passenger Car	4	12	16	11	14	11	14	11	13	13	-	16	13
1 Ton Utility Truck	11	-	-	19	23	15	11	-	-	-	3	17	19
3/4 Ton Utility Truck	11	-	12	-	-	-	-	-	15	23	13	-	15
1 Ton Passenger Van	6	-	10	-	17	-	-	-	23	-	-	15	-
Cargo Van	7	-	15	8	11	13	15	-	13	-	-	12	14
Minivan	6	13	11	15	13	-	-	14	16	-	16	-	15
Light Dump Truck	10	12	16	13	15	22	23	17	20	18	23	-	13

Source: ODOT

Note: Dashes (-) imply the district did not dispose of that vehicle type during FY2017-2019

Despite the Department's claim that District managers have the expertise necessary to make appropriate decisions relating to fleet management, we found wide variation between Districts and within individual Districts. That is to say, there is little to no consistency to when vehicles are disposed of across the Department. Barring extreme circumstances, such as a vehicle being

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totaled, fleet should be disposed of at a standard interval, such as 4 years and 48,000 miles. This was not seen in our review of ODOT's fleet management.

Taking an example of a single type of vehicle, a half-ton pickup truck used for passenger travel or light tool transportation, there is significant variation in disposal rates. The graphic below shows the age of disposal for half-ton pickups at the District level between FY2017 and FY2019. Not only is no District coming close to the recommended disposal age of five years, most have a range of disposal age that spans several years.

Age of Half-Ton Pickup at Disposal by District (FY2017-2019)
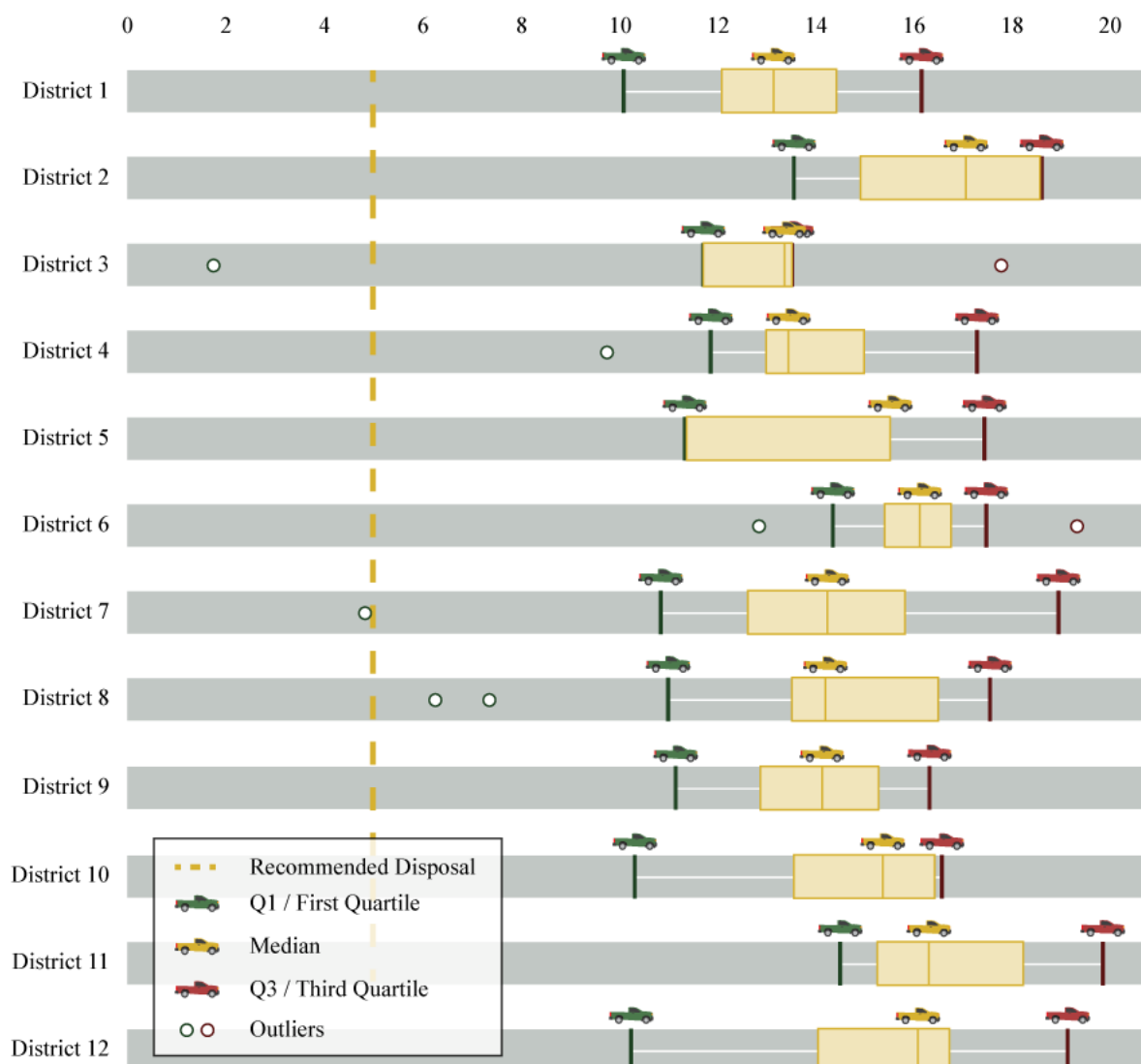
Source: ODOT

Despite ODOT's commitment to revamp the fleet cycling policies and procedures, we found that the Department is not disposing of vehicles in a manner that conforms to recommended practices. As seen in the table and graphic above, the majority of Districts are maintaining

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vehicles for years past the optimized disposal age. This can lead to costly repairs and maintenance that arise later in a vehicle's lifespan.

During the course of our audit, we identified life expectancy benchmarks that are set by ODOT. However, ODOT explained that these ages are benchmarks and that significant discretion relating to fleet management, and in particular fleet replacement, are left to District managers. Further, the ODOT fleet central office does not hold districts to the targets identified in its Equipment Information Management System (EIMS).

In addition to the Department failing to adhere to either our recommended disposal age or their internal benchmark, we found that within each District, there is minimal consistency in disposal practices. In some cases, a vehicle type may have more than 10 years of variation in disposal age within a single District.

Conclusion

We found that within several categories of vehicles, disposal age varies significantly from District to District, and sometimes within the same District. While ODOT's Central Office indicated that District Officials were best suited to make decisions related to fleet replacement, the variation in disposal age which exists indicates that this is not the case.

Vehicles within the same category should have similar disposal ages, within a reasonable range. We previously provided recommended disposal ages for several vehicle categories at the request of the Department, however this recommendation has not been implemented. Without standardized guidance, some District Officials are making decisions relating to fleet replacement that are inefficient and wasteful.

ODOT should institute standardized polices regarding fleet cycling in order to ensure equipment and vehicles are disposed of in a manner which maximizes their useful life and financial value. This will ensure that the millions of dollars spent annually on fleet purchases are spent in an efficient, effective, and transparent manner.

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Capital and Expenditures

Maintaining roadways is a key function for ODOT that helps to ensure safe roadways in our state. It involves a combination of routine operational expenditures and long-term capital planning. During the 10-year period between FY2019 and FY2028, ODOT expects to invest nearly $13 billion to preserve, improve, and replace bridges and pavement statewide. Allocating these resources to projects in order to maximize the efficiency and effectiveness of ODOT's work is a critical factor to ensure the continued quality of Ohio's roadways.

Background

ODOT maintains more than 43,000 miles of highway lane miles and more than 14,000 bridges throughout the state. Ensuring that these roadways remain in drivable condition is costly and time consuming. Determining which projects are addressed in any given year is a complex process which involves several layers of decision making, not least of which is the allocation of financial resources.

In recent years, ODOT shifted from a focus on replacing assets to a focus on rehabilitation which can help assets last longer at a better overall value. As part of the shifting focus towards long-term sustainability, in 2017, ODOT established a Funding Council to assist in allocating available funding to ODOT's operating and capital programs, including its bridge and pavement programs. According to Funding Council Charter, membership is comprised of the following:

- Funding Council "Executive Champions"
  - Chief of Staff/Assistant Director
  - Assistant Director, Operations
  - Assistant Director, Chief Engineer
- Funding Council Co-Chairs
  - Two (2) District Deputy Directors
- Funding Council Voting Members (in addition to Co-Chairs)
  - Seven (7) District Deputy Directors
- Funding Council Non-Voting Members
  - Deputy Director, Division of Planning
  - Deputy Director, Division of Finance
  - Executive Financial Advisor
  - Administrator, Office of Budget and Forecasting (administrative support)

The mission of the Council is to guide the overall use of ODOT's financial resources by recommending funding allocations for operating and capital programs to the ODOT Governance Board (comprised of the Director, Chief of Staff and Assistant Directors).[8] The Funding Council ensures that the optimum level of funding is provided to each program to achieve ODOT's mission, vision, values, goals, and Critical Success Factors. The Council bases its benchmarking

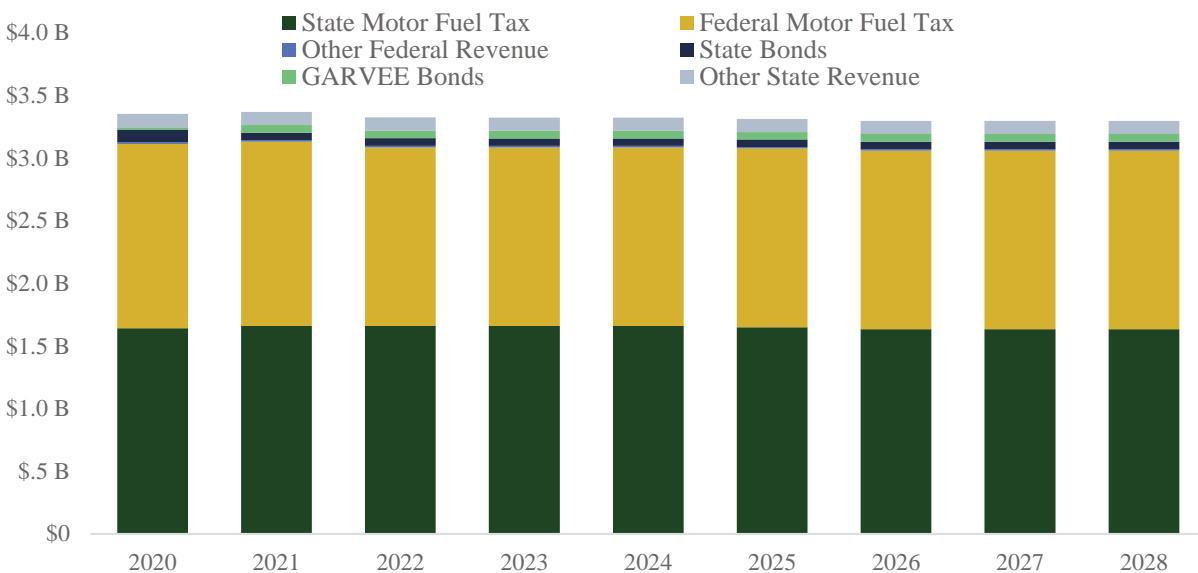---

[8] ODOT Funding Council Charter

results on a data-driven decision process that focuses on creating steady-state conditions for the Department's assets. ODOT reports that the council has given the Districts a greater voice in the budgeting process.

Revenues

In FY 2020, the state gas tax was increased at the request of ODOT, in order to offset slower growth in revenues due to gas-tax revenue not keeping pace with inflation. Am. Sub. H.B.62 133rd Gen. A. (2019) effective July 3rd, 2019, raised the gas tax to 38.5 cents for gasoline and 47 cents for diesel beginning July 1st, 2020.[9] This increase was expected to generate an additional $865 million per fiscal year in the FY 2020-2021 biennium. The bill stipulated that 55.0 percent the new revenue was earmarked for state government and 45.0 percent was earmarked for local governments, so ODOT was projected to gain an additional $476 million allocated to the Highway Operating Fund with the remainder being allocated to local governments for transportation infrastructure projects.[10]

Federal funding is provided through the Highway Trust Fund, which is financed primarily by the federal fuel tax. Congress is responsible for authorizing federal funding, which is apportioned to projects in accordance with certain requirements. Current funding was authorized by the Fixing America's Surface Transportation Act (FAST) which was enacted in 2015 was in effect until the

Projected State and Federal Revenue

Legend:
- State Motor Fuel Tax
- Other Federal Revenue
- GARVEE Bonds
- Federal Motor Fuel Tax
- State Bonds
- Other State Revenue

Y-axis: $0, $.5 B, $1.0 B, $1.5 B, $2.0 B, $2.5 B, $3.0 B, $3.5 B, $4.0 B

X-axis: 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028

Source: ODOT

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[9] See ORC § 5735.05(E)

[10] According to ODOT leadership, as of October 2020, actual fuel tax collections are below estimate by approximately $154 million.

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end of the CY 2020 and is currently (as January of 2021) continuing under a one year extension. Out years are based on ODOT's current projections.

State and federal revenue, as seen in the projection on the previous page, are expected to be fairly steady over the next ten fiscal years. However, due to the nature of construction projects, ODOT typically often use debt instruments to finance projects with a long useful life, such as a bridge or large section of highway. Borrowing money allows ODOT to complete a project over a relatively short amount of time which helps to minimize traveler disruptions due to construction (e.g. the sooner ODOT can finish a project the sooner the highway can be reopened for travelers). In addition, completing projects sooner can also reduce overall costs due to construction inflation. Construction inflation is typically higher than the inflation in the general economy, due to relatively higher costs of skilled construction labor and materials. Construction costs typically increased 3.0-5.0 percent annually during recent years, whereas general inflation was under 2.0 percent. The chart below shows construction inflation from 2012-2020.

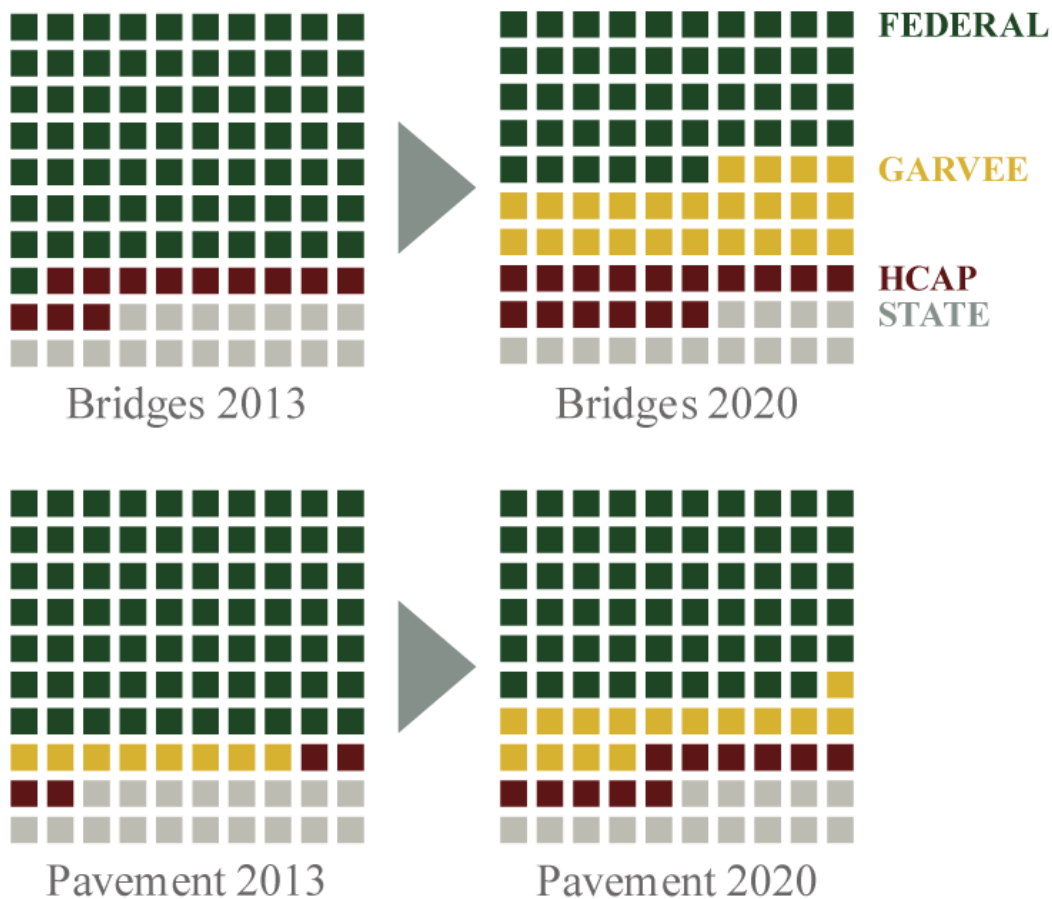## ODOT Construction Cost Change Over Time

Source: ODOT Bid Analysis & Review Team

The use of debt is a well-understood principal of public finance, because debt allows a government to spread out the cost of a project with a long useful life (such as a major bridge or road) to future users. Article VIII, §2m of the Constitution of the State of Ohio allows the state to issue a total principal amount of up to $220 million in new highway bond debt each fiscal year, but not more than a combined total principal amount of $1.2 billion in outstanding highway bond debt may exist at any one time. These bonds are known as HCAP bonds. Highway bonds of this type are general obligation bonds which pledge the full faith and credit, are issued against future state gas tax revenue, and taxing power of the state for repayment. In addition, ODOT can also issue bonds against anticipated future federal revenue, known as GARVEE bonds. The Department creates an annual budget with projected state and federal revenues, including anticipated bond revenue, in order to identify what projects can be completed. Revenue projections are reviewed and agreed on by ODOT's Funding Council and Governance Board. Examples of recent uses of bond include:

- In June 2020, $85 million in HCAP bonds were issued by the Ohio Treasurer's Office on behalf of ODOT. These bonds funded 27 capital road and bridge projects spanning 19 Ohio counties. Such projects include resurfacing and rehabilitation of portions of I-77 in Stark County; rebuilding, resurfacing and widening of structures in the I-70/I-71 "split" in Franklin County; and a major bridge and multi-lane reconstruction and widening of I-75 in Wood and Lucas Counties.
- In April 2018, the Treasurer's Office issued $370 million in bonds on behalf of the Department of Transportation. These bonds fund various 24 capital road and bridge projects across 12 Ohio counties. Such projects include resurfacing and repairing parts of I-275, the Ohio Bridge Partnership Program consisting of replacing 220 structurally deficient bridges throughout Ohio, and adding one lane in both directions between IR 70 and US 33.

The two charts below compare bridge and pavement funding broken out by state and federal funding, and HCAP and GARVEE bonds for 2013 and 2020. Both charts show that ODOT has become more heavily reliant bond funding during recent years, but particularly through the use of GARVEE bonds.

Funding Sources Comparison

Bridges 2013 → Bridges 2020

Pavement 2013 → Pavement 2020

Source: ODOT

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Why We Looked At This

ODOT is projected to spend $13 billion dollars on roadway maintenance and construction over a ten year period. Approximately 40 percent of bridge funding and 26 percent of pavement funding is being obtained through issuing debt based on future revenue projections, however revenue projections are not guarantees and a variety of factors could impact those future revenues. Ensuring decisions are made based on sound financial criteria will ensure ODOT's ability to act as good stewards of taxpayer resources, as well as ensure that funding sources are well matched.

What We Looked At

We reviewed how the Department is allocating resources and obtaining funding related to pavement and bridge maintenance, repair, and construction.

What We Found

We found that the Department is increasingly relying on bond funding to complete projects. While the majority of bond dollars are used for long-term projects, the Department has in recent years used bond funding to meet basic preservation needs. We identified two recommendations which will allow ODOT to make sound financial decisions relating to the utilization of bond funding in the future:

- **Recommendation 3.1:** ODOT has occasionally used bond funds for operations as opposed to projects with a long useful life. The Department should reserve bond funding for those projects with a long useful life. Doing so ensures that sources and uses of funds are matched in an appropriate manner, and only projects with benefits that outweigh the cost of borrowing are financed as such; and,
- **Recommendation 3.2:** ODOT does not have a policy which requires a debt affordability study before the issuance of new debt. ODOT should require debt affordability studies to gauge when ODOT can afford to take on new debt. Debt affordability studies can help ODOT further optimize its use of debt and therefore make better use of limited resources.

Recommendation 3.1: Use of Bond Financing

ODOT has occasionally used bond funds for operations as opposed to projects with a long useful life. Reserve bond funding for those projects with a long useful life. Doing so ensures that sources and uses of funds are matched in an appropriate manner, and only projects with benefits that outweigh the cost of borrowing are financed as such.

Impact

While no immediate financial implication is associated with this recommendation, ODOT pays an average of 3.164 percent of interest annually on money raised through bond sales, so reducing the use of bond funds to pay for routine preservation tasks could reduce the overall costs of preservation.

Methodology and Analysis

ODOT's use of bond funding was discussed during interviews with ODOT's team. The Department mentioned that, in recent years, excess bond funds have been used to address basic preservation needs, such as chip sealing for pavement or bridge cleaning for bridges. While ODOT indicated it is their intention to move away from this practice in conjunction with the 2019 fuel tax increase, the current economic downturn has resulted in fewer drivers and, therefore, lower than anticipated fuel consumption. For example, in the aggregate, net taxable gallons for the months of March, April and May 2020 were 428.5 million (24.3 percent) lower than during the same months in 2019. The year-over-year variances for these months is displayed in the chart below.

Net Taxable Gallons of Motor Fuel, March-May 2019 and 2020
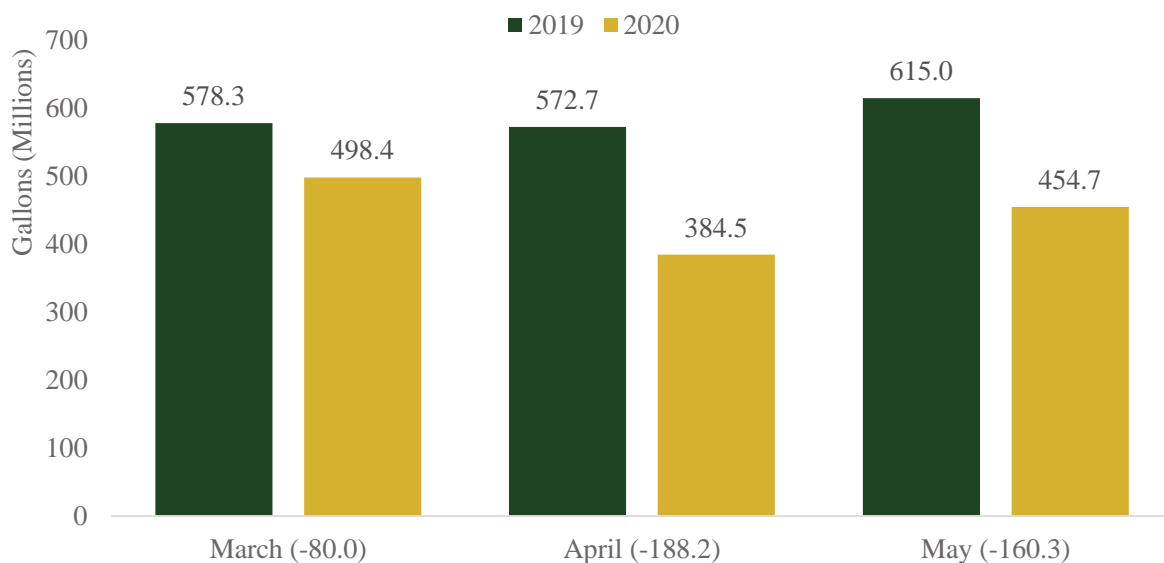
Source: Ohio Department of Taxation Motor Fuel Reports, FY2019 and FY2020

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According to the article *State and Local Borrowing*, from the Center on Budgetary and Policy Priorities "Almost all state and local bond debt is long-term debt incurred to pay for capital expenditures, primarily infrastructure projects, such as roads and bridges, schools, water systems, and hospitals not to cover operating expenses," (2018). While it is commendable that ODOT has strived to move away from bonding for basic preservation in recent years, if the fuel tax increase is, in fact, what enabled the Department to do so, a decline in fuel tax revenues may jeopardize this goal. It is recommended that ODOT maintain its commitment to reserve bonding for projects with a long useful life in alignment with best practices.

Conclusion

ODOT has recently used the proceeds of bond sales to fund non-capital expenditures. Using bond funding for non-long term investments could lead to the ODOT incurring additional cost related to the preservation of roadways.

Recommendation 3.2: Issuance of Future Bond Debt

ODOT does not have a policy which requires a debt affordability study before the issuance of new debt. ODOT should require debt affordability studies to gauge when ODOT can afford to take on new debt. Debt affordability studies can help ODOT further optimize its use of debt and therefore make better use of limited resources.

Impact

Debt affordability studies can help ODOT further optimize its use of debt and therefore make better use of limited resources.

Methodology and Analysis

ODOT debt policies were researched through interviews with key personnel and through a thorough review of ODOT's policies regarding debt. Debt affordability studies are data-driven analyses that equip states with the ability to manage debt in a way that aligns with their resources as well as their spending priorities by evaluating the impact of potential issuances on self-imposed debt caps. ODOT issues debt in accordance with state law but does not currently have a policy that requires debt affordability studies before the issuance of debt.

According to a study by the Pew Charitable Trusts (Pew), although all states employ some measures to track their debt, 23 states – including Ohio – do not require debt affordability studies.[11] According to Pew's analysis of state debt affordability studies, best-practice states:

- Evaluate their debt affordability using metrics, benchmarks and multi-year projections under several scenarios.
- Define a purpose for the affordability study and include all relevant debt. The purpose should reflect the state's debt issuance structure.
- Require that debt affordability studies be conducted and make clear their purpose, use and who will prepare them. Spell out a timetable so the report is released as the governor is putting together capital and operating budget proposals to submit to the legislature.

The state of North Carolina separately assesses (a) debt supported by general funds and (b) borrowing backed by transportation revenue, and then combines the results of the two evaluations. This allows its legislature to focus in on liabilities of particular purpose (e.g., transportation debt) while also taking a broader view of its long-term obligations.[12]

Conclusion

ODOT does not have a policy that requires debt affordability studies before issuing bonds. A policy requiring debt affordability studies will help assure that ODOT is issuing debts in accordance with best practices and reduce the risk of issuing debt that could strain cash flow.

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[11] The Pew Charitable Trusts, "Strategies for Managing State Debt," (June 2017).
[12] North Carolina Department of State Treasurer, "Debt Affordability Study," (February 1, 2020).

Issue for Further Study: Use of Debt

According to Article VIII, §2m of the Constitution of the State of Ohio, the state can issue debt equal to up to $220 million per year for highway construction and maintenance, and the state may have a balance of up to $1.2 billion in outstanding highway bond debt at any given time. As of FY 2020, a total of $1 billion in outstanding debt had been issued, meaning there was a total of about $200 million in unused bond capacity. In recent years, construction costs increased an average of 3.5 percent each year, whereas general inflation increased an average of 1.9 percent each year. Due to the annual increase costs of construction, completing a project sooner will generally make the entire project less expensive.

While there are many factors that the Department needs to consider before undertaking a project, ODOT should research if there are opportunities to take full advantage of the statutory borrowing limit and therefore finish more construction projects in a given year.

Bridge Management

ODOT is charged with ensuring the safety of Ohio's bridge infrastructure. Ohio is responsible for more than 14,000 bridges with a total deck area of over 109 million square feet. Effective preventative maintenance is essential to ensure bridge conditions are adequate and to avoid major costs to repair bridges that have not received sufficient preventative maintenance. Tracking performance measures through a bridge management system (BMS) allows for a data-driven preventative maintenance plan.

Background

In 1967 the Silver Bridge, which connects Gallipolis, Ohio, to Point Pleasant, West Virginia, collapsed, resulting significant loss of life and injuries. As a result of this bridge collapse, Ohio placed a heavy focus on developing an overall program to manage Ohio's bridges safely. ODOT's early focus on bridge safety made Ohio a leader in bridge management and led other states and the Federal Highway Administration (FHWA) to develop safety standards for other states.

The chart on the following page shows a comparison of bridge performance between Ohio and peer states. As the chart demonstrates, Ohio's focus on the bridge program has resulted in the state achieving performance that is equal to or better than peer states.

Acronyms

NBI (National Bridge Inventory) - the official inventory of bridges that the federal DOT receives from state DOTs

NBIS (National Bridge Inspection Standards) – Federal regulation which govern the frequency of and standards for bridge inspections.

GCR (General Condition Rating) – A federal standard for rating each component of a bridge on a scale from 0 to 9; the GCR informs bridge maintenance and repair decisions.

GA (General Appraisal Ratings) – a summary of GCRs for an entire bridge. GAs are used as a high level measure of bridge quality.

AASHTO (American Association of State Highway Transportation Officials) – a professional association that provides training and helps establish professional standards for state DOTs.

Bridge Management System

A Bridge Management System is a type of software that will help the Department evaluate the cost and benefits of long term bridge investment decisions. If implemented as part of an overall Business Intelligence Strategy (see **Section 8**), the Department will be better able to plan for various contingencies in the long-term.

Peer Comparison: NBI Bridge National Performance Measure
DOT Owned Bridges by Deck Area
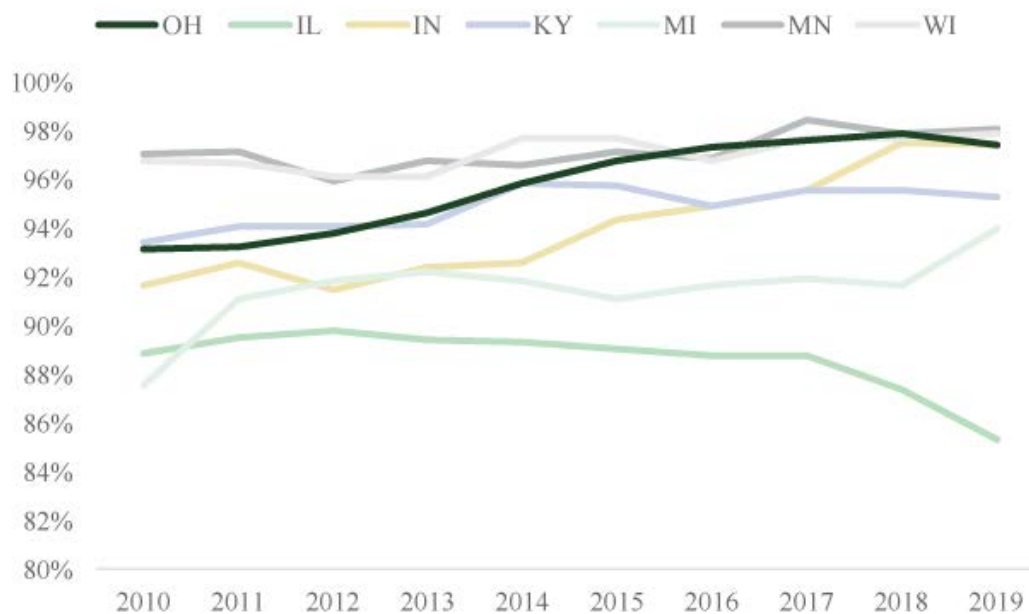
Source: ODOT and Peer States

Another way to think about asset management is by looking at expenditures. The table below compares Ohio expenditures per square foot to peer states, for bridges that are part of the NHS, or National Highway System (i.e. federal highways). The table shows that ODOT is performing well compared to peer states in terms of expenditure per square foot as well as bridge condition. This indicates that ODOT is not only efficient, but effective, in the area of their bridge investments.

NHS Deck Area and Budget Reported in TAMP

	OH	**IL**	**IN**	**KY**	**MI**	**MN**
NHS Deck Area [sq. ft.]	87.68 million	64.69 million	29.99 million	28.53 million	36.98 million	31.44 million
NHS Only 10-year Avg. Budget	$202.90 million	$524.51 million	$219.38 million	$176.30 million	$117.40 million	$69.50 million
Annual Spending by Deck Area [per sq. ft.]	**$2.31**	$8.11	$7.32	$6.18	$3.17	$2.21
DOT Bridges in Good or Fair Condition	**97.4%**	85.4%	97.5%	95.3%	94.0%	98.1%

Source: ODOT and Peer States

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Safely and effectively managing the bridge inventory is one part of an overall asset management plan (pavement is another, separate type of asset). State transportation departments are required by the Code of Federal Regulations, 23 CFR 515, to develop an asset management plan in accordance with minimum standards and requirements.[13] An asset management plan should include how the department will make risk-based decisions to manage its physical assets and should lay out investment strategies to address condition and system performance gaps. The minimum standards for bridge and pavement management systems are:
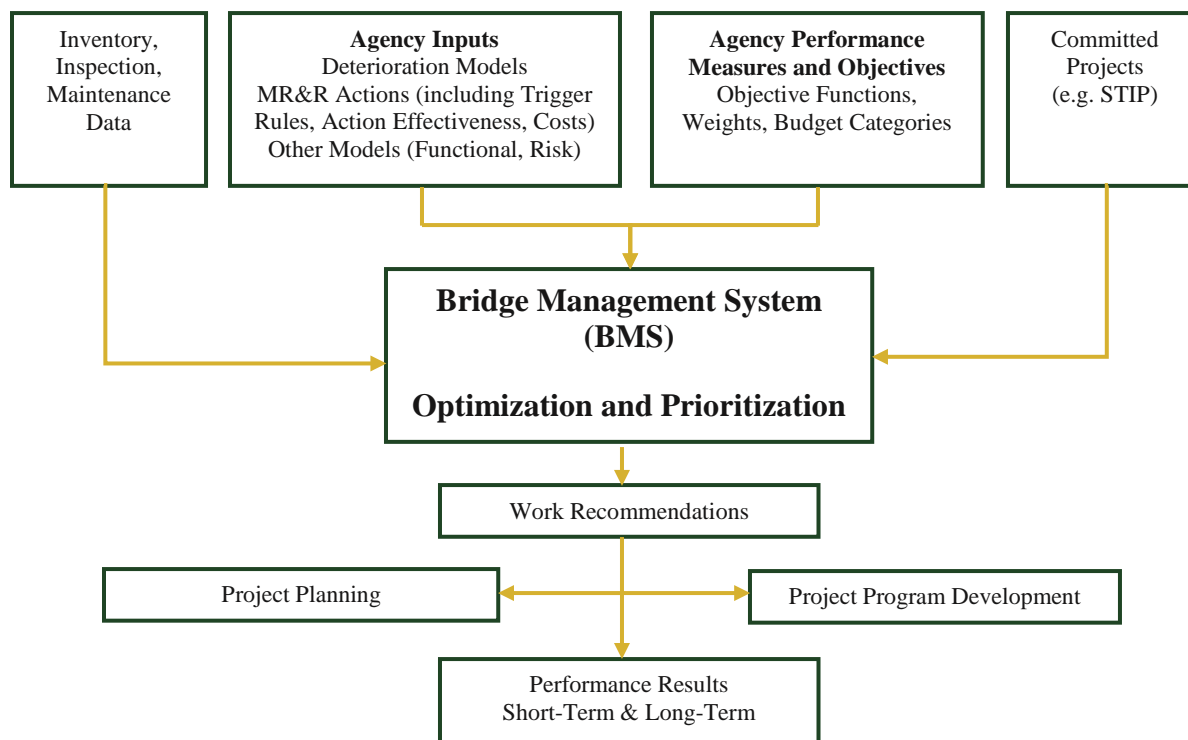
- Collecting, processing, storing, and updating inventory and condition data for all NHS pavement and bridge assets (*Collecting Inventory and Condition Data*);
- Forecasting deterioration for all NHS pavement and bridge assets (*Forecasting Deterioration*);
- Determining the benefit-cost over the life cycle of assets to evaluate alternative actions, including no action decisions, for managing the condition of NHS pavement and bridge assets (*Benefit-Cost Analysis*);
- Identifying short- and long-term budget needs for managing the condition of all NHS pavement and bridge assets (*Identifying Budget Needs*);
- Determining the strategies for identifying potential NHS pavement and bridge projects that maximize overall program benefits within the financial constraints (*Determining Strategies to Maximize Benefits*); and
- Recommending programs and implementation schedules to manage the condition of NHS pavement and bridge assets within policy and budget constraints (*Programs and Implementation Schedules*).

When it comes to bridges, the collective strategies, processes, and tools are referred to as a bridge program. Elements of a bridge program include the inventory (how many bridges do we have?), inspection (how many of our bridges are in good condition?), agency goals (how many of our bridges should be in good condition?), and mathematical models of future conditions.

BMS refers to the software/applications used to support the overall bridge program. An effective BMS allows a government entity to make informed, data-driven, short-term, and long-term investment decisions. The process map on the following page shows how a BMS interacts with other pieces of an overall bridge program. The key takeaway is that a BMS takes in various types of data and information and then produces models which decision makers can use to guide future decision making, such as which bridge projects should be completed in the short, medium, and long term and how much funding will the agency need to accomplish its objectives.

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[13] The effective date for these requirements was October 2, 2017.

BMS Process

Inventory, Inspection, Maintenance Data	**Agency Inputs** Deterioration Models MR&R Actions (including Trigger Rules, Action Effectiveness, Costs) Other Models (Functional, Risk)	**Agency Performance Measures and Objectives** Objective Functions, Weights, Budget Categories	Committed Projects (e.g. STIP)

Bridge Management System (BMS)

Optimization and Prioritization

Work Recommendations

Project Planning ← → Project Program Development

Performance Results
Short-Term & Long-Term

Source: ODOT

One of the most important elements for any type of asset management is the process used to regularly inspect and report the condition of the asset. Bridges are rated based on the General Condition Rating (GCR), which is based upon a 9 to 0 rating scale, with 9 being a major component in excellent condition and zero being a major component that is failed, resulting in closure to vehicular traffic. The FHWA requires that all public road bridge owners inspect their bridges in accordance with the NBIS[14] and provide GCRs for the structure's major components:

- Deck
- Superstructure
- Substructure
- Culvert (if the NBI length structure is a culvert type structure)

The table on the following page provides FWHA descriptor for each rating number and the corresponding performance measure classification as identified in federal law.

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[14] National Bridge Inspection Standards; https://www.fhwa.dot.gov/bridge/nbis.cfm

NBI General Condition Ratings and National Performance Measures[15]

Rating Number	NBI Descriptor	Performance Measure Classification (23 CFR 490)
9	Excellent Condition	
8	Very Good Condition	Good
7	Good Condition	
6	Satisfactory Condition	Fair
5	Fair Condition	
4	Poor Condition	
3	Serious Condition	
2	Critical Condition	Poor
1	"Imminent" Failure Condition	
0	Failed Condition	

Source: FHWA

ODOT uses the CGR to calculate a General Appraisal (GA) rating for any given bridge. GA performance measures take the lowest CGR of the major components (deck, superstructure, substructure, and culvert) as the overall bridge rating. This measure is used by all state DOTs when preparing their TAMPs and reporting the condition of the National Highway System (NHS) bridges. Because the measures are common among all state DOT's, it is a useful way to compare state DOT bridge performance. ODOT's internal goal is to maintain an average GA of 6.8 across all bridge inventory. The chart on the following page indicates that during the previous ten years, the Department has routinely exceeded this goal.

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[15] United States Code of Federal Regulations, Title 23, Part 490, National Performance Management Measures

Bridge Average General Appraisal with Bridge Budget
(Weighted By Deck Area)
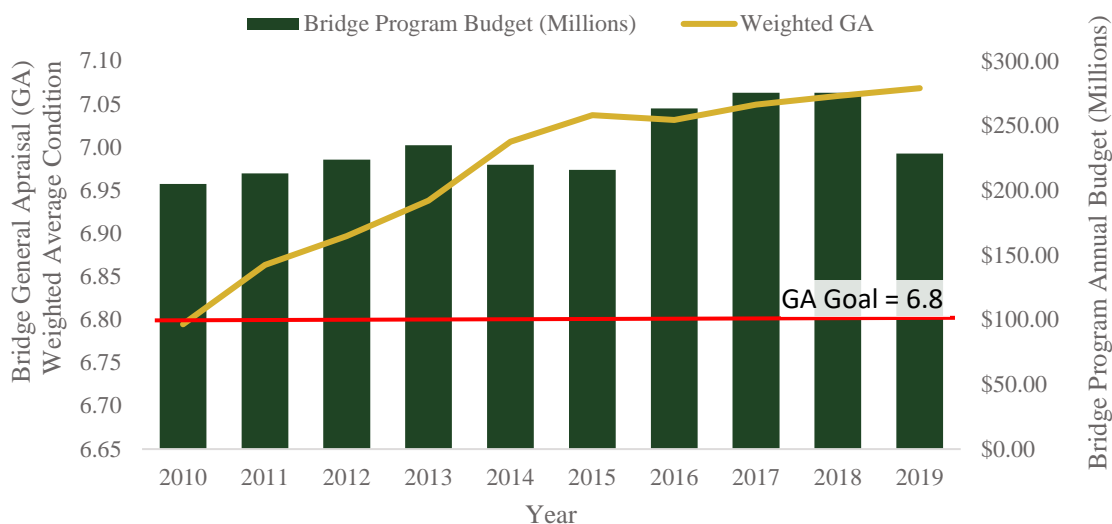
Source: ODOT

Why We Looked At This

ODOT spent about $1.1 billion on pavement and bridge maintenance in FY 2019, accounting for 31.4 percent of the Department's annual expenditures. Bonds funded 36.1 percent of the pavement and bridge program, amounting to $345.1 million. As a major area of ODOT's operations, this area was reviewed to determine if its operations were efficient and effective, as well as providing transparency to one of ODOT's core operations.

What We Looked At

ODOT's bridge management practices were reviewed in accordance with the minimum documented procedures of a pavement and bridge management system required by 23 CFR 515.17. In addition, peer states[16] were interviewed to identify which software they use, the capabilities of their software and other tools, and to compare their progress towards meeting the minimum federal requirements. Finally, ODOT's bridge inspection practices were also reviewed in relation to peer practices and federal regulations.

What We Found

ODOT currently meets two of the six minimum documented procedures: Inventory and Condition Data and Forecast Deterioration. ODOT does not have bridge management software (referred to as a bridge management system, or BMS) in place to determine budget needs. ODOT has processes for determining strategies to maximize overall program benefits and has a project

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[16] The following six states were selected as peers: Illinois, Indiana, Kentucky, Michigan, Minnesota, and Wisconsin.

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selection process, but does not utilize advanced BMS for these activities. In addition, Ohio Revised Code § 5501.47 mandates annual inspection all structures meeting the Ohio definition of 'bridges". No other US state mandates annual bridge inspections. The impact of these findings is that the State of Ohio devotes a disproportionate amount of resources to performing routine bridge inspections when compared to other states.

In comparison to the peer states, Ohio is in line with one state and behind four states in BMS implementation to meet the minimum documented procedures.

Based on this analysis, we identified one recommendation that would assist the Department in improving operational efficiency and effectiveness in bridge management:

- **Recommendation 4.1:** ODOT currently lacks a BMS ODOT should implement and support a successful BMS installation that meets the Federal Highway Administration (FHWA) minimum documented standards (23 CFR 515.17). Without a BMS the Department risks sub optimal decision making and could have a difficult time sustaining current progress with bridge management. The Department projects spending over $300 million per year on bridge maintenance, repair, and preservation over the next decade, so even a 1 percent improvement in efficiency could result in $3 million in annual savings, which, at $2.31 per square foot, could be used to maintain over 1 million square feet of bridge deck each year.
- **Recommendation 4.2:** ODOT currently conducts annual inspection of all bridges. This is a more frequent interval than what is required by federal law. The General Assembly should revise ORC § 5501.47 to remove the requirement that ODOT conduct annual inspections of all bridges and instead adopt a risk based methodology for bridge inspection, consistent with peer states and federal guidelines that allow for a 24-month inspection cycle for some bridges. Bringing ODOT's bridge inspection guidelines in-line with federal guidelines will save an average $9.8 million in annual bridge inspection costs at the state and local level.

Recommendation 4.1: Bridge Management

ODOT currently lacks a Bridge Management System. ODOT should implement and support a successful BMS installation that meets the Federal Highway Administration (FHWA) minimum documented standards (23 CFR 515.17).

Impact

A BMS can help the Department improve long-term forecasting and make more optimal decisions about resource allocation. In addition, implementing a BMS will help ODOT remain compliant with federal regulations. Without a BMS the Department risks suboptimal decision making and could have a difficult time sustaining current progress with bridge management. The Department projects spending over $300 million per year on bridge maintenance, repair, and preservation over the next decade, so even a 1 percent improvement in efficiency could result in $3 million in annual savings, which, at $2.31 per square foot, could be used to maintain over 1 million square feet of bridge deck per year.

Background

According to the federal "Moving for Progress in the 21st Century Act,"(23 CFR 101) asset management is defined as "a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost."

The FHWA Bridge Preservation Guide serves to provide guidance to State governments on establishing or improving existing bridge preservation programs as part of an asset management program. The guide defines the following activities relevant to bridge management:

- **Preservation:** actions that delay the need for costly rehabilitation or replacement while bridges are still in good or fair condition and before the onset of serious deterioration;
- **Rehabilitation:** major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects; and
- **Replacement:** total replacement of an existing bridge with a new facility, when rehabilitation would no longer be cost-effective.

Methodology and Analysis

ODOT's BMS was reviewed in accordance with 23 CFR 515.17 regarding the six minimum documented procedures of a pavement and bridge management system. A subset of states for peer comparison was selected based on proximity to Ohio, environmental similarities, and other related considerations.[17] Relevant staff representing each of the peer states were interviewed to

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[17] The following six states were selected as peers: Illinois, Indiana, Kentucky, Michigan, Minnesota, and Wisconsin.

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determine the comparative level of BMS advancement according to the six minimum documented procedures of a BMS as outlined in 23 CFR 515.17. The six requirements from the Code of Federal Regulations (23 CFR 515.17)[18] describes the minimum documented procedures for bridge and pavement management systems as the following:

- Collecting, processing, storing, and updating inventory and condition data for all National Highway System (NHS) pavement and bridge assets;
- Forecasting deterioration for all NHS pavement and bridge assets;
- Determining the benefit-cost over the life cycle of assets to evaluate alternative actions (including no action decisions), for managing the condition of NHS pavement and bridge assets;
- Identifying short-and long-term budget needs for managing the condition of all NHS pavement and bridge assets;
- Determining the strategies for identifying potential NHS pavement and bridge projects that maximize overall program benefits within the financial constraints; and,
- Recommending programs and implementation schedules to manage the condition of NHS pavement and bridge assets within policy and budget constraints.

A comparisons between how ODOT and peer states are progressing towards meeting the BMS requirements are listed in the table below.

Bridge Management System Development Status

	OH	IL	IN	KY	MI	WI
Inventory and Condition Data	**Yes**	Yes	Yes	Yes	Yes	Yes
Forecast Deterioration	**Yes**	Yes	Yes	Yes	Yes	Yes
Benefit-Cost Analysis	**No**	No	Yes	No	No	No
Identifying Budget Needs	**No**	No	Yes	No	Yes	No
Determining Strategies to Maximize Benefits	**No**	No	Yes	No	Yes	No
Programs and Implementation Schedules	**No**	No	Yes	No	No	No
Tier of BMS Advancement	**Basic-Inter.**	Basic-Inter.	Inter.-Adv.	Inter.	Inter.	Inter.
Count of Elements Met	**2**	2	6	2	4	2

Source: FHWA, ODOT, and Peer States

As shown above, ODOT currently meets two out of six requirements of a BMS. Among the peer states, Indiana and Michigan are the furthest along with implementing a BMS. When it comes to software, Illinois, Kentucky, and Michigan are using AASHTOW BMS software, while

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[18] Code of Federal Regulation 23 CFR 515.17
https://www.govinfo.gov/content/pkg/CFR-2017-title23-vol1/pdf/CFR-2017-title23-vol1-sec515-17.pdf

Michigan, Minnesota, and Wisconsin rely on in-house developed BMS tools. None of these can perform benefit-cost analysis or optimization. Indiana, which uses Deighton dTIMS BMS software, is the only peer state which has software that is fully configured and operational to provide benefit-cost analysis and optimization. By contrast, Ohio manages its bridges currently using manual processes that include spreadsheets for calculating deterioration and geographic information systems (GIS) mapping software to assist with inventory.

One example of an element that could benefit from a BMS is forecasting deterioration. A deterioration model is a mathematical formula that can project how quickly a given asset will deteriorate, and this data can be used to decide when it's most appropriate to take action, such as replacing or repairing an asset. ODOT requires review of bridges just above deficient (poor) and allocates funding that considers this degradation. These forecasting methods provide reasonably accurate forecasts for short-term project and programming decisions. However, more refined models would be needed for longer range forecasts. This is just one example of a situation where having a fully-implemented BMS would help ODOT pull all the above elements together to build a more robust long-range forecast.

Conclusion

ODOT currently practices safe and effective bridge management but lacks a bridge management system that is consistent with the standards set by the FHWA. Without a BMS, ODOT is at risk of making suboptimal decisions regarding the allocation of resources in its bridge program.

Recommendation 4.2: Bridge Inspection

ODOT currently conducts annual inspection of all bridges. This is a more frequent interval than what is required by federal law. The General Assembly should revise ORC § 5501.47 to remove the requirement that ODOT conduct annual inspections of all bridges and instead adopt a risk based methodology for bridge inspection, consistent with peer states and federal guidelines that allow for a 24-month inspection cycle for some bridges..

Impact

Bringing ODOT's bridge inspection guidelines in-line with federal guidelines will save an average $9.8 million in annual bridge inspection costs at the state and local level.

Background

Federal law defines a bridge as being at least 20 feet in length measured along the centerline of the roadway. Ohio Revised Code (ORC) § 5501.47[19] defines bridges as structures that that are greater than 10 feet total span length measured along the centerline of the roadway.[20] This legislation, which was effective in 1973, further directs the ODOT Director to ensure that bridges meeting the ORC § 5501.47 standard be inspected on an annual basis as indicated below:

> "Such inspection shall be made annually by a professional engineer or other qualified person under the supervision of a professional engineer, or more frequently if required by the director, in accordance with the manual of bridge inspection described in division (B) of this section."

Using the Ohio definition, the 2019 bridge data snapshot showed ODOT was managing 14,256 bridges. Most bridge inspections performed under the direction of ODOT are performed with ODOT personnel, although some contractors are used. Similarly bridge inspections performed by counties and municipalities are mostly performed by a combination of public sector employees and contractors. ODOT covers the inspection costs for bridges owned by cities with a population less than 50,000, otherwise the city or county is responsible for funding these operations.

Methodology and Analysis

This section analyzes ODOT bridge inspection policies compared to peer benchmarks and federal regulations. Data was gathered through the review of relevant state and federal laws, analysis of ODOT provided bridge counts and inspection data, and interviews with relevant ODOT and peer DOTs.

The table on the following page compares Ohio with the peer states used for benchmarking in terms of inventory and inspection procedures.

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[19] http://codes.ohio.gov/orc/5501.47, effective Date: 09-28-1973
[20] Ohio Revised Code, Title 55 LV Roads – Highways – Bridges, Chapter 5501.47 Bridge Inspections. http://codes.ohio.gov/orc/5501.47

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Inventory and Inspection Procedures

	OH	IL	IN	KY	MI	MN	WI
Minimum Span Length of Structures managed as Part of the Bridge Program	**10 Feet**	6 Feet	20 Feet	20 Feet	10 Feet	10 Feet	20 Feet
Maximum Time Frame Between Routine Bridge Inspections	**12 Months**	24 Months	24 Months	24 Months	24 Months	24 Months	24 Months
Agency Collects Bridge Element Condition States	**Yes**	Yes	Yes	Yes	Yes	Yes	Yes

Source: ODOT and Peer States

The definition of a "bridge" is an agency prerogative as to how certain types of structures are managed. While Ohio DOT policy includes managing structures with span lengths less than the NBI standard, several other peer states also exceed FHWA guidelines including Illinois, Michigan, and Minnesota.

As indicated, all the peer states follow the NBIS standard for maximum interval of routine bridge inspection of 24 months, making Ohio the exception in this comparison. FHWA representative indicated that approximately 83 percent of all bridges that are subject to NBIS requirements are inspected every 24 months, 12 percent are inspected annually and 5 percent are inspected on a 48 month basis.[21]

The current inspection cycle was developed as a response to the 1967 Silver Bridge collapse. The Silver Bridge collapse was also the event that lead to the creation of the National Bridge Inspection Program (NBIS).[22]

The chart on the following page shows a projection of ODOT's bridge condition over a 10 year period 2018-28. These projections demonstrate that ODOT's focus on its bridge program has had positive results.

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[21] Ibid.
[22] https://www.transportation.gov/testimony/highway-bridge-inspections

Projected NHS Condition Distribution – Bridges
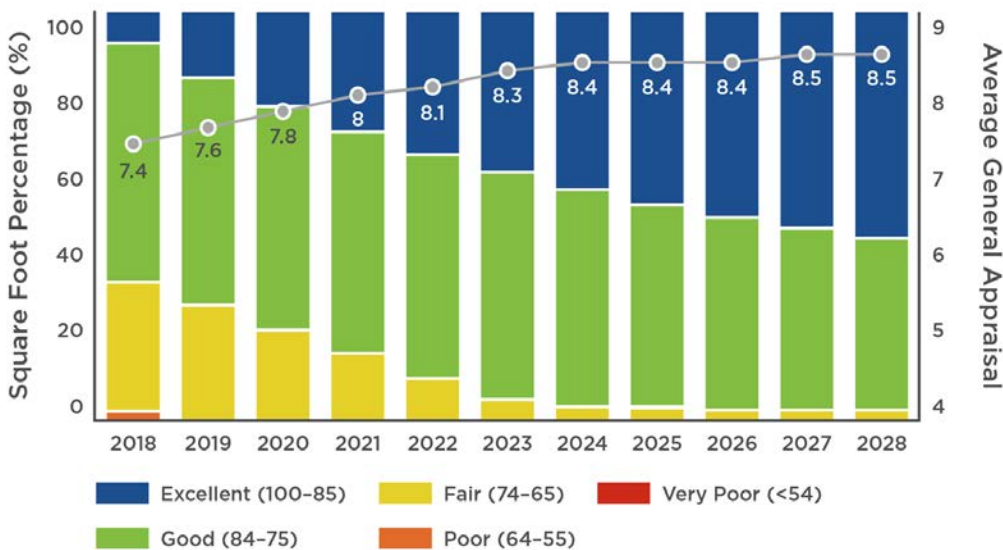
ODOT is now in a positon where its bridge inventory is largely safe and in good condition. In addition, federal regulations and peer states have developed modern standards for bridge inspection that strike a balance between efficiency and public safety.

The Silver bridge collapse occurred in 1967 and Ohio's bridge inspection practices were developed as a response in the early 1970s. At that time, annual inspections of every bridge was the easiest way to assure that Ohio's bridges would remain safe. Since that time, however, the FHWA has developed a more sophisticated risk-based approach to inspections that is based on a number of factors including a specific bridge's age and condition. In general, a risk-based approach means that newer bridges in better condition will be inspected as little as once every 24 months, while older bridges or those in worse condition will continue to be inspected every 12 months.

The table on the following page shows ODOT's estimated number of structures that would qualify for 24-month inspections under ODOT's proposed routine inspection criteria. This will only apply to bridges that are in good condition which is defined as having a General Appraisal (superstructure and substructure GCR) or deck GCR rating of 7 or greater. Bridges that meet any one of the following criteria must continue to receive an annual routine inspection.

- Bridges that have fracture critical members;
- Structure critical bridges;
- Bridges with live load restrictions (Posted bridges);
- Bridges with a general appraisal or deck summary code lower than "7-Good;" or,
- Bridges determined to be at risk the by the local program manager.

Estimated Annual Cost Savings if Adopted

Public Entity	24-Month Eligible Bridges	Reduced Inspections Per Year	Estimated Cost per Inspection[23]	Estimated Cost Savings
Ohio DOT	8,365	4,183	$1,000	$4,183,000
Turnpike	297	141	$1,000	$141,000
Counties	12,400	6,200	$800	$4,960,000
Municipalities	1,196	598	$800	$478,000
Reduced Inspections		**11,122**	**Annual Savings**	**$9,762,000**

Source: ODOT

This information was used to estimate cost savings per year for ODOT, counties, and municipalities if the proposed legislation is passed. ODOT indicates that these savings mostly represent the time and expense of having ODOT personnel perform these inspections. These resources would be available to support other portions of the bridge program that require additional resources such as development of their Bridge Management System and the Culvert Inspection Program.

Conclusion

Among its peers, ODOT is the only state to require annual inspections of all bridges. The state law requiring annual inspections was put in place for the purpose of public safety but prior to the development of modern inspection standards. Federal guidelines and peer state policies allow for up to 24 months between inspections for bridges in acceptable conditions. ODOT should work with the General Assembly to revise current ORC to allow a risk-based approach to inspecting bridges. By doing so, the Department will save nearly $10 million annually on inspection related expenditures.

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[23] ODOT 09/21/2020 Interview

Pavement

Pavement is one of the most important factors that assure a traveler's ride is safe and comfortable. Due to pavement's centrality to roadways, it's no surprise that the management and maintenance of pavement is a core area of ODOT's business. The Department spends an average of $800 million annually on pavement replacement, repair, and reconstruction.

Definitions

National Highway System:
The National Highway System (NHS) includes the Interstate Highway System as well as other roads important to the nation's economy, defense, and mobility. The NHS was developed by the Federal Department of Transportation in 1995 in cooperation with the states, local officials, and metropolitan planning organizations (MPOs).

Preservation:
This category includes low-cost treatments applied to assets in relatively good condition to slow the rating of deterioration or address minor repairs. For Pavements, preservation treatments include chip seals, microsurfacing, and thin overlays.

Major Rehab:
This category involves major work to restore the structural integrity of an asset as well as work that may be necessary to correct major safety defects. For Pavements, rehabilitation may involve a structural overlay of the Pavement surface.

Major New:
This category refers to the construction of brand new assets, including Pavements or Bridges, on new alignments. Adding new Pavement lanes to an existing highway address congestion is an example of an activity that falls in this category.

Pavement Condition Rating (PCR): A standard measure of the current condition of a piece of pavement that takes into account such factors as cracking and wear.

Background

The pavement management program falls under the authority of ODOT's Transportation Policy Division, with districts and counties also playing a role in the process. The process has evolved over time from past practices that relied more heavily on experience and judgement to make funding and project selection decisions. Since 2017 however, ODOT has implemented a data driven approach to program development and project selection.

In order to monitor the condition of the pavement, ODOT uses an internally developed, manual data collection process that includes the calculation of a pavement health score called the Paving Condition Rating (PCR). ODOT uses PCR to help make decisions about pavement investment, including when and where to make repairs or do replacements.

Pavement management is an area where there is a cooperative approach between districts and the central office. ODOT Districts select the final projects while the central office develops the budgets. Central office uses a computer program known as the Pavement Management System

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(PMS) that analyzes the condition of ODOT's pavement and calculates the optimal treatment options for a given section of pavement. This is known as the PMS optimization analysis. Central office performs the PMS budget optimization analyses and distributes the optimized work plan list of activities to the districts and identifies the budgets for each. Districts create projects using those fund amounts while also seeking to match 75 percent of PMS optimization analysis output recommendations for project location and treatment type. However, Districts can move a project up or down in time within the analysis time period of six years so long as they meet the 75 percent match requirement.[24]

The following chart shows statewide pavement management expenditures by type and overall PCR. While the pavement condition was declining in 2013 and 2014, beginning in 2015 the PCR has increased, indicating that the overall condition of the pavement used on roads managed by ODOT has improved over time.
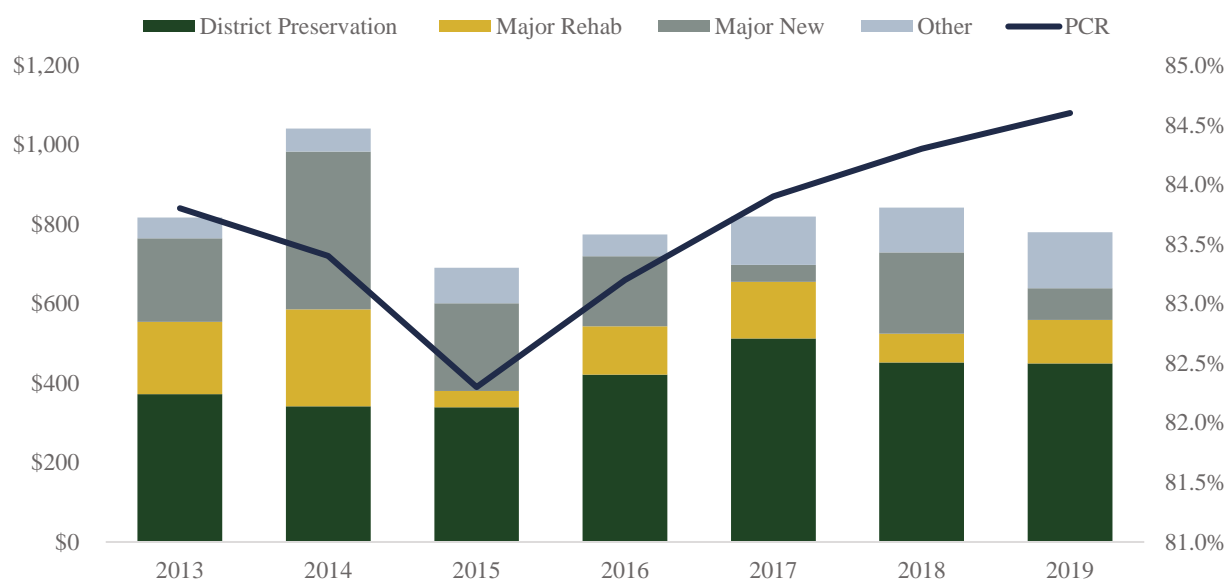
Pavement

ODOT manages pavement effectively; however, the Department is currently heavily reliant on a manual data collection process and a relatively short projection period for future pavement expenditures.

Both of these factors could make it difficult for the Department to maintain current performance over a longer time period.

In order to maximize both flexibility and sustainability of its pavement management practices, the Department should implement changes as part of an overall business intelligence strategy (see **Section 8**)

Statewide Historical Condition vs Expenditures

Source: ODOT

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[24] Appendix B of the ODOT Transportation Asset Management Plan (TAMP) contains a detailed description of the district work plan process.

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The table below shows a comparison between Ohio and peer state pavement conditions and planned expenditures on an annualized and per lane mile basis.[25] While ODOT achieves similar results to peer states in regards to pavement condition, it does so at a higher cost per lane mile.

Ohio and Peer State Comparisons

		OH	KY	MD	NY	PA	WV	WI
NHS Lane Miles		19,856	12,335	7,616	19,739	20,944	5,993	16,190
Planned NHS Annual Expenditures (in millions)		$601.00	$193.80	$253.00	$300.00	N/A	$144.70	N/A
Planned $/Mile		**$30,268**	$15,711	$33,221	$15,198	N/A	$24,145	N/A
Interstate Current Condition	Good	60%	66%	60%	42%	66%	83%	59%
	Poor	**0%**	0%	1%	3%	1%	0%	2%
Non-Interstate Current Condition	Good	47%	45%	34%	19%	35%	61%	36%
	Poor	**1%**	1%	7%	9%	2%	0%	6%

Source: ODOT and Peer States

Why We Looked At This

ODOT has historically spent approximately $800 million per year in pavement including repairs, rehabilitation, and new construction. Between FY 2013 and FY 2019 ODOT spent an average of $543 million per year on repairing or rehabilitating pavement, or about 66.0 percent of the total annual pavement expenditures, whereas the Department spent an average of $190 million per year on new construction.[26] The large amount of money is indicative of the fact that managing pavement is one of ODOT's most critical functions. Optimizing pavement management will help ODOT to better utilize available resources.

What We Looked At

We compared the processes and systems ODOT uses for pavement management. We paid special attention to ODOT's use of data of pavement management, the assumptions made in budgeting, and the relationships between ODOT's central office and districts. We compared ODOT's practices to peer states and industry standards.

What We Found

We found that ODOT is behind peer states when it comes to adopting automation in the collection of pavement data. Further, we found that the pavement analysis performed by ODOT

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[25] Planned expenditures were based on 10 year projections included in each state's TAMP.
[26] New construction was not in the scope of this audit.

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may be underestimating the budget needed over the next 10 years to sustain network pavement conditions compared to historical trends. We also found that ODOT should study the optimal match between Districts and the central office when it comes to pavement treatment options.

As a result of our analysis we identified three recommendations relating to pavement that ODOT could implement to improve operational efficiency and effectiveness:

- **Recommendation 5.1:** ODOT currently has a manual process used to collect pavement data. Peer states typically use either a fully automated system or a hybrid between automation and manual data collection. ODOT should develop an efficient and effective pavement data collection plan consistent with best practices. Manual data collection could result in inconsistent data collection, which could lead to suboptimal decision making. In turn, this could make it more difficult for the Department to sustain its current progress with pavement management;
- **Recommendation 5.2:** ODOT currently fully projects future pavement expenditures for five years, whereas best practice states use much longer projection periods. ODOT should adopt best practices for pavement projections. By optimizing the time horizon of pavement projections, the Department may be able to select more cost effective treatment options; and,
- **Recommendation 5.3:** ODOT currently requires districts to match 75 percent of the projects identified by the central office using the pavement management system. Districts report having little issue hitting this metric, suggesting that the 75 percent match might be too low. ODOT should conduct a study to optimize project selection at the district level, including the maximum percentage match between PMS project recommendations and the timeframe Districts have to complete the projects. Calculating the optimal percentage of project selections that can be expected could lead to additional savings or better long term decisions related to project planning.

Recommendation 5.1: Pavement Data Collection

ODOT currently has a manual process used to collect pavement data. Peer states typically use either a fully automated system or a hybrid between automation and manual data collection. ODOT should develop an efficient and effective pavement data collection plan consistent with best practices.

Impact

While there is no direct financial impact of this recommendation, efficient and effective data collection is a critical component of making sound investment decisions. Specifically, manual data collection could result in inconsistent data collection, which could lead to suboptimal decision making. In turn, this could make it more difficult for the Department to sustain its current progress with pavement management.

Methodology and Analysis

This section analyzes ODOT's pavement data collection. Data was gathered from ODOT's Transportation Asset Management Plan (TAMP) and additional pavement and financial data provided by the Department. Peer data was provided by the peer states. Additional information was obtained through interviews with ODOT and peer DOTs. Analysis was conducted by comparing ODOT's practices to peers and federal guidelines.

One major factor in pavement data collection is the question of whether the data is collected manually or automatically. Manual data collection on pavement is performed by a trained observer driving down a specific section of highway of observing and recording pavement conditions. In automated data collection, a van equipped with special equipment records pavement conditions as its driving and pavement conditions are rated by computer. There is also a semi-automated process, where images of the pavement are collected automatically and rated by trained observers.

As described, each state manages different metrics of pavement and network condition. Unlike bridge management, where the national standard of NBI means all states are reporting the same information, it is common practice within pavement management for agencies to follow unique processes. ODOT collects data with internal forces using pavement condition data collection equipment that is manufactured and maintained commercially. Data is collected on 1/10th mile intervals. ODOT uses federal guidelines to determine which sections are in good, fair or poor condition. The table on the following page summarizes peer states' data collection practices compared to Ohio.

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Data Collection Practices

	OH	**KY**	**MD**	**NY**	**PA**	**WV**	**WI**
Data Collection Process	Manual	Both	Automated	Automated	Automated	Automated	Manual
In-House or Vendor?	In-House	In-House	In-House	Vendor	Vendor	Vendor	In-House
Collection Cycle	State Routes: Annual Federal Routes: Biennial	Biennial	NHS: Annual Smaller Routes: 2-3 Years	State System: Annual Local Fed Aid: Biennial	NHS: Annual Non-NHS: Biennial	NHS: Annual Non-NHS: Biennial County: Every 5 Years	Annual

Source: ODOT and Peer States

ODOT has a federally required Data Quality Management Plan (DQMP)[27], which documents the procedures for managing pavement data quality. The DQMP process for pavement data is general and mostly involves reviewing values that are outliers (too high or low), or in different wheel paths. It is a visual review of automated data based on experience and staff judgment.

Maryland and New York have notable approaches to managing their respective pavement networks through performance metrics. Maryland converts metrics into remaining service life and lane mile years, and sets performance targets for the Districts. There are no consequences for not hitting targets; however, the following incentives are provided for exceeding preventative maintenance targets:

- Offering general bonus funds for discretionary regional purposes;
- Providing innovation bonus funds for using certain preservation treatments; and,
- Giving a 40 percent increase for specific projects.

New York State uses a model to project what is achievable within each District in terms of condition, cracking, backlog, and average surface rating. These projections are then provided to the Districts. If a region's proposed plan varies significantly from the plan and associated projections provided, that region is required to re-work its plan. It is common for the project selection process to have many iterations prior to final acceptance with state DOTs.

With federal legislation 23 CFR 490, there is a concerted effort made by FHWA to try to ensure better accuracy and repeatability in the reporting of federal pavement condition metrics. With the push from FHWA, state DOTs have begun formalizing data quality, accuracy, and repeatability

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[27] Data Provided by ODOT: ODOT_DQMP_20180630_FINAL.docx.

processes. Part of that process has been adopting automated data collection tools to work towards objective and repeatable condition data measurements.

ODOT is undergoing a research project to analyze the potential advantages of moving to a more automated data collection system. The research project is expected to last until 2022. The Department acknowledges that other states do use more automated processes. ODOT is concerned that switching to an automated process could be more expensive and may not produce significantly better results.

The Department should finish its current research project while continuing to monitor developments in peer states. Ultimately, the Department should select the data-collection method that will provide for the best overall long-term value, taking into account both the financial cost and effective pavement management.

Conclusion

ODOT currently uses a manual data collection process to collect data on pavement condition. While ODOT is collecting data, manual data collection may not be as accurate or as effective a method as automatic data collection. By not using an automated data collection system, ODOT may be sub-optimizing its pavement data collection process.

Recommendation 5.2: Consider a longer time-horizon for pavement planning

ODOT currently fully projects future pavement expenditures for five years, whereas best practice states use much longer projection periods. ODOT should adopt best practices for pavement projections.

Impact

By optimizing the time horizon of pavement projections, the Department may be able to select more cost effective treatment options.

Methodology and Analysis

This section concerns ODOT's budgeting practices for future pavement investment. Data was provided by ODOT and peer states. Additional information was obtained through interviews with ODOT and peer state personnel. Information included ODOT's PMS optimization projections that forecast funding levels and predicted PCR values on pavement projects from 2020 through 2031. ODOT's practices were compared to peer states and best practices.

The chart below shows ODOT's projected expenditures and PCR for the period from FY 2020 to FY 2025. This projection includes the majority of funds that are expected to be used on pavement projects in Districts and at Central Office.

Projected Pavement Expenditures and PR
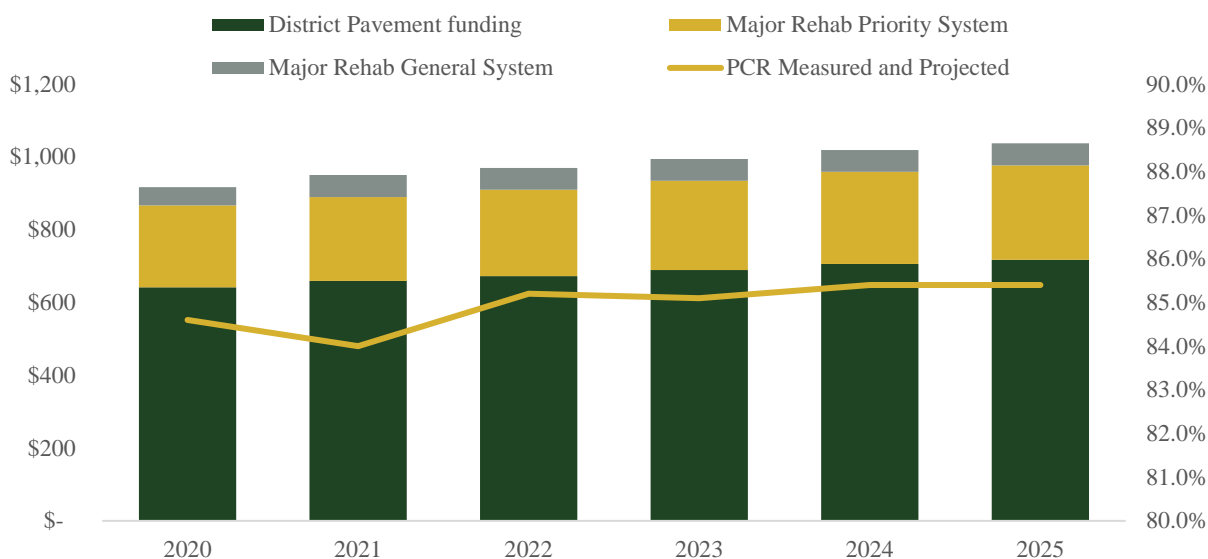
Source: ODOT

The chart below contains expenditures versus conditions for the entire State, forecasted for 2020-2031. The data provided below comes from ODOT's final accepted optimization scenario, denoted as Opt 9. This information as an example of the analysis process used by ODOT to determine funding needs from these forecasts.

Statewide Forecasted Condition vs. Optimization Analysis Funding
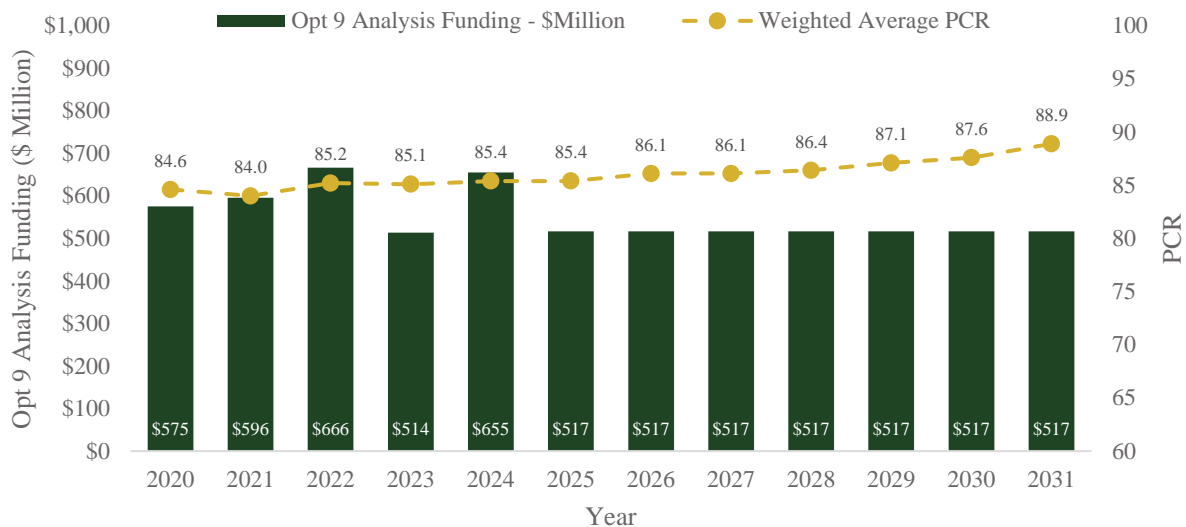
Source: ODOT

As shown, the Department is only projecting to expend $517 million per year after 2025; however, the Department acknowledges that there is an expectation that expenditures will actually exceed those shown above, but the Department has not yet programed the PMS with the additional expected expenditures.

The Federal Highway Administration (FHWA) published guidance entitled, Using an LCP (Life Cycle Planning) Process to Support Transportation Asset Management: A Handbook on Putting the Federal Guidance into Practice (2019). The FHWA guidance notes that multiple bridge and pavement analysis scenarios should be conducted. Each scenario can represent another credible set of options, such as varying investment amounts, or varying how funds are allocated. For example, one scenario could emphasize increasing the replacement of aged, poor-condition pavements. Another scenario could rely primarily on preserving good pavements. Having conducted various scenarios, the range of options can be evaluated, and the preferred option selected.

When considering different Life Cycle Planning strategies, the first step in the analysis is to set a fixed level of funding for each asset sub-group and/or highway system to compare the long-term impacts of several different options. For example, a State DOT may compare the results of several different LCP strategies, including one that represents the typical treatment strategy and another that applies more preservation than is typically considered. State DOTs with funding constraints that do not allow them to address all system needs may evaluate strategies that rely on more frequent cycles of low-cost preservation treatments on low-volume roads to

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determine whether an alternate strategy reduces the overall cost of system preservation. (page 23)

FHWA also says the following about the length of the analysis period that a DOT should run with its management system:

> **Analysis Period**: Establishes the timeframe that will be considered for the LCP analysis. For pavement LCP analysis, the chosen analysis period should be at least long enough to span the life of the next major rehabilitation activity and preferably extend through the lives of several rehabilitation treatments or the first reconstruction event. Care should be exercised to not unnecessarily increase the analysis period and raise the difficulty and uncertainly of predicting future events. State DOTs should continually monitor and update the performance models used in the PMS in order to improve the reliability of the outputs. For network level LCP, a typical analysis period would range between 20 and 40 years.

Some states with operable pavement and bridge management systems are conducting analyses well beyond 10 years. For example:

- The Indiana DOT asset management plan (page 6-8) shows bridge and pavement scenarios through 2038. (page 42)
- The Colorado DOT asset management plan also includes pavement and bridge analysis scenarios to 2038 (pages 42 and 45)
- The Minnesota DOT asset management plan uses life cycle periods long enough to capture one complete replacement cycle of assets. (page 106) Because different assets have different life cycles, the span of analysis varied by asset class. For pavements, bridges, and storm water tunnels, the analysis period was 70 years. For overhead sign structures, traffic signals, and high mast lighting the analysis period was 50 years. Noise walls were analyzed on a 120-year life cycle.

The Department mentioned that they recognize the advantages of conducting longer term projections, but there are currently limits in ODOT's computer hardware that prevent longer projections. The Department does anticipate that a planned hardware upgrade will facilitate more accurate long term scenario planning.

Conclusion

ODOT uses the PMS to project the expected future pavement investment. Between FY 2014 and FY 2019, ODOT spent an average $800 million per year in pavement investment. The Department currently fully projects pavement expenditures for five years in advance, and partially projects pavement expenditures for up to 10 years. Moving to a longer time frame could improve pavement optimization.

Recommendation 5.3: Optimize Project Selection

ODOT currently requires districts to match 75 percent of the projects identified by the central office using the pavement management system. Districts report having little issue hitting this metric, suggesting that the 75 percent match might be too low. ODOT should conduct a study to optimize project selection at the district level, including the maximum percentage match between PMS project recommendations and the timeframe Districts have to complete the projects.

Impact

Although there is no direct financial impact of this recommendation, calculating the optimal percentage of project selections that can be expected could lead to additional savings through optimization.

Methodology and Analysis

This section analyzes ODOT's policy of requiring districts to match 75 percent of PMS projects recommended by PMS. Data for this section was gathered through interviews with ODOT personal and reviews of ODOT's policies. Peer data was gathered through interviews with peer states and data gathered from peer DOTs.

Decisions about which treatments are most appropriate for a specific pavement section begin at Central Office with an analysis that is produced by the Pavement Management System (PMS), a piece of software ODOT uses to determine optimal treatment options based on pavement conditions. Districts are required to match at least 75 percent of the projects identified by PMS. Districts have a six-year window within which to complete the PMS-identified projects.

ODOT and Peer State Treatment Selection

	OH	KY	MD	NY
Treatment Project Selection	Districts are required to achieve a 75% match to the projects selected by PMS.	Centralized with input from districts	Decentralized with input from central office	Decentralized with input from central office.
Specific Match %	75%	N/A	N/A	N/A

	PA	WV	WI	
Treatment Project Selection	Decentralized except for interstates.	Hybrid between central office and districts.	PMS analysis is the basis for project selection at the regional level.	
Specific Match %	N/A	N/A	N/A	

Source: ODOT and Peer States

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As shown on the previous page, three out of six peer states have a more decentralized project selection process. In addition the following nuances should be taken into account:

- Kentucky's process is generally centralized with some input from the districts.
- Pennsylvania's Interstate project selection process is centralized.
- West Virginia considers its process to be both centralized and decentralized, depending on the situation.

Additionally, each peer state identified a similar collaborative project development process between Central Office and the Districts that includes providing initial network-level project plans to the districts. The Districts then provide input to determine the project selections.

Overall, ODOT's requirement is that programmed pavement activities match 75 percent of the optimization in District work plans. This practice of setting and enforcing project selection standards is considered a best practice. This is because any time an agency requires the final work plan to be within a reasonable tolerance of the optimization output, there is a better chance that the performance goals being predicted will be achieved. However, ODOT could consider tweaking the criteria to optimize expectations.

ODOT Districts seem to be having no significant issue achieving the 75 percent target, suggesting that higher match targets are achievable. This would likely be especially true if some of the recommended PMS configuration changes identified in other sections of this report are implemented.

ODOT may need to revisit the time range that a project can be moved. Six years is a long time and a project selected in year one may no longer be viable in year six. No peer state reported allowing such a long timeframe for selected projects.

Conclusion

ODOT's current policy is that District pavement projects should match 75 percent of projects recommended by central office and Districts have six years to complete those projects. It is possible that both the 75 percent match and timeframe to complete the projects are suboptimal, which could lead to a suboptimal selection of projects.

Maintenance Management

A safe, efficient, and accessible highway system is crucial for Ohio citizens and businesses. Considering that ODOT makes significant investments in maintaining its roadway network facilities, it is critical to assure the long-term operation of these investments to maintain infrastructure asset value for stakeholders and users.

Background

ODOT owns, operates, and maintains a variety of transportation infrastructure assets to support its mission. Maintenance management at ODOT involves performing a range of routine and preventive activities designed to ensure serviceability, extend the life, and maximize the performance of these assets. Maintenance includes activities such as:[28]

Maintenance
This section illustrates one of the Department's strongest opportunities to improve its operations by strengthening the data collection. As is, maintenance management is the area with the weakest use of strategic business intelligence (see **Section 8**).

- Drainage maintenance;
- Pavement markings;
- Signs;
- Protective barriers;
- Shoulders;
- Pavement patching and crack sealing;
- Vegetative control; and
- Litter collection.

The Department is responsible for maintaining over 43,000 lane miles of roadway infrastructure. ODOT employs 2,603 maintenance personnel who perform an estimated 80-95 percent of routine highway maintenance activities in-house, while outsourcing the remaining work to local contractors.

Maintenance activities are conducted through a decentralized organizational approach. The Department's Assistant Director of Field Operations has overall authority over the operations of ODOT's 12 districts. The Office of Maintenance Operations reports to the Assistant Director and provides budget management guidelines and funding allocations to the districts. However, the Districts ultimately control the work being done and materials used in accordance with ODOT standards and specifications.

Each budgeting cycle, the work units within each District develop a detailed work plan of specific road repair projects, equipment purchases, material needs, land and building improvements, and other projects with an estimated cost for each. All the planned work for the

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[28] Snow removal is typically considered a maintenance activity but was not included in the scope of this audit.

year goes into the District work plan, which is then submitted to the statewide budget committee. The budget committee then determines the exact budget for each of the 12 Districts and Central Office, based on the contents of the work plans.

Why We Looked At This

ODOT spends about $200 million annually on maintenance-related payroll. Maintenance activities are a major focus of Highway Technicians, which make up about half of ODOT's total workforce. A review of ODOT's maintenance practices provides opportunities to identify areas for improvement within a major section of the Department's operation.

What We Looked At

Maintenance operations and management program were reviewed to determine the extent to which the agency applies nationally recognized asset management practices in its development and delivery. Specifically, systems for collecting and analyzing data on roadway asset condition and maintenance costs were reviewed. Additionally, the system for inspecting and rating roadway infrastructure was assessed.

To identify ODOT's current status in each of the maintenance areas identified for review, we conducted document/data review and outreach to ODOT personnel. This outreach included conducting virtual interviews with representatives from ODOT's Division of Operations (DO) as well as multiple outreach efforts to the 12 ODOT Districts.

Peers were identified for comparison based on proximity to Ohio, environmental similarities, and related considerations, including the size of their transportation system. Indiana, Kentucky, Michigan, Minnesota, New York, and North Carolina were selected as peer states and participated in interviews with regarding their maintenance operations.

What We Found

Maintenance managers across all ODOT Districts are consistently inspecting their roads every two weeks to record and take corrective action on any deficiencies found. Capital maintenance planning is performed annually and coordinated between ODOT headquarters and Districts. However, ODOT lags peer states in leveraging the benefits of a computerized maintenance management system that could improve analysis and reporting of costs associated with routine maintenance activities. Despite investing several million dollars into a computerized maintenance system, ODOT only partially uses the system and now plans to replace it. Other peer states have successfully implemented this system.

Further, ODOT does not compare its costs for conducting maintenance work in-house to the cost of hiring contractors. Peer states are able to track unit costs and create reports from this data, and use it to inform decision making on which activities should be performed in-house versus outsourced.

ODOT is currently working to restart its Maintenance Condition Rating (MCR) program. Developing scoring criteria that results in an effective management tool can be challenging. Several peer states have successfully leveraged similar systems to prioritize maintenance needs.

Based on this analysis, we identified three recommendations that would assist the Department in improving operational efficiency and effectiveness in maintenance management:

- **Recommendation 6.1:** ODOT is not currently fully utilizing its existing maintenance management software. In addition, the Department is considering the purchase of a new system despite never having fully implemented the existing system. ODOT should adopt best practices to leverage the existing maintenance management system tools, including better integration with the Department's other IT systems and use in work planning. The lack of data available throughout the course of this audit with respect to maintenance activities implies the Department is incurring risk of misallocating maintenance resources. In addition, the lack of data on unit costs of maintenance activities makes it difficult for the Department to make efficient decisions related to the use of outside contractors;
- **Recommendation 6.2:** ODOT does not currently capture unit cost of common maintenance activities. ODOT should ensure the maintenance management system captures the costs of maintenance activities and allows analysis of the most economical means for conducting highway maintenance. This will allow the Department to have all relevant facts before making resource allocation decisions; and,
- **Recommendation 6.3:** The Department has stopped using its maintenance condition rating to measure performance in maintenance. ODOT should restart, strengthen and enhance the Maintenance Condition Rating (MCR) program. A maintenance condition rating will help the Department monitor performance and in doing so further optimize a major functional operation**.**

Recommendation 6.1: Maintenance Management System

ODOT is not currently fully utilizing its existing maintenance management software. In addition, the Department is considering the purchase of a new system despite never having fully implemented the existing system. ODOT should adopt best practices to leverage the existing maintenance management system tools, including better integration with the Department's other IT systems and use in work planning.

Impact

The lack of data concerning maintenance activities indicates that there is a risk that ODOT is making inefficient decisions related to Maintenance Management. The employees who perform maintenance, highway technicians, make up about half of ODOT's workforce so such a misallocation could have significant impact on department operations. In addition, the lack of data on unit costs of maintenance activities makes it difficult for the Department to optimize the use of outside contractors. Implementation of this recommendation would allow for identification of the optimal mix of resources assigned to achieve programmatic goals.

Background

ODOT implemented its current maintenance management system (MMS) in 2014. This system is an Agile Assets product and is known as the Enterprise Information Management System (EIMS). This system was originally envisioned to use mobile devices for capturing daily work accomplishments. The Department reports that the original mobile devices were not user friendly. After EIMS was implemented, ODOT began using a separate mobile platform for capturing and tracking roadway defects or work needs and activities identified through bi-weekly route reviews. Further, EIMS is not integrated with other frequently used ODOT applications such as Geographic Information System (GIS), the annual work plan database, and bi-weekly data collection applications and databases.

Methodology and Analysis

This section analyzes ODOT's use of a maintenance management system (MMS) to manage and monitor its maintenance functions. Data was gathered through interview with key ODOT personnel. Comparisons were made to peer state maintenance practices.

All 12 ODOT Districts capture and input work accomplishments by crew into EIMS on a daily basis. To accomplish this, District employees fill out paper cards and turn those cards over to a clerk who then manually enters the data into EIMS. Through this process, EIMS captures work hours. However, ODOT perceives that EIMS no longer meets the desired functionality and reporting needs of field maintenance staff. For example, the Department reports that it is difficult to run reports out of EIMS, and reporting functionality is key to making an MMS useful for day-to-day management. In addition, the Department reports that EIMS does not work well with the mobile system that was originally included with EIMS.

ODOT had high hopes for EIMS when it was first implemented in 2014; however, the Department did not fully engage all stakeholders in the process when EIMS was rolled out. As a result, the system does not work well for supervisors and managers or for the Highway Technicians (HTs) who do the bulk of day-to-day work in the counties. Districts never used EIMS for work planning; instead, work plans were made in Excel documents complete separate from the system.

The Department is currently in the planning stages of replacing this system. In the interim, county garages are instead using a non-EIMS integrated iPad-based application as a field data collector to identify work to be done as part of a bi-weekly field review. This application accumulates the target work identified in a list that can be filtered and queried.

EIMS is largely being used as repository for daily work accomplishment information but is not being widely used as a work planning or budgeting tool for tracking performance and decision making. Essentially, ODOT is using an array of other software tools and databases to drive maintenance decision making on a day to day basis instead of functionality that could be configured in EIMS. One result of using multiple, unconnected processes and systems is that it is almost impossible for the Department to leverage technology to make maintenance management easier. For example, because District work plans are not held in EIMS, it's very difficult to monitor how many hours District or County personnel are putting towards accomplishing specific annual goals.

The six peer states interviewed also use the MMS from Agile Asset—which is an industry leader for MMS solutions.[29] In comparison with ODOT, the peers generally had many more system linkages between the MMS and other systems. Additionally, many of these states were using their MMS to track performance and/or costs in many more areas and in some cases, also were using mobile technologies to support data collection and entry.

According to the peers, the central maintenance or asset management offices tend to be the sponsors of their MMS and are experts in its use, generally providing on-going training for field users. The ODOT Office of Maintenance Operations does not appear to have the same level of involvement with EIMS as several of the peers. States that report a successful implementation of their MMS have included heavy involvement of their central maintenance office personnel in its configuration to match maintenance business processes more closely and take ownership of the system.

The table on the following page provides a comparison of how peer states use various elements of their MMS, including linkages to other systems.

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[29] The peer states are Indiana, Kentucky, Michigan, Minnesota, New York, and North Carolina.

MMS Comparisons

System	OH Agile Asset	IN Agile Asset	NY Agile Asset	MI Vue Works	NC Agile Asset	MN Agile Asset	KY Agile Asset
Interface with Financial System	Yes	No	Yes	No	Yes	Yes	Yes
Interface BMS	No	Yes	Yes	No	Yes	Yes	No
Interface PMS	No	No	Yes	No	Yes	Yes	Yes
Integrated Service Request System	No	Yes	Yes	Yes	Yes	Yes	Yes
Work Planning Functionality	No	Yes	In Process	Yes	Yes	Yes	No
MQA Integration	No	No	No	Yes	Yes	Yes	Yes
Interfaced Inventory, Materials Management	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile Unit Crew Data Entry	No	No	No	Yes	In Pilot	Yes	No
Location referencing of work performed via asset location, GPS and/or agency LRS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tracking Contract Maintenance	No	No	Unknown	Yes	Yes	No	Yes
Interfaced Equipment Management	Yes	Yes	Yes	Yes	Yes	No	Yes
Tracking/Reporting for FHWA ER or FEMA Events	No	Yes	Unknown	Yes	Yes	Yes	Yes
What-If analysis for various performance targets and levels of funding	No	Yes	No	Yes	No	No	No
Establishment/Tracking of annual work program	No	Yes	In Process	No	Yes	Yes	Yes

Source: ODOT and Peer States

Conclusion

A well designed MMS is critical to the operation of a DOT. ODOT's current system, EIMS, is built on an industry-standard system that has been used successfully in peer states, but ODOT is not currently fully utilizing its existing technology. The Department recognizes the importance of an MMS but is currently pursuing the purchase of a new system rather than fully implementing the system they already purchased. The Department should explore every opportunity to optimize their existing system before committing to the purchase of something else.

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Recommendation 6.2: Unit Cost Analysis

ODOT does not currently capture unit cost of common maintenance activities. ODOT should ensure the maintenance management system captures the costs of maintenance activities and allows analysis of the most economical means for conducting highway maintenance. This will allow the Department to have all relevant facts before making resource allocation decisions.

Impact

While there is no direct financial impact of this recommendation, ODOT could be missing a major opportunity to optimize costs by not routinely collecting data on unit costs.

Background

Unit cost is a concept that refers to the cost of a specific activity, such as guardrail repair. This section is concerned with ODOT's ability to compare the unit cost of activities performed in-house with ODOT employees to activities performed by outside contractors. ODOT estimates that 5-20 percent of routine highway maintenance activities is outsourced to local contractors. ODOT's use of maintenance outsourcing is sporadic and usually limited to major activities involving specialized skills or equipment. Examples of previously outsourced maintenance activities include guardrail repair, highway lighting, pavement striping with reflective pavement markers, and removal of heavy trees and brushes.

Methodology and Analysis

This section evaluates ODOT's use of unit cost analysis in its maintenance functions. Data for this section gathered through interviews with ODOT personnel. Comparisons were made to peer state practices.

ODOT does not routinely track or analyze the unit cost of in-house maintenance activities. ODOT does collect data on work hours in EIMS, so the data does exist to calculate the cost of internal task, but EIMS, as currently configured, makes it difficult to run reports (see **R6.1**). Contracted maintenance work is not currently managed or tracked within EIMS. Therefore, ODOT does not have an established process for evaluating the effectiveness of in-house versus outsourced maintenance activities on a cost or productivity basis.

Through interviews, some Districts indicated that they would like to have the ability to outsource more work, but reported it would be a challenge from a budgeting side. Districts report that their labor costs absorb most available maintenance budgets, leaving little available monies to use contracted maintenance. Several Districts also indicated that they lack the personnel and equipment to meet the needs of their infrastructure, but even with additional funding, would struggle to hire additional qualified workers.

The peer states of Indiana, Michigan, and North Carolina provided insight into how they track in-house versus outsourcing costs. The Indiana Department of Transportation bases decisions on whether to perform work in-house or contract out based on comparing in-house unit prices to

contract unit prices. The Michigan Department of Transportation entered into a performance-based contract with a private contractor to cover all routine maintenance activities in one of its counties. While this was only recently implemented, outcomes have so far been positive. The North Carolina Department of Transportation is able to produce detailed data reports on maintenance expenditures for in-house and outsourced work through its MMS.

ODOT was unable to provide the data to compare in-house maintenance spending to contract maintenance spending and does not track or compare spending on a unit cost basis. This information should be readily available through an MMS or agency financial system. In comparison, the peer states reported that they can easily track contract work through their MMS, allowing for a comparative analysis with in-house costs. Although cost is not the only consideration when deciding whether an activity should be outsourced, it is an important component of that decision.

Conclusion

Keeping track of unit cost is an important way to measure and manage internal performance. ODOT's existing data systems make it very difficult to make direct comparisons between in-house and outsourced cost. By not tracking unit costs, ODOT is at risk of sub-optimizing decisions about outsourcing and resource allocation.

Recommendation 6.3: Maintenance Condition Rating Program

The Department has stopped using its maintenance condition rating to measure performance in maintenance. Restart, strengthen and enhance the Maintenance Condition Rating (MCR) program.

Impact

While there is no direct financial impact of this recommendation, a maintenance condition rating can help the Department monitor performance and in so doing further optimize operations.

Background

A Maintenance Condition Rating (MCR) is a standard measure of maintenance conditions typically developed in house by a DOT. ODOT had an MCR that was developed in the 1990s with other critical success factors (see the **KPIs section**). In 2018, ODOT reviewed existing MCRs and found that the scores were not relevant to key decision makers including supervisors and District Deputy Directors. Districts perceived that the scoring was deceptively high and with so little range in scores as to render it ineffective as a management tool. In addition, the system's inability to capture perceived deficiencies in assets or groups of assets prevented the Districts from identifying where to focus resources for a uniform level of service. Finally, ODOT had been using a third party contractor to do the evaluation and ODOT reports that the contractor had been slow returning results. As a result, this CSF was suspended and no assessment has been conducted in the last two years.

Methodology and Analysis

This section evaluates ODOT's use of an MCR to monitor the performance of its maintenance practices. Data was gathered through interviews with ODOT personnel and review of the Department maintenance manual. Comparisons were made to peer states and best practices.

Within the last year, ODOT began a planned transition back to in-house assessments and is revising the MCR manual. The draft manual defines MCR as a visual inspection conducted from a moving vehicle of four categories: barrier, pavement, pavement marking, and traffic control devices (signs). MCR inspections will be randomly generated and will occur on every county's state-maintained highways every six months.

District staff have assisted in developing the new manual, but have not come to resolutions regarding MCR scoring. ODOT has not yet determined a satisfactory metric and recognizes it will need to get consensus from the Districts to avoid ratings that do not provide actionable feedback.

According to *Highway Maintenance Quality Assurance* (National Cooperative Highway Research Program Transportation Research Board, 1997), about half of the state departments of

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transportation have developed Maintenance Quality Assurance (MQA) programs. Many states, (including ODOT) that have implemented these programs are only assessing and reporting conditions. Further, only a handful are currently leveraging the additional benefits that MQA data can offer with respect to developing activity-based work plans, needs-based budgets, or providing support for trade-off decisions.

The Michigan Department of Transportation has a Performance-Based Maintenance rating system that is based on rating selected assets using threshold conditions on a percent passing scoring criteria. The system is still relatively new, and the goal is to be more data driven as it continues to evolve. Data collected through the system has been used to prioritize maintenance needs.

ODOT's system is similar to those of peer states in that it compares the existing threshold conditions of individual maintenance characteristics with the acceptable threshold condition. However, there are concerns around the integrity of the system, as field managers are aware that only a specific quadrant of their area will be assessed each year, and they may therefore concentrate their efforts on that area. Peer states often mitigate this problem by applying random sampling throughout the maintenance area instead of focusing on all road segments in a concentrated quadrant of the county. Additionally, the threshold condition criteria should be within an acceptable range for both management and customers to avoid scores appearing deceptively high.

Conclusion

An MCR program is critical for setting and tracking maintenance goals. ODOT abandoned their MCR program two years ago and is in the process of developing an updated MCR. Having an effective MCR program will assure that ODOT can successfully monitor their own performance.

Overhead Costs

Within any organization, financial considerations must be taken into account when making decisions related to operations. These considerations are critical to staffing decisions, asset management, and project selection in any given year. Understanding the financial implication of decision making is a critical component to ensuring that resources are used in the most economic and efficient manner.

Background

At a high level, a balanced budget involves a series of calculations ensuring that expenditures and revenues are equal to each other. If an organization has excess revenue at the end of a year, it may indicate that it did not maximize resources; conversely, if expenditures exceed revenues, an organization may have issues in regards to overspending. While these high level analyses are important to understanding the overall fiscal health of an organization, they are not as useful when making programmatic decisions.

The majority of ODOT's expenditures can be classified as project based – whether building new roadways or maintaining existing ones, the work that is being done on the ground is comprised of ongoing projects which are supported by both the Districts and Central Office administrators. The determination of what projects to undertake involves allocating costs and personnel resources on a granular level. Determining the cost and potential benefits of projects is a necessary step in identifying operational priorities.

While some expenses are easily identified and tied to specific projects, such as raw materials or labor hours, others can be more difficult to appropriately allocate. Organizational expenses can be classified as one of three types for purposes of allocation:

- **Direct Costs:** Those expenses that can be tied to a specific project, such as direct labor hours or raw materials;
- **Overhead:** Indirect costs, such as depreciation of equipment or personnel benefits, that are not tied to a specific project but that can be tied to projects generally; and,
- **General and Administrative:** Those indirect costs that are unavoidable in nature and are tied primarily to support functions, such as human resources and legal departments, but also rent and utilities associated with office space or other buildings.

Other relevant accounting concepts include:

- **Avoidable Costs:** Those costs which will not be incurred if a particular activity is not performed;
- **Unavoidable Costs:** Those costs which will be incurred regardless of the decision to undertake a particular decision; and,
- **Marginal Cost:** The change in costs incurred by adding one additional unit.

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When making organizational decisions, such as hiring new staff or project prioritization, it is necessary to understand how these different types of costs are applied. Understanding these accounting concepts and ensuring that they are properly implemented is a critical part of an organization's success.

Why We Looked At This

ODOT spends billions of dollars annually maintaining Ohio's roadways and bridges. While the work is costly in nature, it is important to ensure that resources are being spent in an efficient and transparent manner. Previous performance audits of ODOT identified questions regarding the use of overhead calculations in determining when to outsource for labor rather than using internal labor or hiring additional staff. Appropriate overhead calculations will help ODOT answer questions such as: What is it the full cost to have an internal employee complete a task (patch a pot hole, fix a guardrail, etc.)? How does that compare to the full cost of having the same task completed by a contractor? What types of activities represent the best use of internal employees and what do contractors cost for the same thing? What do ODOT's internal employees do really well? How can we assign our employees to tasks where they excel and then make the most effective use of contractors? Answers these questions, and more, are important to the operation of any enterprise which uses both in-house staff and outsourcing as a means to achieve production targets.

What We Looked At

We examined ODOT's operations and compared them to industry best practices and professional standards. We met with agency leaders to discuss financial management, policies, procedures, and use of overhead for management decisions. We also reviewed several accounting concepts and how those concepts are applicable to ODOT's current practices.

What We Found

There are several appropriate, but distinct uses for overhead. Appropriate overhead rates and applications are dependent on different situations and analysis. We found that ODOT uses overhead in three primary areas:

- **Federal Reimbursement:** Many ODOT projects receive funding from the Federal Highway Administration (FHWA). The FHWA sets criteria that allows state DOTs to bill for project expenses that are eligible for federal funding. The federal funding generally includes both overhead and general and administrative expenses in addition to the direct costs of the project. When ODOT submits expenses for reimbursement for these projects, the agency is allowed to charge an overhead rate as a part of its federal cost recovery. Exact parameters for what can be included in the rate is governed by FHWA rules. This audit did not evaluate the federal reimbursement overhead rate which ODOT uses.
- **Contractor Overhead:** In accordance with federal and state DOT procurement regulations, contractors and consultants hired by ODOT are allowed to include overhead charges in their billing. These overhead charges are added to the contracted hourly rate,

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and generally cover the corporate administrative costs associated with the contract employees. This rate is reviewed by ODOT's Office of External Audits in order to ensure consultants are correctly calculating their overhead charge and allocating only allowable allow costs within overhead. This audit did not evaluate these contractor overhead rates or ODOT's associated processes.

- **Internal Departmental Overhead:** ODOT calculates an internal overhead rate by cost center[30] as part of the agency's ongoing budgeting and planning process. This information is used at the supervisory level and is used by the business office to control costs. The information is generally used to make comparisons on a year over year basis and is used to identify areas of potential concern during the annual budget process.

For the three applications of overhead specified above, federal reimbursement, contractor overhead, and internal departmental overhead, ODOT has well defined processes and identified employees responsible for carrying out the analysis.

The use of overhead in project level financial analysis, specifically in insource/outsource decisions, represents a fourth potential use of the concept. Unlike the other three applications, ODOT is not currently applying a standardized process or methodology to incorporating overhead into this decision making. When determining the relative costs & benefits of hiring outside contractors versus using ODOT staff on a particular project or task, the various ODOT departments are generally responsible for completing their own financial analysis, with limited Central Office guidance. In this decentralized structure, ODOT departments are inconsistently and incorrectly applying the concept of overhead in their project level decision making.

Based on our review, we identified one recommendation which will assist the Department in future decision making:

- **Recommendation 7.1:** ODOT does not currently use an industry standard methodology to calculate the cost of overhead for the purposes of management decision making. ODOT should develop a standardized methodology for applying overhead to insourcing and outsourcing decisions, and assist the various departments in their application of appropriate cost-benefit analyses. Between FY 2015 and FY 2019, ODOT spent approximately $105 million on consultant services annually. If a one percent savings could be realized by ODOT through optimizing the agency's decision making processes, the Department could realize more than $1 million in annual savings.

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[30] Cost Centers are units within an organization to which costs may be charged for accounting purposes. In the case of ODOT cost centers comprise a specific department, e.g. District 1 or the Office of Consultant Services.

Recommendation 7.1: Standardizing Overhead Application

ODOT does not currently use an industry standard methodology to calculate the cost of overhead for the purposes of management decision making. ODOT should develop a standardized methodology for applying overhead to insourcing and outsourcing decisions, and assist the various departments in their application of appropriate cost-benefit analyses.

Impact

Allocating overhead based upon appropriate criteria may result in significant cost savings related to the use of contracted labor. Between FY 2015 and FY 2019, ODOT spent approximately $105 million on consultant services annually. If a one percent savings could be realized by ODOT through optimizing the agency's decision making processes, the Department could realize more than $1 million in annual savings. In OPT's audit of ODOT released in FY 2019, analysis found that optimizing the balance between contractors and just one type of ODOT employee, Highway Technicians, the Department could save $30 million per year.

Background

ODOT currently does not have a standardized methodology for applying the concept of overhead in cost-benefit analyses. Overhead is used in the agency, but its application within project level decision making is ad hoc, particularly as it relates to staffing of construction and maintenance projects at the District level. ODOT operates in a largely decentralized manner and allows District administrators to make decisions regarding staffing levels and the optimal use of contractors when necessary. However, previous audits found that without guidance from the Central Office there was wide variation between Districts in the deployment of contract employees.

Methodology

We reviewed best practices related to the application of overhead from both industry leaders and academics. After identifying ways in which overhead can be effectively applied for decision making purposes, we mapped ODOT's current state to develop a comprehensive understanding of how ODOT applies overhead. Lastly, we analyzed ODOT's current state to identify if the Department was aligned with industry best practices. Analysis also helped us develop financial projections related to decisions which may deviate from those best practices.

Analysis

The Government Finance Officers Association (GFOA) recommends that governments allocate indirect costs in a systematic and rational method. Because there are multiple management objectives which can be served by allocating indirect costs, the GFOA does not recommend a one-size fits-all methodology.

As previously identified, ODOT uses overhead in a variety of methods, including the deployment of indirect costs in a manner to maximize federal reimbursement. However, we found that ODOT lacks a uniform methodology for identifying overhead and allocating indirect costs at a project level. In particular, we found that inconsistent decision making regarding outsourcing labor is a result of the lack of guidance on overhead allocation.

While there are appropriate times to use force augmentation consultants, we found that the Central Office defers staffing decisions to the discretion of District Offices, however the District Deputy Directors are making staffing decisions without considering the financial implications of outsourced labor compared to internal staff. ODOT is making these decisions only with information concerning District work plans, availability of skilled staff and contractors, equipment, project timing, and regional conditions. While these other factors are crucial to include in the decision making process, the relative cost of labor options should at least be calculated to provide the decision maker the information. By including costs as a factor in the decision making process, a complete understanding of the decision is available to the administrators making the decisions.

Cost-Benefit Analysis

Organizations often use a cost-benefit analysis to make and analyze decisions regarding costs. For decisions with financial considerations, benefits are weighed against costs. All costs and benefits, such as intangible costs, opportunity costs, and overhead, are included to give analysts the best-rounded outlook of the situation. While this concept is used generally to determine if a project is feasible, it can also be deployed to determine whether outsourcing labor is the most economically advantageous decision, particularly in situations where the available agency labor pool could be deployed to a variety of duties with differing costs.

Case Study

While an overall financial implication cannot be determined based on the appropriate allocation of overhead costs when making staffing decisions, it is possible that significant cost savings could be achieved through minimizing contract labor, or contracting for the least costly project type. For the purposes of illustrating overhead in determining the relative labor costs of contracted work or ODOT staff, ODOT uses the federal reimbursement rate. This rate is only appropriate when recouping costs from the federal government in allowable ways, not internal decision making. However, this method does not accurately reflect overhead associated with labor at a project level. Unavoidable costs should be removed from calculations when determining staffing levels.

Overhead Analysis

ODOT Method		OPT Method		
A. Included in Overhead				
Fringe Benefits, Buildings, Communications, Equipment, Licenses, Office, Postage, Professional, Rental, Seminars, Subscriptions, Travel, Tuition, Utilities, Vehicles		Fringe benefits		
B. Overhead Calculations				
HT Base Rate	$22.03	HT Base Rate	$22.03	
		HT Benefit Rate	$11.74	
ODOT Applied Overhead	150.3%	Benefit Rate as % of Base	53.3%	**Variance**
Total HT Hourly Rate	**$55.15**	**Total HT Hourly Rate**	**$33.77**	**38.8%**
C. Cost Analysis				
Contracted Rate	$95.16	Contracted Rate	$95.16	
In House Rate	$55.15	In House Rate	$33.77	
Difference	$40.01	Difference	$61.39	
Hours Procured	220,443	Hours Procured	220,443	**Variance**
Total Cost	**$12,156,924**	**Total Cost**	**$7,444,360**	**38.8%**

Source: ODOT

Conclusion

ODOT does not make staffing decisions at the District level for projects based on uniform financial analysis or methodology. This results in significant variation in the makeup of internal staff compared to contract employees across Districts and may lead to more cost than necessary associated with contract labor. The Department should develop and deploy a uniform methodology for identifying the true cost of internal labor based on an accurate calculation of overhead which takes into account the variation between avoidable and unavoidable costs.

Strategic Business Intelligence

Decisions about the future are limited by the quality of data and information which guide them. It is difficult to determine what direction an organization should take when it is uncertain as to where it has been or where it is currently. As the scale of an organization increases, either by budget, scope of work, or workforce, the importance of accurate and well maintained data that can be analyzed increases.

Background

As discussed in the previous audit sections, ODOT struggles with identifying, collecting, monitoring, and analyzing data related to business operations. Throughout our previous audits of the Department, we have identified similar issues related to data management. These issues are not insignificant. ODOT leadership should be able to answer fundamental operational questions such as:

- If the Department faced a budget shortfall, what is the optimal mix of program cuts among Maintenance, Pavement, or Bridge Management?
- How would reductions to program efforts impact the State's bridge and highway condition ratings?
- Which ODOT District is most efficient in critical maintenance processes such as chip-sealing?
- What would it cost to increase statewide pavement ratings by a specific percentage?
- Is it more cost effective to outsource certain maintenance functions?

These questions, and their answers, could have a real impact on the Department's operations. While ODOT's funding has traditionally been stable based on gas tax revenues, changes in driving habits could result in significant fluctuations in future collection rates. The Department stated during the course of the audit that revenue collections for FY 2020 were to date below projections due to the pandemic (see **Department Finances** section). Proactively knowing how ODOT could respond to unexpected drops in budget allocations is an important aspect of ensuring the Department runs efficiently and effectively.

Why We Looked At This

As a state agency, ODOT is governed by the laws of the state of Ohio. Specifically, ORC § 121.03 grants Ohio's governor the power to appoint a Director of Transportation (Director) who will serve at the pleasure of the governor. Furthermore, ORC § 5501.04 states that:

> "The director shall be responsible for the determination of general policies in the performance of the duties, powers, and functions of the department and of each division. The director shall have complete executive charge of the department, shall be responsible for the organization, direction, and supervision of the work of the

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department and the performance of the duties, powers, and functions assigned to each division, and may establish necessary administrative units therein."

In summary, Ohio law makes the Director the representative of Ohio's elected governor, and grants the Director both authority and responsibility to oversee the Departments operations. In order to fulfill this charge, the Director (or the Director's appointees) need to have accurate and up-to-date information about the Department's current performance and the ability to reasonably estimate the potential impact of proposed changes made by the Director, the governor, or the state legislature.

It is for this reason that data and information are considered an essential components of an agency's overall performance, and, to that end, the reason that OPT has frequently reviewed ODOT's data management practices as part of previous performance audits and have consistently made recommendations in this arena. In our audits released in 2013, 2016, and 2019, we found that ODOT collects the data required to meet specific state and federal guidelines, but sometimes lacks the processes needed to convert collected data into meaningful information that can be used to conduct more sophisticated cost-benefit analysis or to project potential future scenarios.

The scope areas reviewed in this audit account for over $1.3 billion in annual expenditures, or over a third of ODOT's annual expenditures. For this reason, it's reasonable to expect that these areas are especially sensitive to the need for ongoing cost-benefit decision making and future scenario planning. This is why, in this audit, we conducted thorough review of ODOT's data management and decision making policies in order to provide guidance on how the Department could begin to rectify the systemic issues we have identified.

What We Looked At

Specifically, this section examines the findings presented in the preceding report through the lens of data and business intelligence. Those findings and recommendations previously discussed that relate to business intelligence are discussed in further detail within this section.

What We Found

Data quality and the processes surrounding data collection are unevenly maintained across the ODOT organization. In some operational areas, such as ODOT's Pavement (see **Section 5**) operation, the Department operates within industry leading practices and maintains a tight continuous feedback loop its use of data. In other operational areas, such as Maintenance (see **Section 6**) the Department lags industry leading practices by both failing to collect essential data as well as failing to incorporate existing data into its decision making process.

We found that many of the Department's deficiencies related to business intelligence could be corrected if leadership were to begin the prioritization of certain data and analyses in strategic decision making. In order to assist Department leadership, we recommend:

- **Recommendation 8.1:** ODOT should enhance its business intelligence capabilities to allow Department leadership to manage organizational strategy with quantitative inputs, using data to drive key business decisions. The areas which were examined in this audit represent more than $1.3 billion in annual spending. Improving the efficiency of these programs by even small margins can result in millions of dollars of savings. The full impact of this recommendation is dependent on how well ODOT is able to implement strategic business decisions and change throughout the Department.

Recommendation 8.1: Business Intelligence

ODOT currently collects data and information on its performance, but does not always use that data in a consistent manner for management decision making. ODOT should enhance its business intelligence capabilities to allow Department leadership to manage organizational strategy with quantitative inputs, using data to drive key business decisions.

Impact

The areas which were examined in this audit represent more than $1.3 billion in annual spending. Improving the efficiency of these programs by even small margins can result in millions of dollars of savings. The full impact of this recommendation is dependent on how well ODOT is able to implement strategic business decisions and change throughout the Department.

Background

Performance audits from 2013, 2016 and 2019 identified various data collection issues within the Department. The recommendations in these audits identified the need for uniform processes for the collection, maintenance, and analysis of data within several of ODOT's Divisions.

While ODOT collects an immense amount of data, the collection and maintenance of data is not always conducted in such a way that will allow for strategic analysis. The data which is collected by the Department is generated across dozens of systems and during six main phases of operations:

- Asset Condition Assessment [e.g. current roadway conditions]
- Setting Asset Performance Targets [e.g. target roadway conditions]
- Allocating Resources [e.g. project selection, staffing & contracting choices, delivery timeline]
- Linking work performed to performance objectives [progress reports, performance monitoring]
- Cost Control
- Continuous Process Improvement

Our recommendations in this audit touch on each of these phases of operations across ODOT Divisions. In particular, across Bridges, Maintenance, and Pavement, we have a total of **7** recommendations which are related to business intelligence. These areas represent an average yearly spending of **$1.3 billion dollars, or 41.0 percent** of ODOT's annual budget.[31]

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[31] FY2015-2019 average annual expenditures.

Methodology and Analysis

This section analyzes the Departments use of data and information to make key decisions in the scope areas analyzed in this report. Analysis was conducted by reviewed work conducted in other sections and making comparisons to peer states and best practices.

It is important that governmental organizations make decisions based on strategic data analysis. This type of decision making allows for transparency necessary to safeguard taxpayer dollars. Further, by making strategic business decisions, and understanding the data which drives expenditures, it is possible to proactively and effectively pivot operations when the need arises due to external circumstances.

The report identifies several areas where the Department is lacking in business intelligence and strategic decision making. This recommendation reviews and consolidates those areas that have been previously discussed.

Maintenance

Taken as a whole, the BI findings within the Maintenance (see **Section 6**) section indicate a program not being managed to objective quantitative standards. The audit found that ODOT is missing key inputs & analysis at every operational phase considered. These BI deficiencies have resulted in a situation where the ODOT Director and his direct Central Office designees:

- Do not have an objective & timely snapshot of maintenance conditions and needs across the Districts. This hinders budgeting & resource allocation across both programs & geography;
- Do not have a visibility into complete work plans for maintenance activities across Districts, including current or prior-year variance reports of actual vs planned maintenance accomplishments. This hinders ability to hold district leadership accountable; and,
- Do not have a grasp on internal maintenance unit-of-output and cost structures. This prevents the ability to accurately model outsourcing studies.

The diagram on the following page shows the process flow and necessary sub-components of a quantitatively-managed highway maintenance operation. DOTs use a) roadway condition data to generate b) work plans, which are project lists designed to achieve certain condition rating targets and estimate staffing needs. Work plans are then executed with maintenance c) field activity, which both makes physical improvements to roadway conditions and generates unit-cost data that informs future work plans. These three main headings— roadway condition data, work plans, and field activity— represent an iterative feedback loop that allows DOTs to make data-driven choices in the deployment of maintenance projects.

Business Intelligence Process
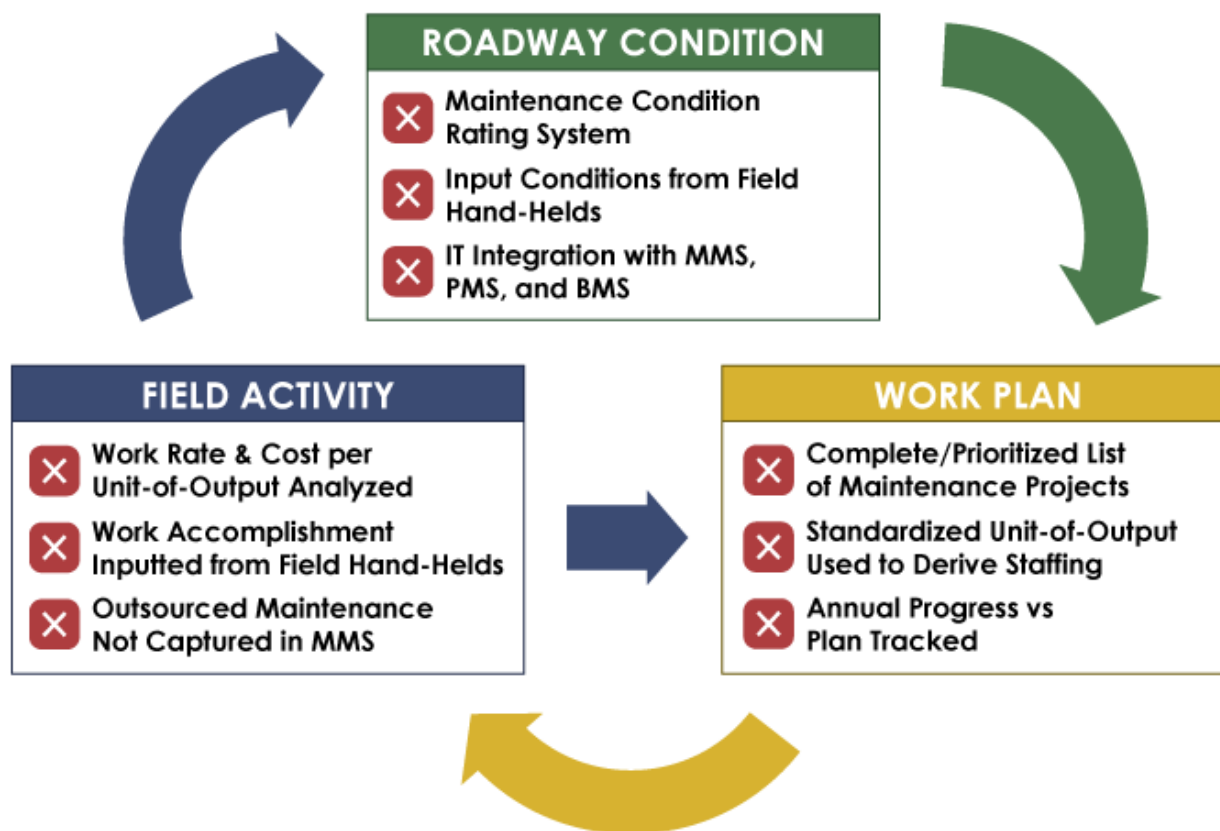
Source: ODOT and OPT

The bulleted Xs in the process diagram represent BI sub-components ODOT is currently lacking in its maintenance operation. Explained in detail in Maintenance (see) these deficiencies include:

- **Maintenance Condition Rating:** This is a metric which rates sections of roadways based on a database of continuously updated condition inputs. The Department has failed to maintain this metric for the past two years due to concerns about the outsourced vendor. Without maintaining an objective measure of maintenance condition, ODOT is limited in its ability to plan and prioritize projects within a given District as well as in its ability to equitably shift maintenance resources around the state. One technical limitation is that there is no way to input data into the Department's maintenance management system while in the field using handheld devices. Further, the MMS does not interface with the bridge management system or pavement management system.
- **District Work Plans:** These plans are designed to identify and outline work conducted at the District level. Our review indicated that these work plans are, to varying degrees, incomplete, and no District provides enough information to allow for the identification of appropriate staffing levels. Progress against the work plan is not tracked, nor is tracking

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required by the Central Office. Work plans are also not integrated into the Department's MMS.

- **Field Activity:** The Department does not conduct any standard analyses on actual maintenance units-of-accomplishment. For example, the Department would have a difficult time comparing the cost of a guardrail repair for ODOT employees and an outside contractor. Because of this, the employee and crew rates-of production for these standard activities is unknown. Nor does the Department prescribe any targets or standards for crews on these routine maintenance tasks. Lacking a baseline understanding of employee production rates makes forward-looking planning and continuous improvement difficult. Additionally, the inability to input accomplishment data with hand held devices in the field, as with condition rating data, impairs the ability of the Department to generate timely data. Finally, the maintenance work that ODOT outsources is not integrated at all into the current MMS. It is important to note that states using the same software as ODOT are able to configure the software to accomplish these tasks.

Pavement

Because ODOT relies on its pavement management system (PMS) to generate 75% of the Department's pavement treatment recommendations, it is imperative to populate PMS with accurate pavement-condition data and calibration parameters. Given the size of ODOT's Pavement Budget, $800M annually, even small inaccuracies in PMS data inputs and model configuration will easily manifest in tens or hundreds of millions of dollars in capital misallocation.

We identified several BI shortcomings of this nature. Broadly grouped, the most potentially impactful deficiencies include:

- **Long-Term Accuracy:** ODOT currently fully forecasts future pavement expenditures for five years in advance and partially forecasts future expenditures for 10 years. By not forecasting further in advance, ODOT may be sub optimizing pavement treatment decisions (see **R5.1**).
- **Inputs:** ODOT currently uses a manual and ad-hoc process to update unit cost and inflation terms in PMS, which raises the risk of input data not being updated in a timely manner. Because the model is sensitive to these inputs, stale data could result in sub optimal treatment recommendations. Additionally, Automated Data Collection (**R5.2**) is not happening.
- **Model Calibration:** Within the area of model calibration, audit work identified opportunities to further optimize treatment recommendations by extending time horizon parameters and through the use of shorter road segments with dynamic aggregation. We also found that the 75% district planning match can be undermined by the looser 6-year window constraint (See **R5.3**); overall budget constraint.

Ultimately, the Department may face higher long-term costs because it is running a model which only assesses short-term needs. More economical rehabilitation or reconstruction treatments may not be recommended due to the modeling constraints. ODOT uses a five year timeframe to

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determine costs and benefits of pavement projects; however, pavement could last well beyond 10 years and a longer time-frame may result in different recommended projects and resource allocation. Since ODOT relies on the pavement management system for 75 percent of pavement-treatment recommendations, it is imperative that ODOT ensure the model is provided accurate pavement-condition data. ODOT's pavement data quality management seems to consist of relatively superficial analysis of the quality of the pavement data collected manually by pavement raters.

Bridge

The Bridge (see **Section 4**) section concluded that ODOT performs favorably in its bridge operation compared to peer states. Ohio's bridge conditions are generally better than peer states, and ODOT appears to be spending less money on bridges than peers.

The audit recommends ODOT implement a computerized bridge management system (BMS) in order to bring the Department fully in compliance with FHWA standards. With proper implementation & utilization, the functionality to run cost-benefit analyses & treatment optimizations within an advanced BMS should allow ODOT generate further incremental performance gains in its bridge operation.

ODOT's current high performance relative to peers within the Bridge operation, despite the lack of advanced BMS, demonstrates that there is more to business intelligence than software alone. ODOT currently monitors, within a manual process flow, bridge performance measures that track bridge replacement and rehabilitation needs, deck rehabilitation or replacement needs, deck wearing surface needs, and protective steel coating needs. With good asset inventory & condition data in place, as well as a decision-making process that identifies & prioritizes optimal bridge treatments, it is possible to competitively manage the Bridge program without high end software.

In migrating to a modern BMS, ODOT should preserve these existing processes and metrics. The BMS can then be used to conduct scenario analysis, run detailed analysis of past outcomes, and locate opportunities to optimize further.

Conclusion

ODOT has historically collected the data needed to effectively manage its offices and divisions but has not taken a department-wide approach to strategic data management. The lack of a consistently applied, department-wide approach to strategic data management could make it difficult for ODOT to sustain progress into the future.

Client Response Letter

Audit standards and AOS policy allow clients to provide a written response to an audit. The letter on the following pages is the Department's official statement in regards to this performance audit. Throughout the audit process, staff met with ODOT officials to ensure substantial agreement on the factual information presented in the report. When the Department disagreed with information contained in the report, and provided supporting documentation, revisions were made to the audit report.

December 22, 2020

Auditor Keith Faber
88 East Broad Street, 5th Floor
Columbus, OH 43215

Dear Auditor Faber,

The Ohio Department of Transportation (ODOT) extends its sincere appreciation to you and your staff for your final report on the department's recent performance audit.   As we know, this audit was mandated by section 755.90 of House Bill 62, commenced in September 2019, and was completed in two separate phases. The audit contained multiple scope items in both phases. Phase one focused on heavy equipment leasing/fleet management, seasonal employment, construction inspection and IT consultant management. Phase 2 examined processes in multiple areas including Pavement, Bridge, Maintenance, Fleet, Overhead and Strategic Information.

The fifteen-month engagement required an immense amount of partnership, collaboration and cooperation between the audit team, ODOT districts, multiple divisions within central office and the Kercher Group, the consultant your office employed to assist with the audit.   ODOT extends a sincere thank you to The Kercher Group for its thoroughness and transparency throughout the engagement. ODOT appreciates that Kercher recognized Ohio as a benchmark and industry leader among our transportation peers in many of the areas Kercher examined. Finally, ODOT would like to thank Nicole Bent, Director of the Ohio Performance Team (OPT), and section leads Brent Grace, Aaron Shaw and Zach Kromer for their involvement

As an agency, we are continuously looking for opportunities to save taxpayer dollars and improve efficiency of operations. We look forward to addressing your recommendations as we move forward in completing our mission. Attached you will find ODOT's response to the final performance audit.

Best regards,

Jack Marchbanks, Ph.D.
Director
Ohio Department of Transportation

Cc: Pamela Vest Boratyn, Assistant Director BHR/Chief of Staff
    Sara Downs, Deputy Director, Finance, ODOT

Division of Facilities & Equipment Management
Division of Operations
Division of Finance
Division of Planning
Division of Engineering
ODOT Performance Audit Phase 1 Response
December 2020

ODOT received the full draft of the phase two report of the performance audit on Friday, December 11, 2020. Leadership presiding over the audited divisions carefully reviewed the report to prepare this formal response to be submitted to the OPT by Tuesday, December 22, 2020. Our responses are below.

Recommendation 1.1: ODOT should implement performance monitoring through the use of well-developed performance indicators and key performance indicators applied at the appropriate level.

ODOT agrees with the need to revise our current KPI's and it will work on bringing performance monitoring up to an appropriate level. Our plan moving forward is to re-visit the current process and work to pair down the amount of KPI's we have in order to realize more efficiency, transparency and effectiveness.

Recommendation 2.1: ODOT Fleet Central Office should implement policies for the replacement of fleet equipment for ODOT Districts. The policies should be supported by a data driven methodology and should identify when districts should dispose of equipment and what should be considered when evaluating if a replacement is necessary.

ODOT agrees with this recommendation are currently in the process of creating business practices to implement a life-cycle program for ODOT's fleet equipment.   This business practice will give guidance to the districts in areas such as procurement, utilization and disposal.   ODOT will use reporting from the Enterprise Information Management System (EIMS) to create a long-term fleet replacement plan that would schedule the disposal and accusation of equipment. ODOT plans to use the Auditor's recommended optimized age and further create optimized life cycles for the remainder of our equipment types phased in over time and as our budget and funding allows.

Recommendation 3.1: Reserve bond funding for those projects with a long useful life.

ODOT's Division of Finance is diligent in its efforts to ensure ODOT is making well informed and financially responsible decisions. The impact section of the Auditor's report for this recommendation states that ODOT pays an average of 3.164 percent of interest on money raised through bond sales. However, it should be noted that the rates achieved in recent issuances have been lower than this. The last 16 HCAP and GARVEE issuances have been below this rate, dating back to 2010. As has been the case in the last decade, borrowing rates have been lower than construction inflation, which can achieve present value cost savings on projects by simply doing the projects sooner.

ODOT issues bond funds with the intention of applying those proceeds to capital, construction projects with a long useful life. ODOT's standard practice is to provide bond proceed funding to major programs within the agency. There have only been two periods of time in the last 15 years where ODOT utilized bonds on preservation projects. The first period was between 2010 to 2013. The use of bonds was a legislatively mandated decision. In 2010 and 2011, the legislature was trying to stimulate the economy. In order to do so, they required ODOT to transfer $100 million cash in each of those years to the OPWC and ODOT in turn had to add $100 million in bond appropriations in each of those years to keep its programs whole. The second period was from 2017 to 2019. This was a result of flat or less than expected revenues and construction inflation. The attached chart shows that during that 15-year period, only 13% of bond proceeds was spent on ODOT preservation projects.

Amount	% of Total	Program
$ 1,869,543,643.94	41%	Major New
$ 84,961,401.48	2%	OBPP
$ 576,439,254.50	13%	Preservation
$ 624,373,621.15	14%	Major Bridge
$ 1,452,347,257.50	32%	Major Rehab
$ 4,607,665,178.57	**100%**	**Total**

Nearly half of all bonds spent on preservation projects was the result of decisions made based on statewide economic conditions. The current administration sought, and the General Assembly passed an increase in the motor fuel tax revenue. Therefore, ODOT does not foresee the need to utilize bond proceeds for any preservation needs in the foreseeable future and intends to continue to take a conservative stance with regard to requesting bond appropriations. It is not the agency's common practice to utilize bond funds within the Preservation program and with the passage of H.B. 62, ODOT is hopeful to continue bond funds on projects with the longest, and most useful life possible, and does not expect to return to the levels of bond appropriations requested in the 2018/2019 biennial budget.

Recommendation 3.2: Require debt affordability studies to gauge when ODOT can afford to take on new debt.

The Department has a very robust revenue-and-use proforma which it utilizes to determine debt impacts and affordability. In addition, ODOT has a cash forecasting system which it utilizes for the various bond programs to determine when bonds need to be issued to cover outstanding bond appropriation expenses which have been authorized by the General Assembly. The timing of bond sales is important to ensure ODOT has cash on hand to make payments. Timing of issuance is also important so that ODOT does not incur unnecessary interest expense. In-house staff have the skills and resources needed to determine debt impacts and affordability and routinely run scenarios based on requests from ODOT's Funding Council and the Executive Leadership team.

ODOT currently has an internal policy limiting annual debt service to no more than 20% of state or federal revenues, whichever is applicable. Currently, both state and federal debt service fall well below these levels. Also, ODOT is limited to the $1.2 billion cap on HCAP bonds, and GARVEE bonds required a coverage ratio of at least 5x (which is higher than many other states' bond programs). This ratio is typically in the 8-10x range. These internal policies and debt covenants prevent ODOT from borrowing irresponsibly. ODOT also does internal modeling at times to determine when and how much can be borrowed under various assumptions, to stay within contractual debt covenants. As ODOT takes on new debt in the future, the Finance Division will develop and employ a thorough in house debt affordability study to ensure viability.

Recommendation 4.1: ODOT should implement and support a successful Bridge Management System installation that meets the Federal Highway Administration (FHWA) minimum documented standards (23 CFR 515.17).

ODOT concurs with this recommendation. ODOT has reviewed the available Bridge Management Systems that meet the minimum standards in 23 CFR 515.17 and selected the ASSTHO Ware software package BrM. Prior to the commencement of this performance audit, ODOT purchased a license of BrM. ODOT takes an immense amount of pride in our bridge program, which we think was reflected in The Kercher Group's final report. Kercher's analysis found that, although ODOT has one of the largest bridge inventories in the country, state bridge conditions are better than most peers. Additionally, the report found ODOT is spending less on bridges than most of its peer states while still maintaining higher bridge conditions, which they opined is indicative of decades of good management.

Recommendation 4.2: The General Assembly should revise ORC §5501.47 to remove the requirement that ODOT conduct annual inspections of all bridges and instead adopt a risk based methodology for bridge inspection, consistent with peer states and federal guidelines that allow for a 24-month inspection cycle for some bridges.

ODOT agrees with this recommendation and is confident a 24-month bridge inspection cycle can be completed safely and responsibly, but this will require a legislative change.

Recommendation 5.1: Develop an efficient and effective pavement data collection plan consistent with best practices.

ODOT agrees with this recommendation.   Kercher's final report found that ODOT's overall spending and resulting pavement conditions is equivalent to, or even more efficient than, most of our peer states. Additionally, Kercher noted that ODOT is using a state-of-the-art computerized pavement management system to identify economical pavement investments and our project selection process includes matching a percentage of pavement treatments and locations to the pavement management system output, both of which are best practices compared to peer states. As noted in the audit report, ODOT will complete ongoing data collection system research and determine the most value-added collection process to meet the Department's long-term pavement management needs.

Recommendation 5.2: Adopt best practices for pavement projections.

ODOT will incorporate the best practices for pavement projections in the multiyear prioritization. The Department will continue to utilize the pavement management system to forecast conditions, optimize treatments, assist with determining allocation levels, and meet the Departments goals.

Recommendation 5.3: Conduct a study to optimize project selection at the district level, including the maximum percentage match between PMS project recommendations and the timeframe Districts have to complete the projects.

The Department agrees to studying the optimized percentage of project selected. ODOT's Central Office will continue to work with the Districts to develop work plans and validating the District projects and will ensure workplans are in alignment to the greatest extent practical.

Recommendation 6.1: Adopt best practices to leverage the existing maintenance management system tools, including better integration with the Department's other IT systems and use in work planning.

ODOT's Division of Operations will review the EIMS platform and plan to have ongoing discussions with the vendor, Agile Assets, to identify and implement efficiencies toward simplifying and leveraging reporting tools in order to better identify best practices.

Recommendation 6.2: Ensure the maintenance management system captures the costs of maintenance activities and allows analysis of the most economical means for conducting highway maintenance.

ODOT currently leverages data to convey costs on items such as snow and ice removal, salt, litter and pothole patching to the media and the public. Per Kercher, ODOT has been a leader among peer states with respect to performance management for many years, and as such, has instituted agency metrics to foster uniformity in outcomes across a decentralized organization. ODOT understands the importance of analyzing this data in order to make financial decisions.

Recommendation 6.3: Restart, strengthen and enhance the Maintenance Condition Rating (MCR) program.

Based on interviews conducted by Kercher in March 2020, ODOT's Central Office Maintenance Administration restarted the MCR Program in May 2020 and is currently using the manual that was provided to the Kercher Group during the interviews. Central Office Maintenance Administration will continue to evaluate the effectiveness of the MCR and strengthen and enhance the manual as necessary.

Recommendation 7.1: ODOT should develop a standardized methodology for applying overhead to insourcing and outsourcing decisions and assist the various departments in their application of appropriate cost-benefit analyses.

There are many methodologies that could be applied for applying overhead to insourcing and outsourcing decisions, one of which is outlined in the case study of this recommendation. However, due to the many variables associated with an insourcing/outsourcing decision, (i.e. short-term vs. long-term, current and future work capacity, footprint and equipment availability, etc.) a single, standardized approach may not be best.

Because of these factors, ODOT Finance Division's Cost Accounting team typically recommend the use of an 80% additive to be applied to in-house work when comparing to outside contractor work under the following circumstances: 1) the resources are able to be reallocated to other direct activities; and 2) the work is in excess of our normal capacity. The 80% rate represents fringe benefits as well as the additional cost of both contractor oversight/supervision and general administration. Otherwise we would recommend a fully loaded rate similar to the Federal or Internal rates.

ODOT will work to create to create a "uniform methodology" for labor costs. However, one-size does not fit all in calculating total overhead for insourcing vs outsourcing decisions, so multiple methodologies may need to be developed depending on the circumstance.

Recommendation 8.1: ODOT should enhance its business intelligence capabilities to allow Department leadership to manage organizational strategy with quantitative inputs, using data to drive key business decisions.

ODOT leadership understands the need for a more micro-level approach to Business Intelligence which will allow Districts and front-line division heads to leverage data to make better decisions. ODOT currently uses a data driven process with information provided by multiple reports and agency specialist groups, such as the Funding Council and Tech Council, to provide recommendations for decision-making that impacts the entire Department. These resources allow the Director and leadership team to make well-informed, macro level decisions with detailed input from representatives of each Division and District. Toward that effort, ODOT believes the Innovate Ohio initiative is a step in the right direction. Additionally, HR50 is in alignment with this recommendation. It will help ODOT provide more guidance to its workforce strategy. HR50 requires agencies to view all of the work performed under their umbrella as a comprehensive whole. This will allow ODOT to better assess which work is permanent and best performed by State of Ohio staff and which work would be best performed by consultants, contractors, and other non-employees. Having access to usable and relevant data about work activities performed by both ODOT and non-ODOT staff will greatly help the department make more informed decisions about its workforce in both the short and long term.

Appendix A: Purpose, Methodology, Scope, and Objectives of the Audit

Performance Audit Purpose and Overview

Performance audits provide objective analysis to assist management and those charged with governance and oversight to improve program performance and operations, reduce costs, facilitate decision making by parties with responsibility to oversee or initiate corrective action, and contribute to public accountability.

Generally Accepted Government Auditing Standards (GAGAS) require that a performance audit be planned and performed so as to obtain sufficient, appropriate evidence to provide a reasonable basis for findings and conclusions based on audit objectives. Objectives are what the audit is intended to accomplish and can be thought of as questions about the program that the auditors seek to answer based on evidence obtained and assessed against criteria.

We conducted this performance audit in accordance with GAGAS. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Audit Methodology

To complete this performance audit, auditors gathered data, conducted interviews with numerous individuals associated with the areas of Department's operations included in the audit scope, and reviewed and assessed available information. Assessments were performed using criteria from a number of sources, including:

- Peer States;
- Industry Standards;
- Leading Practices;
- Federal and State statues; and
- Policies and Procedures.

Audit Scope and Objectives

In order to provide the Department with appropriate, data driven, recommendations, the following questions were assessed within each of the agreed upon scope areas:

Summary of Objectives and Conclusions

Objective	Recommendation
Bridges	
What opportunities exist to improve the efficiency and effectiveness of ODOT's bridge management practices?	**R4.1, 4.2, 3.1, 3.2**
Pavement	
What opportunities exist to improve the efficiency and effectiveness of ODOT's pavement management practices?	**R51, 5.2, 5.3, 3.1, 3.2**
Maintenance	
What opportunities exist to improve the efficiency and effectiveness of ODOT's maintenance practice?	**R6.1, 6.2, 6.3**
Fleet and Equipment	
What opportunities exist to improve the efficiency and effectiveness of ODOT's fleet and equipment purchasing practices?	**R2.1**
Strategic Information Management	
What opportunities exist to improve strategic management information practices for ODOT?	**R1.1, 8.1**
Overhead	
What opportunities exist to improve the efficiency and effectiveness of ODOT's calculation of overhead rates?	**R7.1**

Although assessment of internal controls was not specifically an objective of this performance audit, internal controls were considered and evaluated when applicable to scope areas and objectives. The following internal control components and underlying principles were relevant to our audit objectives[32]:

- Control environment
    - We assessed the Department's exercise of oversight responsibilities in regards to managing and monitoring selected programs.
- Information and Communication

[32] We relied upon standards for internal controls obtained from *Standards for Internal Control in the Federal Government* (2014), the U.S. Government Accountability Office, report GAO-14-704G

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o We considered the ODOT's use of quality information in relation to Bridges, Pavement, Maintenance, and fleet and equipment management.
o We considered ODOT's communication practices to stakeholders in selected areas.
- Control Activities
  o We considered the ODOT's compliance with applicable laws and contracts.

Appendix B: Key Performance Indicators

ODOT has recently started to develop and implement KPIs across offices and divisions within their organization, 118 in total, which were evaluated by OPT using SMART criteria. In the chart below, if all criteria were met, the KPI scored a 5, if none of the criteria were met, the KPI scored a zero. Below is a table of the Central Office Divisions, the number of KPIs, and the Total Quality scores of the KPIs.

Distribution of KPI Score Quality By Division

Source: ODOT and AOS

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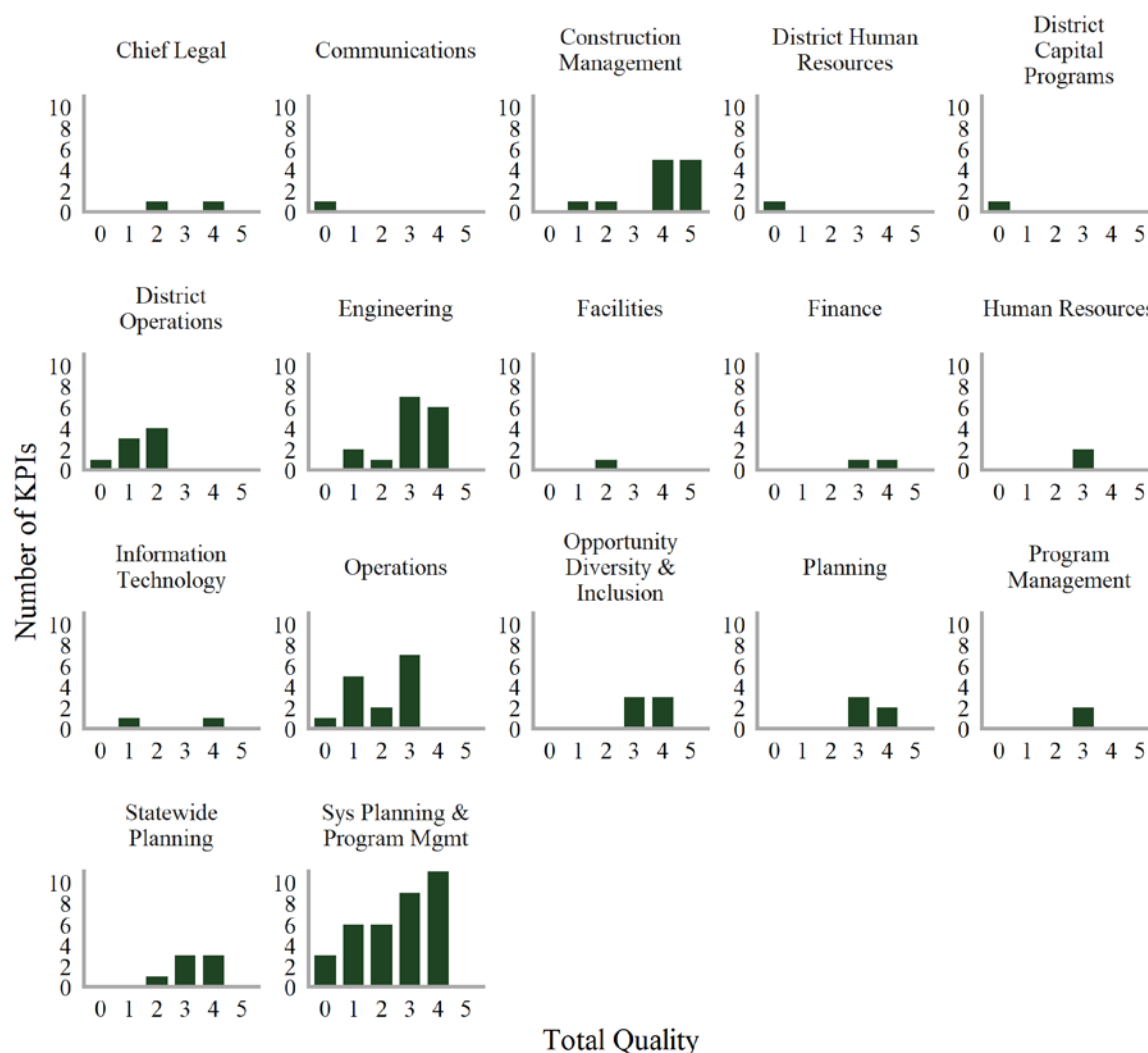
KPI evaluation followed SMART criteria:

SMART	DEFINITION
Specific	Target a specific area for improvement
Measureable	Quantify, or at least suggest, an indicator of progress
Assignable	Specify who will do it
Realistic	State what results can realistically be achieved, given available resources
Time-Related	Specify when the result(s) can be achieved

The most effective KPIs were developed by the Construction Management Division, an example is shown and analyzed below:

- **What:** Technical Process Reviews, Field Visits, and/or District Construction support. Technical Process Reviews (TPR), Field Visits and District Construction support help the ODOT District Construction Offices adhere to ODOT's policies, procedures, and rules. It is the method of monitoring and supporting consistency and reasonable conformance to established requirements, policies, and procedures at the District level.
    - o The ODOT Central Office Construction Administration Staff Specialists are responsible for assisting the ODOT Districts in maintaining uniform contract administration and management practices in construction. In addition, the Staff Specialists are responsible for providing technical assistance to the Districts.
- **How:** The ODOT Central Office Construction Administration Staff Specialists provide oversight, technical assistance, support, training, and quality assurance to ODOT District Construction personnel to ensure uniformity of construction and consistency of contract administration across districts.
- **When:** Staff Specialists will achieve the goal of conducting an average of three Technical Process Reviews, Field Visits, and/or District Construction support per month.
- **Where:** TPRs, field visits and District Construction support are conducted throughout the State either at an ODOT facility/District office or project site. Documentation is kept on the ODOT shared "O" drive.
- **Who:** ODOT Central Office Construction Administration Staff Specialists conduct construction administration TPRs, Field Visits and/or District Construction support to observe ODOT District construction administration practices, provide any necessary training and record innovative practices that are discovered during reviews so that these may be considered for implementation as improved ways of doing business in the future.

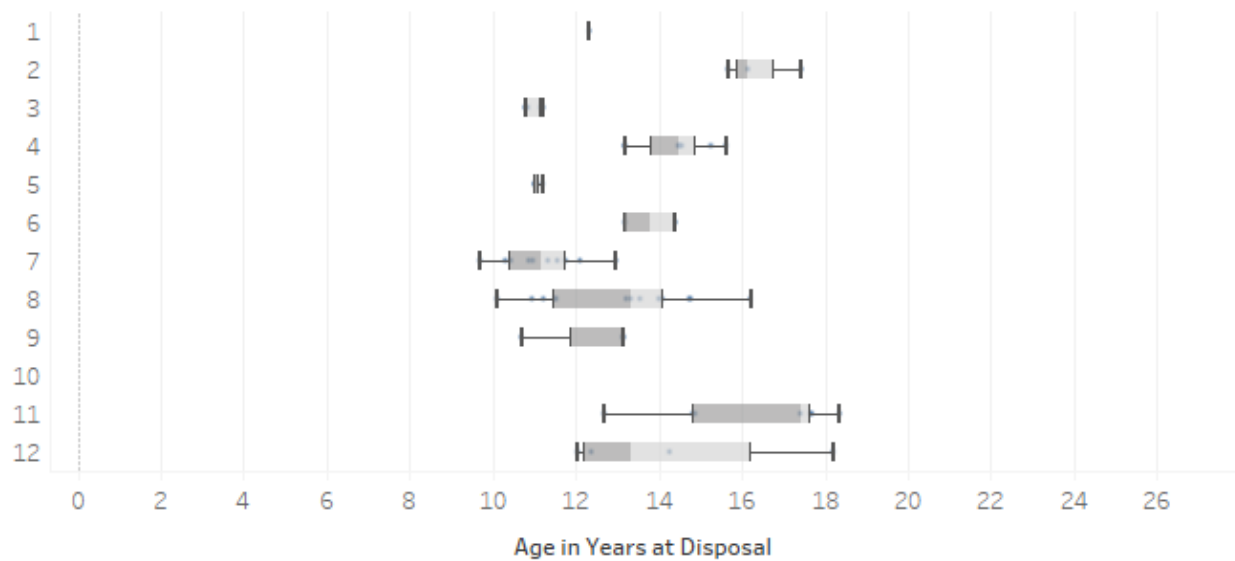This KPI meets SMART criteria in the following way:

- **Specific** – Three things are being measured (Technical Process Reviews, Field Visits, and/or District Construction; What)
- **Measurable** – The TPR, Field Visits, and/or District Construction support three times per month (When)
- **Assignable** – Staff Specialists will conduct TPR, Field Visits, and/or District Construction support (Who)

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- **Realistic** – Relying on the knowledge of the office to determine that 3 times per month is a realistic goal, which can be verified through documentation on the file drive for confirmation (Where and How)
- **Time-Bound** – KPI is established to be performed within a time window of one month, and can be regularly monitored (When)
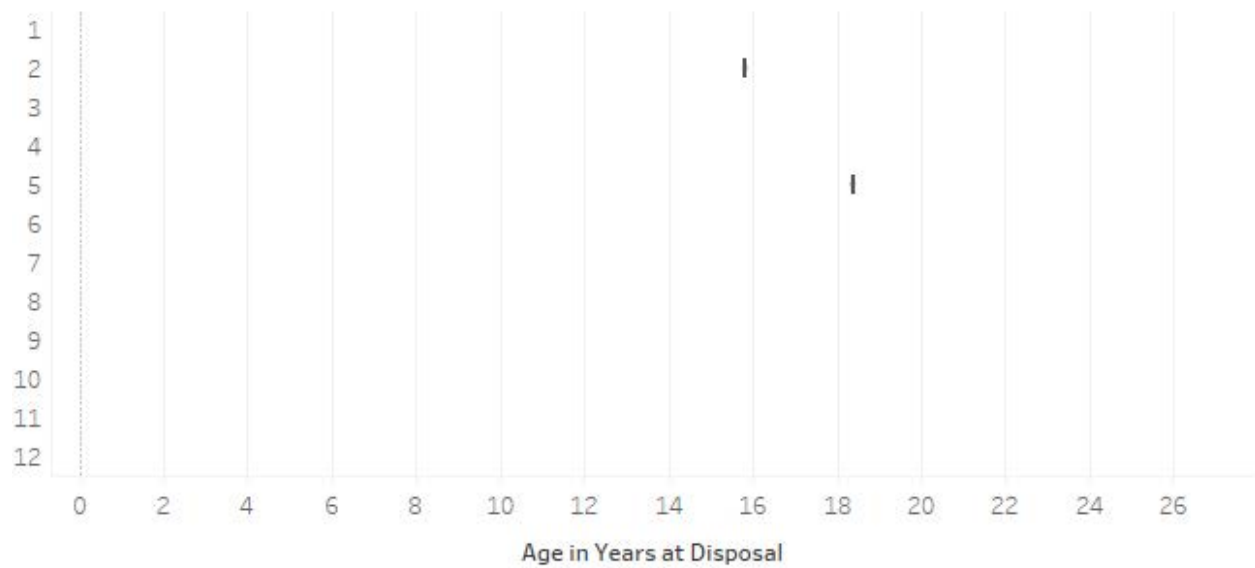
Appendix C: Fleet Management

In addition to the half-ton pick-up truck, we reviewed the age in years at disposal of 11 additional fleet categories. These vehicle types were chosen based on work conducted in previous audits. The results of our analysis are displayed in the following boxplots. While some categories of vehicles have a limited sample size during the timeframe we reviewed (FY 2017 to FY 2019), the available data shows patterns of significant variation for all vehicle types both within individual Districts and across all Districts.

101 – Passenger Car

Age in Years at Disposal

132 – 1/4 Ton SUV

Age in Years at Disposal

133 – 1/2 Ton SUV

Age in Years at Disposal

201 – Minivan

Age in Years at Disposal

203 – Cargo Van

Age in Years at Disposal

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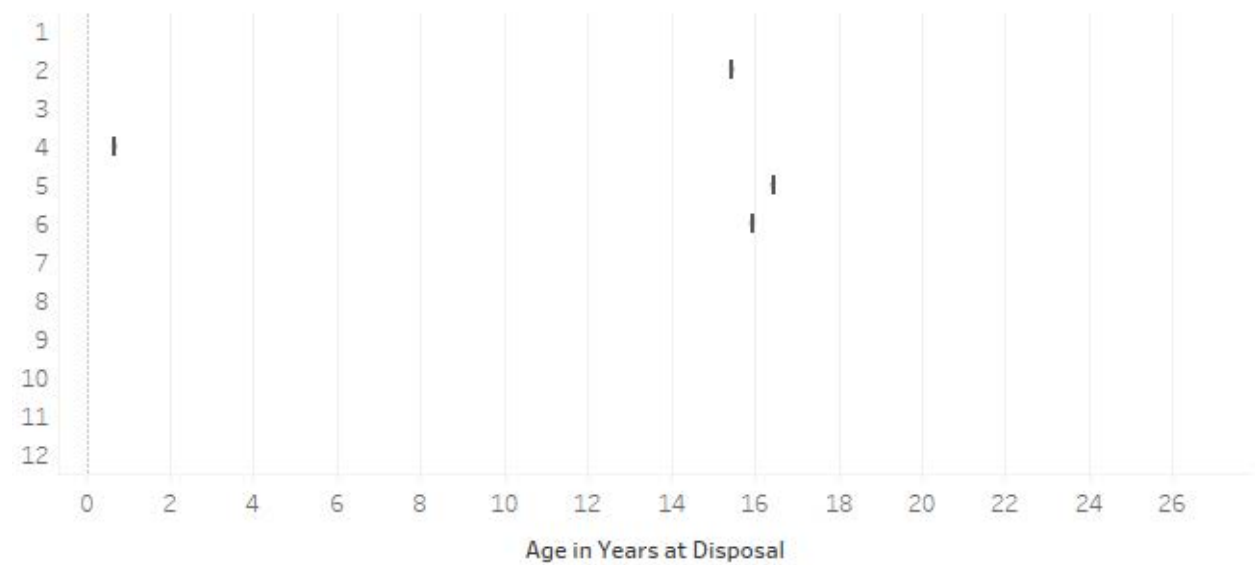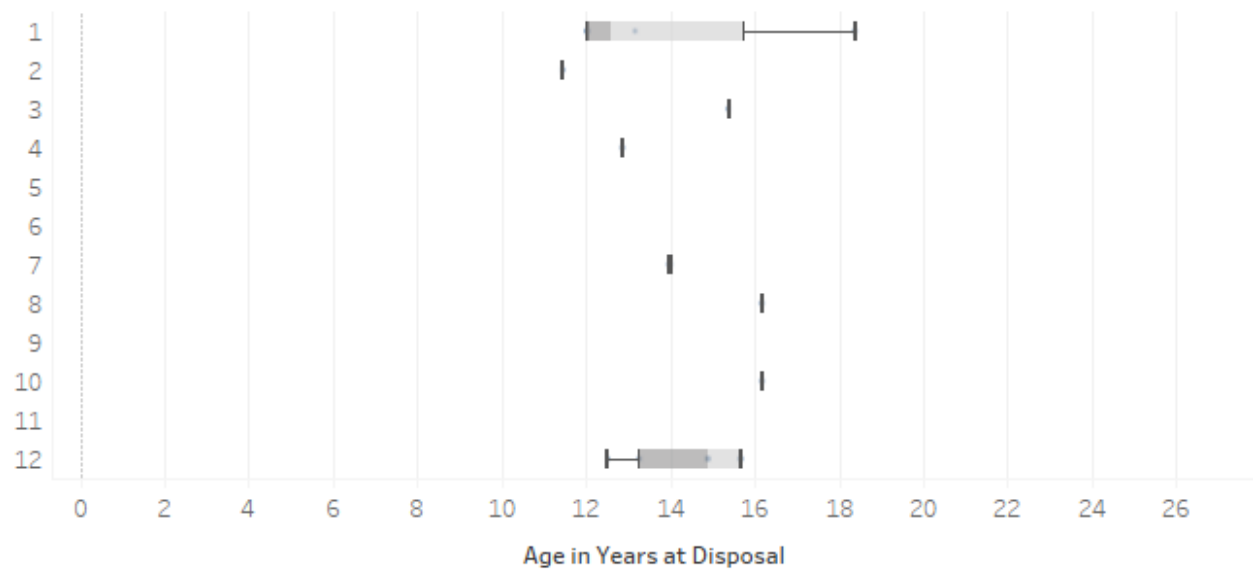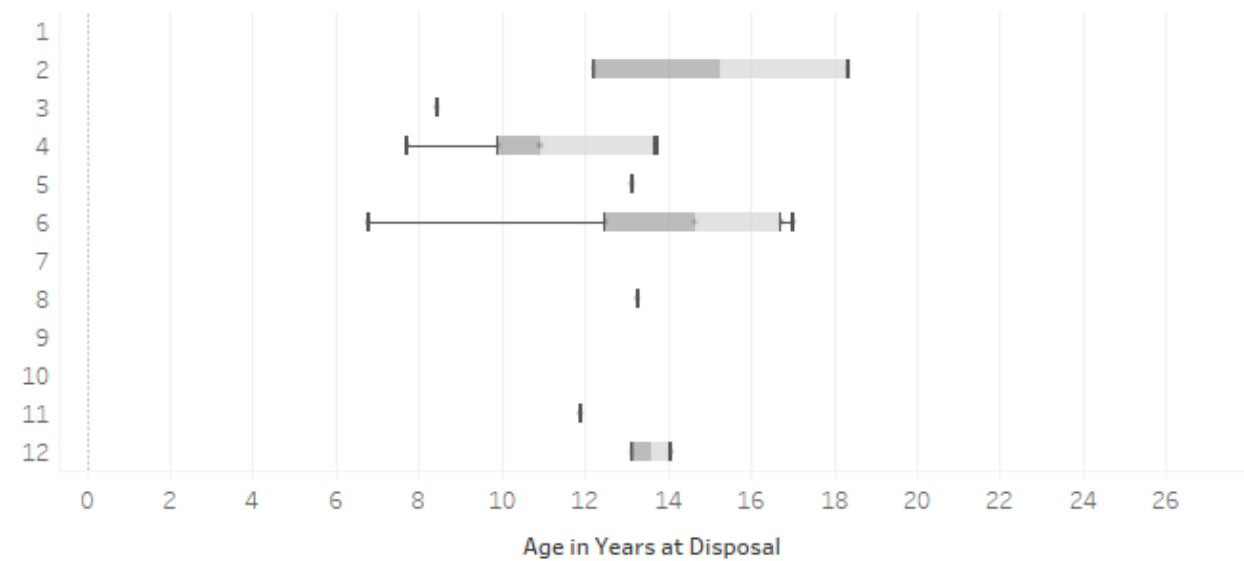
204 – 1 Ton Passenger Van

213 – 1 Ton Utility Truck

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214 – 3/4 Ton Utility Truck

Age in Years at Disposal

222 – 3/4 Ton Pickup

Age in Years at Disposal

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223 – 1 Ton Pickup

Age in Years at Disposal
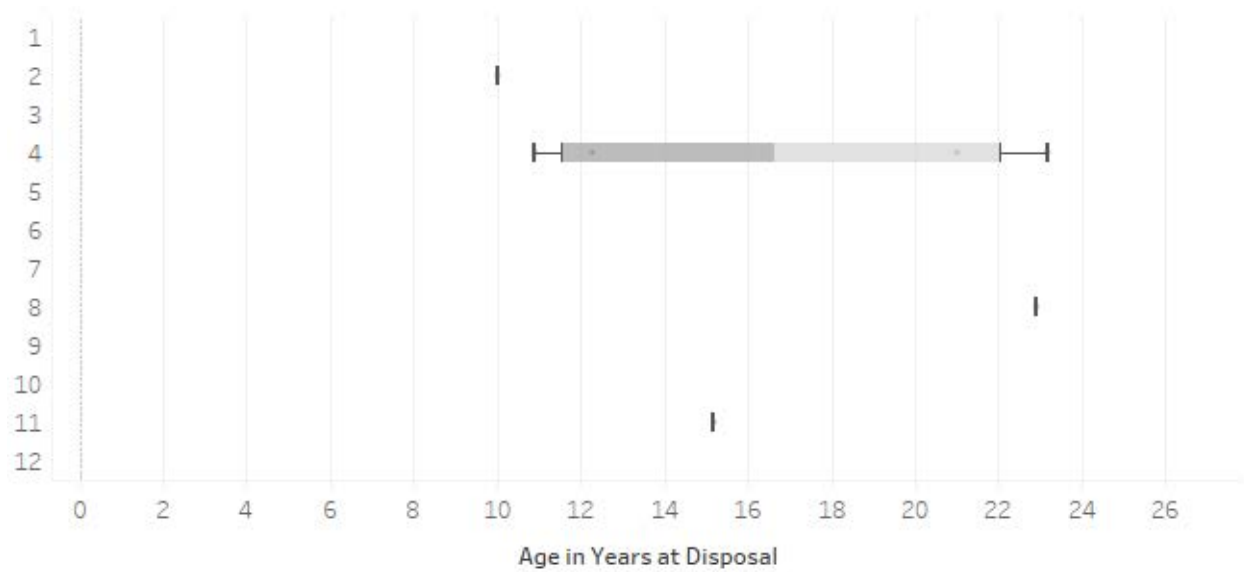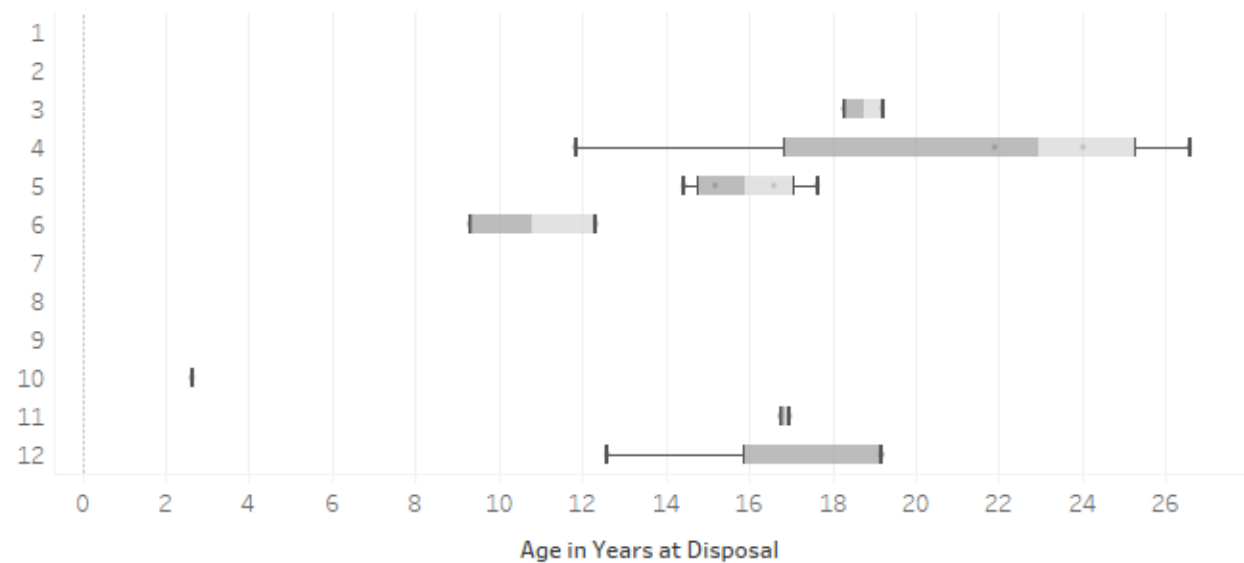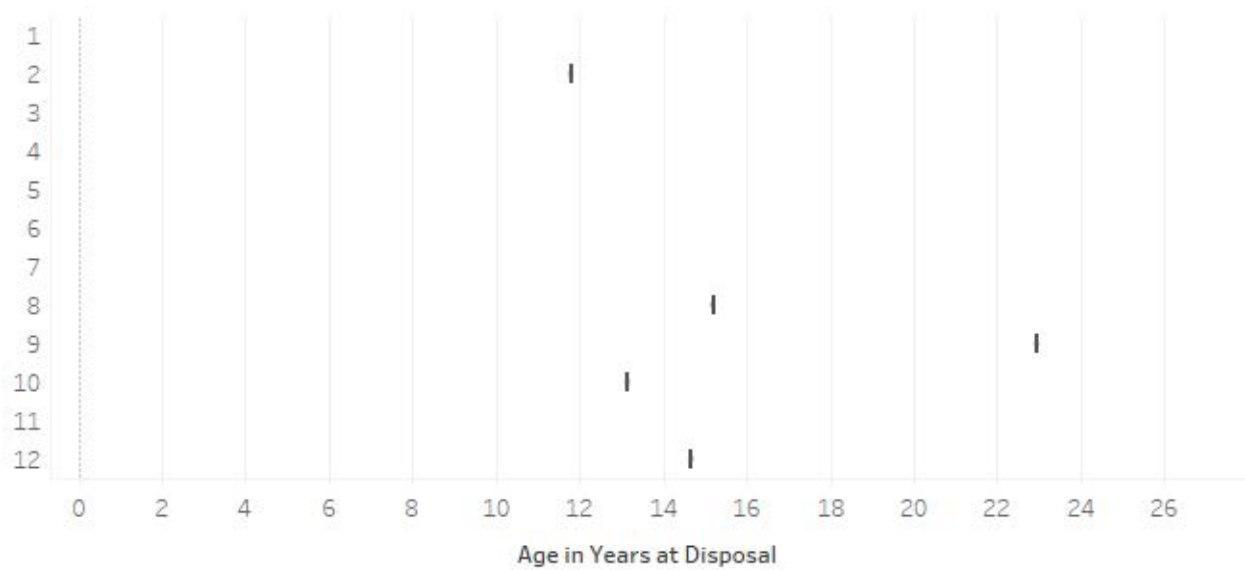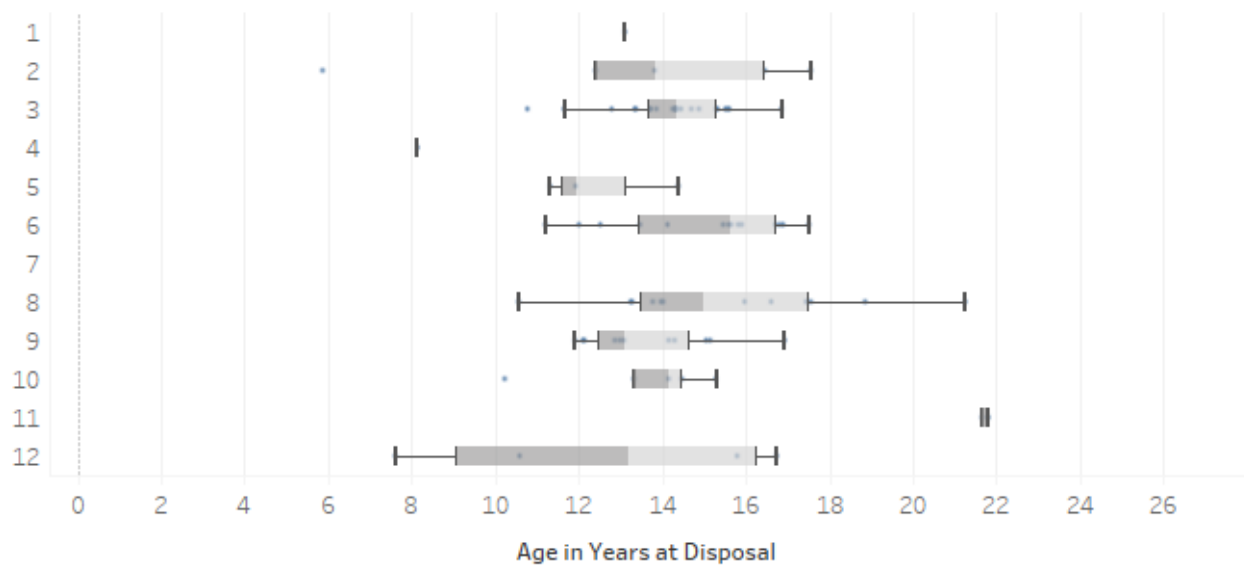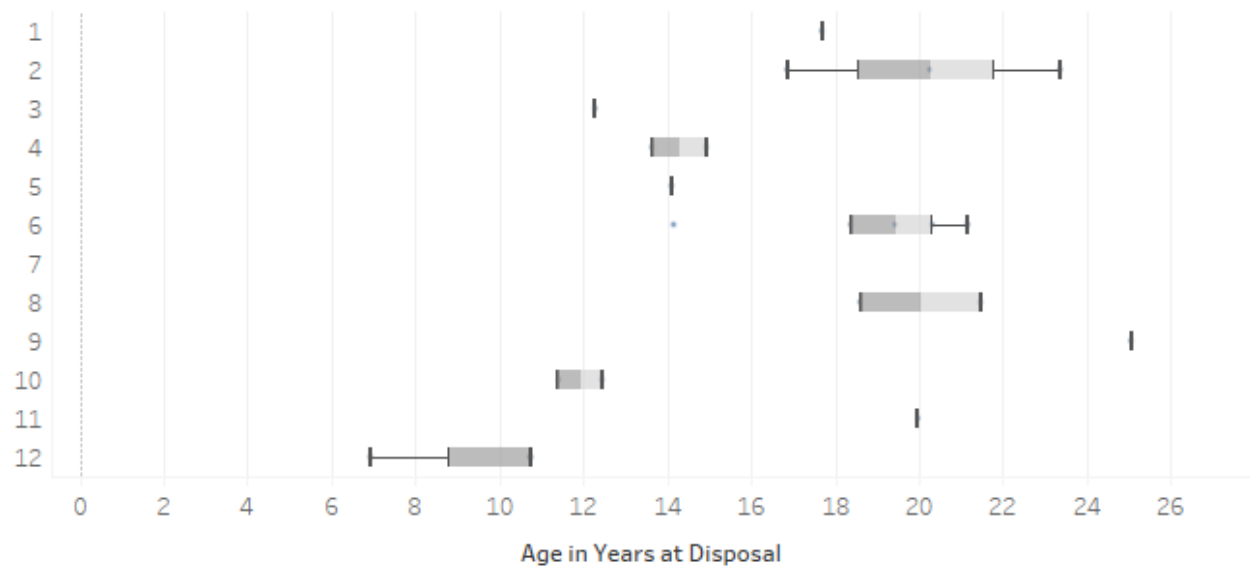
253 – Light Dump Truck

Age in Years at Disposal
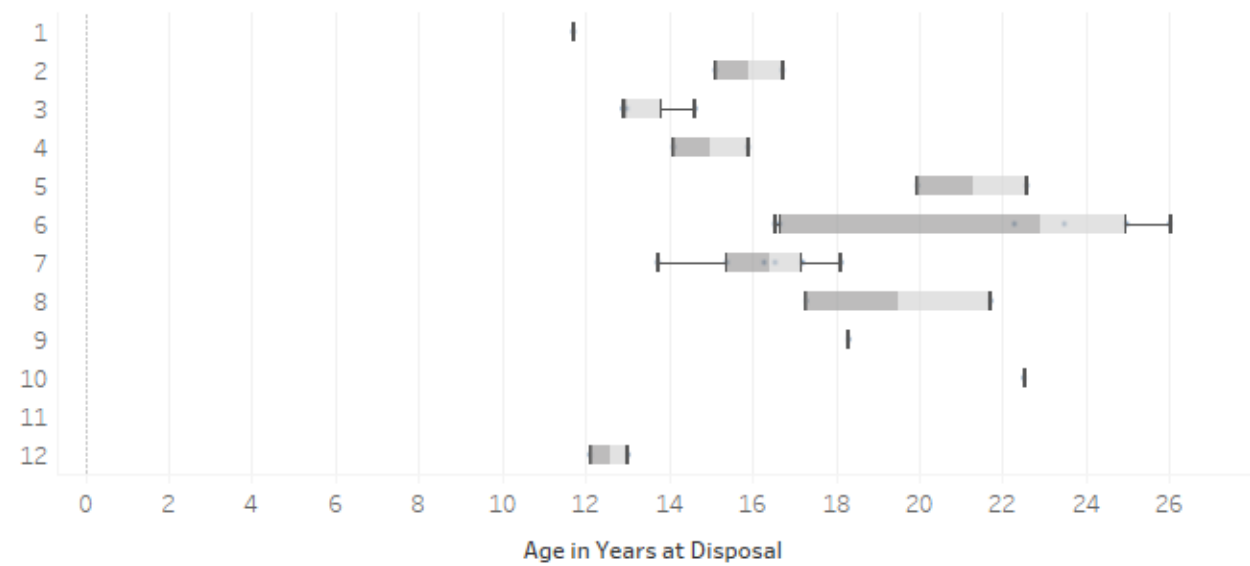
Appendix D: Kercher Reports

OPT retained the services of the Kercher Group, Inc. in order to obtain subject matter expertise relating to bridge and roadway management. These technical memos provided detailed insight into the Department's operations and were used to develop several of the recommendations contained in this report. The full memos developed by Kercher can be found online here: **ODOT 2021**.

OHIO AUDITOR OF STATE
KEITH FABER

OHIO DEPARTMENT OF TRANSPORTATION

FRANKLIN COUNTY

AUDITOR OF STATE OF OHIO CERTIFICATION

This is a true and correct copy of the report, which is required to be filed pursuant to Section 117.26, Revised Code, and which is filed in the Office of the Ohio Auditor of State in Columbus, Ohio.

Certified for Release 2/25/2021