Dave Yost • Auditor of State

The State of Ohio, Auditor of State

Ohio Department of Transportation Performance Audit October 2016

This page intentionally left blank.

Dave Yost · Auditor of State

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

It is my pleasure to present to you this performance audit of 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 is outlined in the letter of engagement signed September 18th, 2015.

This audit includes an objective review and assessment of selected program areas within ODOT in relation to surrounding states, industry standards, and recommended or leading practices. The Ohio Performance Team (OPT) of the Auditor of State's (AOS) office managed the project and conducted the work in accordance with Generally Accepted Government Auditing Standards.

The objectives of this engagement were completed with an eye toward analyzing the Department, its programs, and service delivery processes for efficiency, cost-effectiveness, and customer responsiveness. The scope of the engagement was confined to the area of Capital Planning and Budgeting.

This report has been provided to ODOT and its contents have been discussed with Department leadership, division leadership, program specialists, and other appropriate personnel. The Department is reminded of its responsibilities for public comment, implementation, and reporting related to this performance audit per the requirements outlined under ORC § 117.461 and § 117.462. The Department is also encouraged to use the results of the performance audit as a resource for improving overall operational efficiency as well as service delivery effectiveness.

Sincerely,

Dave Yost
Auditor of State
October 11, 2016

88 East Broad Street, Columbus, Ohio 43215
Phone: 614-466-4514 or 800-282-0370
www.ohioauditor.gov

Additional copies of this report can be requested by calling the Clerk of the Bureau's office at (614) 466-2310 or toll free at (800) 282-0370. In addition, this report can be accessed online through the Auditor of State of Ohio website at http://www.ohioauditor.gov by choosing the "Audit Search" option.

http://ohioauditor.gov

Table of Contents

This page intentionally left blank.

I. Engagement Purpose and Scope

Ohio Revised Code (ORC) § 117.46 provides that the Auditor of State (AOS) shall conduct performance audits of at least four state agencies each budget biennium. In consultation with the Governor and the Speaker and Minority Leader of the House of Representatives and the President and Minority Leader of the Senate, AOS selected the Ohio Department of Transportation (ODOT or the Department) for audit during the fiscal year (FY) 2015-17 Biennium, encompassing FY 2015-16 and FY 2016-17.

Prior to the formal start of the audit, the Ohio Performance Team (OPT) and ODOT engaged in a collaborative planning process which included initial meetings, discussions, and assessments. Based on these planning activities, AOS and ODOT signed a letter of engagement marking the official start of the performance audit, effective September 18, 2015.

The letter of engagement established that the objective of the audit was to review and analyze selected areas of ODOT operations to identify opportunities for improvements to economy, efficiency, and/or effectiveness.

The letter of engagement led to OPT planning and scoping work, in consultation with ODOT, which identified the following scope area: **Capital Planning and Budgeting**

This operational area comprises the scope of the audit as reflected in this report.

Based on the established scope, OPT engaged in supplemental planning activities to develop detailed audit objectives for comprehensive analysis. See **Section VIII: Audit Scope and Objectives Overview** for an overview of this scope area and audit objectives.

II. Performance Audit Overview

The United States Government Accountability Office develops and promulgates government auditing standards that provide a framework for performing high-quality audit work with competence, integrity, objectivity, and independence to provide accountability and to help improve government operations and services. These standards are commonly referred to as generally accepted government auditing standards (GAGAS).

Performance audits are defined as engagements that provide assurance or conclusions based on evaluations of sufficient, appropriate evidence against stated criteria, such as specific requirements, measures, or defined business practices. Performance audits provide objective analysis so that management and those charged with governance and oversight can use the information 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.

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

III. Methodology

Audit work was conducted between September 2015 and July 2016. To complete this report, AOS staff worked closely with ODOT staff to gather data and conduct interviews to establish current operating conditions. This data and information was reviewed with staff at multiple levels within ODOT to ensure accuracy and reliability. Where identified, weaknesses in the data obtained are noted within the report where germane to specific assessments.

To complete the assessments, as defined by the audit scope and objectives, OPT identified sources of criteria against which current operating conditions were compared. Though each source of criteria is unique to each individual assessment, there were common sources of criteria included across the audit as a whole. These common sources of criteria include: statutory requirements, such as contained in ORC or Ohio Administrative Code (OAC); ODOT internal policies and procedures; other State agency policies and procedures; industry standards; and government and private sector leading practices. Although OPT reviewed all sources of criteria to ensure that these comparisons would result in reasonable, appropriate assessments, OPT staff did not conduct the same degree of data reliability assessments as were performed on data and information obtained from ODOT.

The performance audit process involved information-sharing with ODOT staff, including preliminary drafts of findings and proposed recommendations related to the identified audit

scope and objectives. Status meetings were held throughout the engagement to inform the Department of key issues and share proposed recommendations to improve or enhance operations. Input from the Department was solicited and considered when assessing the selected areas and framing recommendations. The Department provided verbal and written comments in response to various recommendations, which were taken into consideration during the reporting process. Where warranted, the report was modified based on agency comments.

This audit report contains recommendations that are intended to provide the Department with options to enhance its operational economy, efficiency, and effectiveness. The reader is encouraged to review the report in its entirety.

IV. ODOT Overview

Responsibilities and Mission

ODOT is a cabinet-level Department and, as such, the Director of Transportation (the Director) is appointed by and serves at the pleasure of the Governor. As a State agency, ODOT is charged with overseeing the planning, construction, and maintenance of the State's transportation infrastructure. ODOT plans, designs, constructs, and maintains the State's network of highways and bridges and provides financial and technical assistance to the State's public transit systems, general aviation airports, and railways.

The Department's mission is, "To provide easy movement of people and goods from place to place, we will:

- Take care of what we have;
- Make our system work;
- Improve safety; and
- Enhance capacity."

Specific ODOT duties are outlined in ORC § 5501.03 and include duties to:

- Coordinate and develop, in cooperation with local, regional, state, and federal planning agencies and authorities, comprehensive and balanced state policy and planning to meet present and future needs for adequate transportation facilities in this state, including recommendations for adequate funding of the implementation of such planning;
- Coordinate activities with those of other appropriate state departments, public agencies, and authorities, and enter into any contracts with such departments, agencies, and authorities as may be necessary to carry out its duties, powers, and functions;
- Cooperate with and assist the public utilities commission in the commission's administration of sections 4907.47 to 4907.476 of the Revised Code, particularly with respect to the federal highway administration;
- Cooperate with and assist the Ohio power siting board in the board's administration of Chapter 4906 of the Revised Code;
- Give particular consideration to the development of policy and planning for public transportation facilities, and to the coordination of associated activities.

- Conduct, in cooperation with the Ohio Legislative Service Commission, any studies or comparisons of state traffic laws and local traffic ordinances with model laws and ordinances that may be required to meet program standards adopted by the United States department of transportation pursuant to the "Highway Safety Act of 1966," 80 Stat. 731, U.S.C.A. 401;
- Prepare, print, distribute, and advertise books, maps, pamphlets, and other information that, in the judgment of the director, will inform the public and other governmental departments, agencies, and authorities as to the duties, powers, and functions of the department; and
- Consider technologies for improving; safety, mobility, aviation and aviation education, transportation facilities, roadways (including construction techniques and materials to prolong project life).In addition, the Department should consider technologies being used or developed by other states that have geographic, geologic, or climatic features similar to this state's, and collaborate with those states in that development.

The following ORC sections are relevant to the areas of ODOT's responsibilities analyzed in the report:

- **Organizational Structure and Responsibilities** – The functions of the Department with respect to highways are granted under ORC § 5501.11. The authority to remove snow and ice from roadways is granted under ORC § 5501.41. The authority to divide the state into up to 12 administrative districts is granted under ORC § 5501.14. The requirement for ODOT to maintain an inventory of buildings and have it certified annually by Department of Administrative Services (DAS) is stipulated under ORC § 125.16.
- **Building Operations** – The authority to operate buildings to support operations is granted under ORC § 5501.40.
- **Construction Finance** – The authority to enter into loan agreements for the purchase and construction of facilities is granted under ORC § 5501.312. The authority to issue bonds for the funding of site construction projects is granted under ORC § 5501.76 and ORC § 5528.54. For the purpose of completing a transportation site, the authority to accept funds from any source is granted under ORC § 5501.77. The authority to sell or dispose of real property is granted under ORC § 5501.34. The authority to dispose of property that is either unfit for use or no longer needed by the Department is granted under ORC § 5513.04.

Organizational Structure

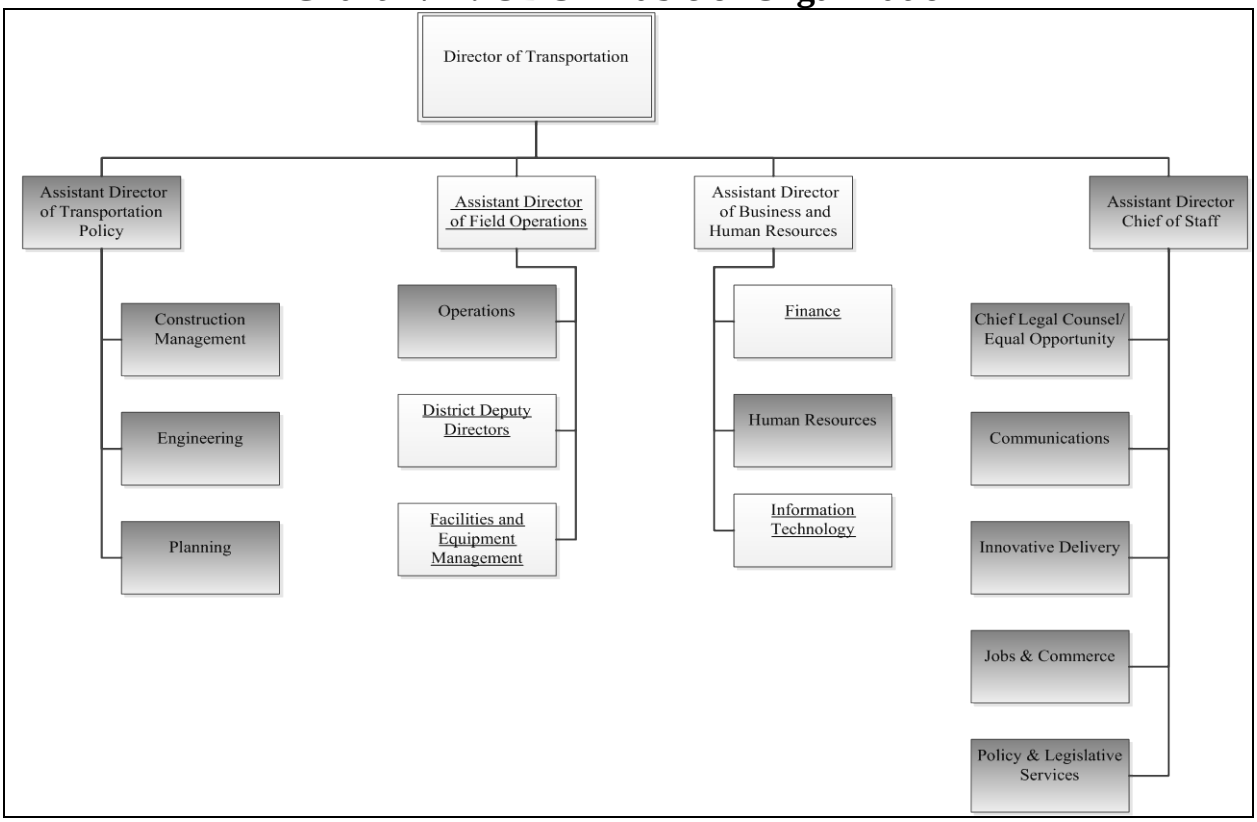
Within ORC Title 55: Roads - Highways - Bridges, ORC § 5501.02 authorize that:

> "All duties, powers, and functions conferred by law on the Department of Transportation and the divisions of the Department shall be performed under such rules as the Director of Transportation may prescribe, and shall be under the Director's control. The Director shall appoint such employees of the Department as are necessary, and shall prescribe their titles and duties."

ODOT carries out its statutory responsibilities, mission, and mission components through 13 main operating divisions and offices, which include: Construction Management, Engineering, Planning, Operations, Facilities and Equipment Management, Finance, Human Resources, Information Technology, Chief Legal Counsel/Equal Opportunity, Communications, Innovative Delivery, Jobs and Commerce, and Policy and Legislative Services.

Chart IV-1 illustrates both the basic organizational structure and the leadership hierarchy of the Department. Key to the scope and objectives of this performance audit are the day-to-day responsibilities for facilities management and strategic responsibilities for facilities planning. These roles are specifically within the responsibility of ODOT's Office of Facilities and Equipment Management, district deputy directors, and assigned staff.

Chart IV-1: ODOT Table of Organization



Note: While shaded positions and functional areas are customers and stakeholders for the facilities planning process, underlined positions and functional areas have specific day-to-day operational oversight over the aspects of facilities planning that are covered in this report.

Organizational History

Since its formal establishment, ODOT has had a history of organizational change in structure and function as a result of changing statutory roles and responsibilities. The first iteration of ODOT was referred to as the Ohio Department of Highways and was established on February 15, 1905 with a budget of $10,000. In 1933, the Department organized the first highway patrol. The Department of Highways grew rapidly during the late 1940s and through the 1950s as an increased emphasis was placed on the construction of the interstate highway system. In 1972 the Department of Highways was dissolved and the modern Department of Transportation was created to facilitate coordination between the maintenance and construction of different types of transportation.

Staffing and Budgetary Resources

ODOT is Ohio's second largest agency in terms of employees by headcount. The agency has a staff of 5,548 located across 12 districts, as well as a Central Office in Columbus, Ohio.[1] ODOT's total appropriated budget for the FY 2015-17 biennium was $5.87 billion; $2.88 billion for FY 2015-16, and $2.99 billion for FY 2016-17. Since FY 2014-15, the Department has allocated $267.4 million for facilities-related expenses. This includes $240.6 million for new construction and $26.8 million for special projects such as existing site improvements.

[1] ODOT's employee count is as reported by DAS as of July 31, 2016.

V. Summary of Recommendations and Impact

The following table shows summary performance audit recommendations and total financial implications for this report.

Table V-1: Summary of Section Recommendations and Impact

Report Section	Recommendations	Annual Impact
Capital Planning and Budgeting		
• Data Quality	**R1**	N/A
• Operations Data Quality	**R2**	N/A
• Operations Support Cost/Benefit Analysis	**R3**	$65,000
• Capital planning and budgeting	**R4**	$3,500,000
Adjusted impact of offsetting recommendations [1]		($65,000)
	Total Financial Implication	**$3,500,000**

[1] If **R4** is fully implemented it will include implementation of **R3**; as such, the impact of **R3** is offset from the total financial implication.

VI. Audit Results

The performance audit identified recommendations within the scope area of **Capital Planning and Budgeting,** and the audit is presented in four separate sections:

- **Facilities Data Collection – Utilities and Maintenance:** This section of the performance audit focuses on analyzing the quality of the site-related data generated by ODOT, with the objective of determining the suitability of this data for use in management decision making
- **Facilities Data Collection – Operations:** This section of the performance audit focuses on analyzing the quality and significance of operations-related data generated by ODOT for use in the facilities planning process.
- **Facilities Data Collection – Outpost Optimization:** This section of the performance audit focuses on developing a cost-benefit analysis model that guides ODOT in making informed, data-driven site replacement decisions.
- **Facilities Replacement Planning:** This section of the performance audit focuses on analyzing the Department's facilities planning process, with the objective of determining the extent to which ODOT could benefit from a data-driven facilities replacement process.

Recommendations Overview

Recommendation R1: ODOT should implement a uniform process that allows for the accurate and timely collection of utility and site O&M data and information, including:

- **Utilities – Including water, gas and electric;**
- **In-House O&M – Including labor, equipment and materials; and**
- **Outsourced O&M – Including any and all costs for outsourced maintenance.**

Financial Implication R1: N/A

Recommendation R2: ODOT should implement a uniform process that allows for the accurate and timely collection of operations data and information, including:

- **Routes – Including snow and ice control route assignments, treated lane miles, and deadhead miles;**
- **Equipment – Including route truck assignments, plow truck salt and materials capacity, and plow truck cost per mile; and**
- **Weather Events – Including route cycle times, historical weather event data, and historical route cycles per event data.**

Financial Implication R2: N/A

Recommendation R3: ODOT should incorporate formal cost/benefit analyses into the facilities planning process in order to identify and implement opportunities for greater efficiency and effectiveness. These analyses should use data and information from operations, primarily snow and ice control (**see Operational Data Quality**), **as well as**

facilities (**see Data Quality**), **to assess the business needs and evaluate the relative costs and benefits of alternative facility options.**

One opportunity already identified is to repurpose the Laurelville Outpost, which has surpassed its estimated useful life, as a yard[2] in order to reduce overhead costs while still meeting operational needs.

Financial Implication R3: By repurposing the Laurelville Outpost site as a yard rather than reconstructing an outpost, ODOT can avoid considerable construction and annual site maintenance costs. However, in obtaining this benefit the Department will incur additional operating costs. The net result is that the Department will realize an average annual net savings of **$65,000**.

Recommendation R4: ODOT should develop a consistently applied, data-driven process to guide capital planning and budgeting decisions. The process should involve input from key stakeholders, including Central Office, district, and county leadership, in order to identify key metrics to assess which sites are most critical to the Department's mission. At a minimum, the process should include a standardized method to:

- **Evaluate each site's conditions and assessing deferred maintenance;**
- **Evaluate each site's purpose in meeting the Department's mission; and**
- **Compare all sites, as well as alternative options, such as replacing outposts with yards where possible, in order to optimize capital investment.**

Financial Implication R4: Employing this type of data-driven approach could result in average annual savings of up to **$3.5 million** by replacing 34 outposts with less-costly yards.

See **Section IX: Abbreviated Terms and Acronyms** for a list of acronyms used throughout this report.

[2] See pages 11-12 of this report for a full explanation of the purpose of each type of site.

VII. Report Background

In order to support its overall mission, ODOT maintains a total of 370 sites throughout the State. These sites, and associated service functions, resources, and buildings, are managed centrally by the Office of Facilities Management (OFM) in cooperation with district and county management. Each district manager is responsible for maintaining all State and federal highway culverts, bridges, and lane miles within the district and for planning new construction to enhance, improve, and/or expand the transportation system within the district.

Department sites serve a variety of purposes including operational support, communications, and traveler safety. The majority of sites directly support ODOT's day-to-day operational responsibilities, which include highway maintenance and snow and ice control. The four types of sites[3] most directly involved in ODOT operations are as follows:

- **District Headquarters (HQ):** The Department maintains 12 district HQs, each of which serve multiple counties and are staffed year round. District HQs house personnel that are responsible for the planning, design, construction, and maintenance of the State and federal highways. District HQs typically include buildings that perform one or more of the following functions: office space for site employees, a garage for truck storage, vehicle and equipment maintenance, test laboratories, warehouse, equipment storage, salt storage buildings, and fuel tanks.

- **Full-Service Garages***:* The Department maintains 99 full-service garages which are staffed year round and provide administrative support, a mechanic, and a mechanic's lift. Full-service garages typically include buildings that perform one or more of the following functions: office space for personnel, storage space for dump trucks, a wash bay, a mechanic's bay, equipment storage buildings, calcium or hot/cold mix storage buildings, salt storage buildings, brine maker systems,[4] liquid calcium storage tanks, and fuel tanks. These sites also house and maintain the plow trucks used in snow and ice control.

- **Outposts***:* The Department maintains 100 outposts which are primarily seasonal facilities providing minimal accommodations for staff during the snow and ice control season (e.g., restroom facilities and break room/work surface area). Outpost garages can be differentiated from full-service garages by the lack of a mechanic's lift and, with the exception of the outposts in Hilliard and Chesterville, they are not staffed year-round. In addition to seasonal staff deployment, outposts also provide vehicle, equipment, and/or material storage for the purpose of reducing "deadhead" mileage on snow routes.[5] Outposts typically include structures that perform one or more of the following

[3] Each site, regardless of type, will typically contain more than one building or structure on the same location. However, this report will generically refer to the site as inclusive of all site-based buildings, services, and resources.
[4] Brine is a water/salt solution mostly used to give weight to salt so that it does not bounce off roadways during application, but is also used as a pre-treatment option.
[5] Deadhead miles are defined as those traveled by snow plow trucks when not applying salt or other materials.

functions: garage, equipment storage, salt storage, calcium or hot/cold mix storage buildings, brine maker systems, liquid calcium storage tanks, and fuel tanks.

- **Yards:** The Department maintains 26 yards which are used for seasonal material lay-down purposes[6] or storage structures for equipment and materials, particularly salt storage, and are seasonally staffed. Yards may also contain equipment storage buildings, calcium or hot/cold mix storage buildings, brine maker systems, liquid calcium storage tanks, and fuel tanks.

Table 1 shows the count and distribution of all of the active and inactive ODOT sites by type as well as other operating locations and land holdings for FY 2015-16 data. This table provides a macro-view and illustrates where the Department focuses its resources.

Table 1: Site and Locations Summary

Site Type	Active	% of Total	Inactive	% of Total	Total	% of Total
Full-service	99	29.4%	6	18.2%	105	28.4%
Outpost	100	29.7%	6	18.2%	106	28.6%
Yard	26	7.7%	4	12.1%	30	8.1%
District HQ	12	3.6%	2	6.1%	14	3.8%
Sub-Total	**237**	**70.3%**	**18**	**54.5%**	**255**	**69.0%**
Other Operating Locations and/or Land Holdings						
Central Office	5	1.5%	0	0.0%	5	1.3%
Rest Areas	88	26.1%	9	27.3%	97	26.2%
Railroad	0	0.0%	3	9.1%	3	0.8%
Remote Radio	6	1.8%	0	0.0%	6	1.6%
Weigh Stations	1	0.3%	2	6.1%	3	0.8%
Elevator Shaft Building	0	0.0%	1	3.0%	1	0.3%
Sub-Total	**100**	**29.7%**	**15**	**45.5%**	**115**	**31.0%**
Total	**337**	**100.0%**	**33**	**100.0%**	**370**	**100.0%**

Source: ODOT

Note: The Mount Adams Elevator shaft has been classified as inactive in this table because no operational activity occurs there. ODOT owns a retaining wall alongside Interstate 71 and the elevator shaft is there to allow for maintenance access to the cables that hold up the wall.

As shown in **Table 1**, ODOT is responsible for 337 active and 33 inactive sites and operating locations and land holdings. A total of 237, or 70.3 percent, are directly involved in supporting Department operations. Of those sites directly involved in operations, 199, or 84.0 percent, are full-service garages and outposts.

[6] Area cleared for temporary storage of equipment or supplies such as sand, gravel, or pavement removal debris.

Site Ages

Table 2 shows a breakdown of the decade of construction from calendar year (CY) 1900 through CY 2016 for active full-service garages and outposts for FY 2015-16. Examining sites by age is important as age is considered a leading indicator of repair and replacement needs (i.e., older sites with older buildings are likely to require at least higher levels of maintenance and may also require replacement).

Table 2: Full-Service Garages and Outposts Constructed by Decade

	Full-Service Garages		Outposts		Totals	
Decade Built	**Count**	**% of Total**	**Count**	**% of Total**	**Total**	**% of Total**
1900-1949	0	0.0%	3	4.0%	3	2.0%
1950-1959	2	2.0%	7	7.0%	9	4.5%
1960-1969	15	15.2%	42	42.0%	57	28.6%
1970-1979	12	12.1%	18	18.0%	30	15.1%
1980-1988[1]	**17**	**17.2%**	**9**	**9.0%**	**26**	**13.1%**
1989-1999	22	22.2%	12	13.0%	34	17.1%
2000-2010	20	20.2%	3	2.0%	23	11.6%
2011-2016	11	11.1%	6	5.0%	17	8.5%
Totals	**99**	**100.0%**	**100**	**100.0%**	**199**	**100.0%**

Source: ODOT

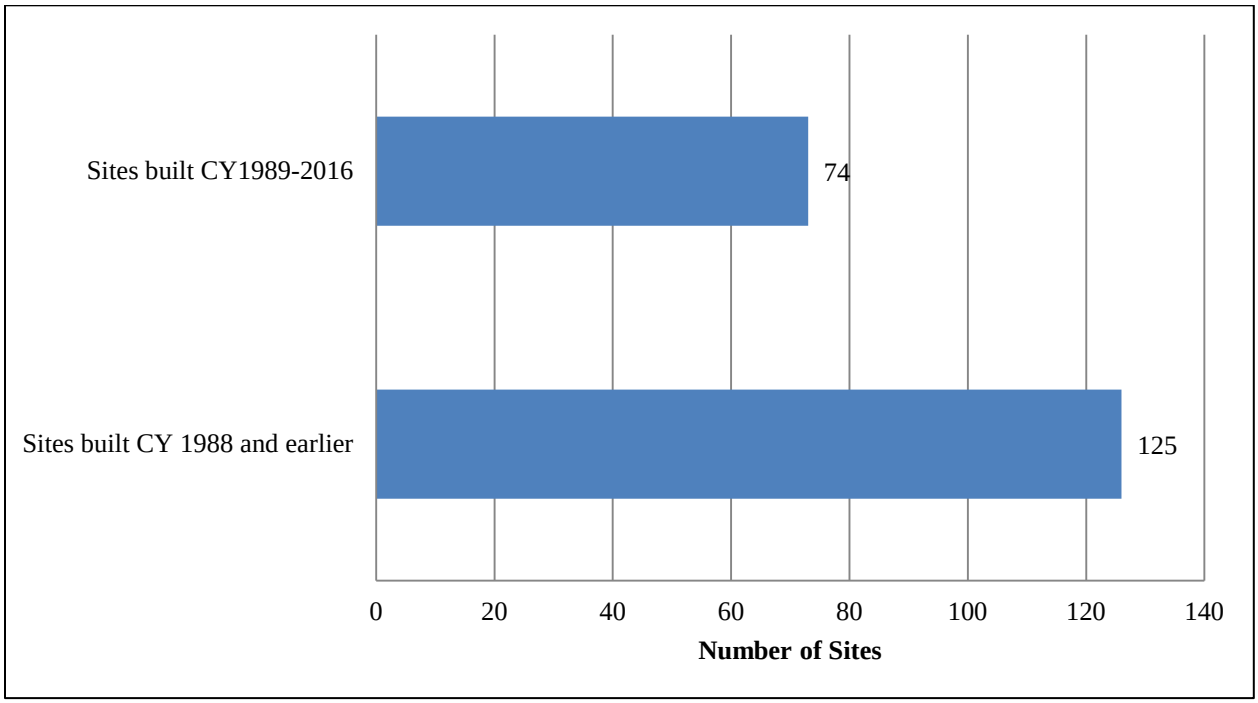
[1] This decade was cut off at 1988 because sites built before 1988 may be too small to accommodate dual-axel dump trucks.

As shown in **Table 2**, 69 sites, or 34.7 percent, were constructed on or before 1969, and of those, a total of 57, or 28.6 percent, were built during the 1960s. The relatively large number of sites constructed during the 1960s was the result of rapid growth of the interstate highway system during that time period. In accordance with accounting guidelines established by the Ohio Office of Budget and Management (OBM) and the Ohio Department of Administrative Services (DAS), state-owned buildings have an estimated useful life of between 20 and 45 years, dependent on factors such as construction type (e.g., concrete, brick, metal, or frame) and building use (e.g., truck storage, administrative, salt storage, etc.).[7] The 45-year useful life expectation means that the Department will have to make replacement decisions for a large number of sites over the next few years. In addition, ODOT has identified that garages constructed before 1989 are functionally obsolete as they are typically too small to house the Department's newer, larger tandem-axle dump trucks.

[7] In accordance with *State of Ohio Asset Management Policies and Procedures* (DAS, 2015) and *Financial Reporting and Accounting Policies for Capital Assets* (OBM, 2014), building assets acquired after July 1, 2001 are required to be accounted for using a mix of general construction, other construction, and land improvements (if applicable). General construction estimated useful life for steel, concrete, masonry, wood, and metal is all 45 years, while other construction for these same asset types are all 20 years. The result is a building with an estimated useful life of 45 years, with components of the building having an estimated useful life of only 20 years. The practical implication of this difference in estimated useful life is that an asset management strategy must take both into account to ensure that repair and replacement practices are appropriately timed to meet the anticipated need.

Chart 1 shows a breakdown of sites built before and after 1989 in order to bring attention to magnitude of near-term reconstruction and/or replacement needs.

Chart 1: Sites Constructed Before CY 1989



Source:ODOT

As shown on **Chart 1**, a total of 125 sites, or 62.8 percent, were constructed in 1988 or earlier and are therefore considered functionally obsolete. Of these sites, 46 are full-service garages and 79 are outposts.

Considered together, **Table 2** and **Chart 1** demonstrate how the Department's historical construction practices and changes in truck storage space requirements contribute to a situation where the Department will have to make replacement decisions for a large number of sites over the next decade. In order to meet this challenge, ODOT began a process to evaluate facilities statewide in FY 2010-11, with the stated goal of becoming a national leader for facilities planning in both the public and private sector.

ODOT leadership identified snow and ice control as a key functional area. As such, the Department sought to measure the demand for snow and ice control as a key driver of demand for facilities. Two major issues identified by the Department were that decision making tends to be district-centric and decision-making is often delegated to district managers. This leads to situations where similar operations are performed differently in each district. For example, decisions about when to replace a site and the size and type of replacement buildings are often left to the discretion of district management. In addition, there were safety and operational concerns with older facilities, such as a lack of separate wash bays and maintenance areas. Specific goals of the Master Planning Process include:

- Reduce the number of facilities statewide;

- Replace outposts with yards where possible;
- Reduce deferred maintenance by replacing aging facilities;
- Reduce utilities; and
- Use more effective construction technologies.

In recognition that full-service garages and outposts have the largest impact on snow and ice control operations, the Department placed a heavy focus on realignment of these sites. To fund the Master Planning Process, the Department raised a total of $200 million through two major bond sales. House Bill 497 was passed by the 130th general assembly and provided ODOT with $100 million in capital funding beginning in FY 2013-14. Senate Bill 310, passed by the 131st general assembly, provided the Department an additional $100 million beginning in FY 2016-17. The Department expects the bond funds to finance the construction of between 30 and 50 new facilities between FY 2013-14 and FY 2018-19.

OPT and the Department worked collaboratively to develop the scope of this audit. Specifically, OPT determined that the Department could benefit from an objective, data-driven review of the Master Planning Process that could analyze potential improvements in the area of data collection and management, as well as review of a more rigorous, data-driven process to manage capital planning and budgeting in the future.

The following sections assess the Department's progress to date with the Master Planning Process. The first two sections, **Data Quality** and **Operations Data Quality**, focus specifically on ways that ODOT can address the collection and analysis of data to improve day-to-day facilities management and improve future facilities planning. The third section, **Operations Support Cost/Benefit Analysis**, analyzes an outpost in Hocking County and provides an example cost/benefit analysis that ODOT can use in the future to help achieve the stated goal of reducing outposts by converting to yards, where appropriate. The fourth section, **Capital Planning and Budgeting**, takes a macro view of the Department's capital planning and site replacement process and compares ODOT's replacement decision-making process to industry standards.

R1. Data Quality

Section Overview

This section of the performance audit focuses on analyzing the quality of the Ohio Department of Transportation's (ODOT or the Department) facility-related operations and maintenance (O&M) data, with the objective of determining the current suitability of this data for use in management decision making and the potential to optimize data collection and information to maximize future decision-making capabilities.

Recommendation Overview

Recommendation R1: ODOT should implement a uniform process that allows for the accurate and timely collection of utility and site O&M data and information, including:

- **Utilities – Including water, gas and electric;**
- **In-House O&M – Including labor, equipment and materials; and**
- **Outsourced O&M – Including any and all costs for outsourced maintenance.**

Financial Implication R1: N/A

Background

The collection and analysis of facilities operating cost data, including utility usage, are recognized as critical components of effective facilities management. The United States Department of Energy (DOE) best practice guide, *Operations and Maintenance Best Practices* (DOE, 2010), notes that tracking O&M costs is a major factor in effective facilities management. Specifically, DOE states that there is a need to understand where O&M time and dollars are spent.

ODOT's Office of Facilities Management (OFM) oversees all ODOT properties including rest areas, garages, outposts, yards, and office spaces, as well as miscellaneous other properties such as radio towers, undeveloped/unused land, and railroad lines. In managing its facilities, OFM requires data and information in, at minimum, the following areas:

- **Time** – Including labor hours of employees dedicated to maintenance and repair (M&R); and
- **Dollars** – Including expenditures on utilities (i.e., water, gas, and electric), equipment (e.g., the cost to use ODOT vehicles and rolling stock), materials, and outsourced M&R.

Although OFM is responsible for oversight of ODOT facilities, the data necessary to provide for effective oversight and management is collected at the district, county, and/or site level.[8] Collected data is then input into databases and/or information management system by district

[8] See **Report Background** for full explanation of ODOT's organizational structure and site descriptions.

employees. These databases and systems, administered and maintained by ODOT's Central Information Technology Division (IT), are then accessible to OFM for oversight and management purposes.

Key databases and systems include:

- **Appropriation Accounting (AA)** ODOT's mainframe procurement system used to record expenditures. AA has been in use since the early 1990s and has been updated as needed to accommodate reporting requirements and technological changes. AA is used for day-to-day purchase tracking with transactions uploaded daily to the Ohio Administrative Knowledge System (OAKS). The data includes purchase order information, such as approval dates, vendors, and purchase amount. The data is recorded at either the district or county level, depending on the expenditure, by district level finance employees.

- **Ohio Administrative Knowledge System (OAKS)** The State's Enterprise Resource Planning system which provides central administrative business services such as Financial Management and Human Capital Management. Specific to facilities management, ODOT uses OAKS Financial Management to account for direct expenses such as contracts, supplies and materials, and utilities. These expenditures are uploaded from AA to OAKS on a daily basis by Finance.

- **Portfolio Manager (PM)** Used to track building utility usage and cost. ODOT started using PM in 2007, following the issuance of Executive Order 2007-02S.[9] PM is made available for free by the United States Environmental Protection Agency through its Energy Star program. The purpose of PM is to track utility usage and cost to identify areas of improvement. Data from utility bills are entered by district-level finance or facility employees.

- **Enterprise Information Management System (EIMS)** Used to record the costs associated with work performed by ODOT employees. This system was implemented in June 2014, effective for fiscal year (FY) 2014-15, to replace the Transportation Management System. Specific to facilities management, EIMS tracks labor, equipment, and material usage and costs incurred by district-level facility employees for in-house M&R work performed on its buildings. In-house M&R work is tracked at the site level. Data is entered in EIMS by district-level facility employees, who track expenses using paper day cards before entering data into the system. Outsourced M&R costs are not tracked using EIMS. Instead, it is recorded at the district level using AA and OAKS.

[9] PM was adopted by the Ohio Facilities Construction Commission (OFCC) to track energy usage at State-owned buildings in compliance with Ohio Administrative Code (OAC) 3318-3-06 following the issuance of Executive Order 2007-02S in 2007, which required state agencies to track all utility costs. Executive Order 2007-02S expired in 2011 and the language requiring tracking of utility usage at State-owned buildings was removed in January 2016. ODOT, however, still uses the program to track utility expenditures and usage.

Each database and system used by ODOT was originally designed to fulfill a primary purpose other than facilities management. Furthermore, even when systems are similar, or even interrelated, such as OAKS and AA, each was designed to fulfill a different purpose. OAKS Financial Management and AA were designed to be used as accounting systems. As such, these systems maintain data in a way which fulfills the Department's appropriation and purchasing approval and tracking obligations, but not necessarily in manner that is most effective for, or informative to, facilities management. Similarly, EIMS and PM were designed to track data and information, including facilities-related data, at a more granular level for general management needs, but again, not necessarily for facilities management.

In addition to the inherent structural limitations of using multiple, loosely connected databases and systems to glean facilities management data, there are also variations in the data collection and reporting processes that present additional weaknesses. Examples of each are as follows:

- **Data Collection and Reporting Process Limitations –** Within PM there is no set policy or process as to who is responsible for entering or reviewing data. As a result, the data entry process, and the extent to which review occurs, varies from district-to-district. Specifically, when a utility bill is received by a district's finance office, the bill is paid using AA and the cost and usage data from the bill is entered into PM. Depending on the district and circumstance, district-level facility or finance staff can enter the data into PM; or, since entering data is not required, data may never be entered into PM at all.

- **Systems Interoperability and Data Verification Limitations –** Lack of interoperability between OAKS, AA, and PM limits these systems usefulness for data cross-referencing and verification. Although high-level cross-checking is possible, the level of detail necessary to facilitate verification down to the site and facility level (e.g., in the case of a utility bill) is either impossible or impractical to complete on a routine basis.

Methodology

This portion of the analysis, **Data Quality**, is focused on evaluating the suitability and sufficiency of ODOT data for use in facilities management and planning. Analyses focused on data required to calculate operating and maintenance cost per square foot on the individual building and site-level basis. The International Facilities Management Association (IFMA) publication *Asset Lifecycle Model for Total Cost of Ownership Management* (IFMA, 2004) recommends the use of cost per square foot as a common benchmarking measure for determining a facility's lifecycle cost.[10] As such, the costs per square foot derived from data associated with the operation and maintenance of buildings (including utilities) will be used throughout this report.

[10] Although IFMA is the lead entity on the publication, the entire document is the work of a broader consortium that also includes the APPA: Leadership in Educational Facilities, Federal Facilities Council, and the National Association of State Facilities Administrators.

O&M cost data was requested from OFM and from each district for FY 2014-15, the last full year of data available at the time this analysis was conducted. Requested data focused on common, recurring costs associated with O&M for facilities, such as:

- **Utilities –** Including water, electricity, and gas.
- **In-House M&R –** Including the following sub-categories:
    - **Labor –** Including M&R labor performed by ODOT employees for facilities maintenance;
    - **Equipment–** Including operating ODOT-owned equipment, such as vehicles, evacuators, lawn mowers, etc., in facility maintenance related activities; and
    - **Materials –** Including any materials used for facilities maintenance, such as salt, lumber, masonry, etc.
- **Outsourced M&R –** Including outsourced maintenance, such as major repairs, janitorial services, and safety inspections.

In responding to this request, data was provided from several sources including AA, OAKS, PM, and EIMS, as well as supplemental data concerning outsourced M&R costs from the districts. Once data request responses were collected and aggregated, the first level of analysis focused on assessing overall availability of key facilities O&M cost data across all ODOT districts and sites on a site-level basis. Insufficient data, or data with identified deficiencies, included missing and/or incomplete data points as well as data points that were not at a level of specificity necessary to calculate site-level O&M costs. The third analysis performed was to calculate the estimated cost associated with the insufficient data by modeling sites with sufficient data and extrapolating the potential costs across the deficient sites.

Analysis

As previously noted, effective facilities management requires a full complement of O&M cost data to fully inform management decisions. This is critically important when considering the potential magnitude of the effect that this information can have on the Department's long-term capital planning (see **Capital Planning and Budgeting**).

Summary O&M Data Sufficiency

Table 1-1 shows a high-level review of relevant facilities O&M cost data for FY 2014-15. As this data is intended to inform site-specific facilities decisions, insufficient data points are identified on a district and site basis. Assessing the overall sufficiency of O&M data by reviewing at the district and site level provides a macro view of the facilities O&M data as well as a detailed view of variation, and opportunities to improve data collection.[11]

[11] Four sites were excluded from analysis due to being inactive during the audit period.

Table 1-1: Sufficiency of Cost Data by Category by District

District	Total Sites in District	Utilities	In-House M&R[1]	Outsourced M&R	Total Insufficient Data Points
1	18	1	1	4	6
2	11	1	0	11	12
3	15	2	3	15	20
4	24	4	7	24	35
5	17	17	0	17	34
6	17	1	1	0	2
7	24	0	3	24	27
8	17	0	0	17	17
9	12	0	4	12	16
10	20	2	8	9	19
11	20	18	6	20	44
12	13	1	2	13	16
Total	**208**	**47**	**35**	**166**	**248**

Source: OFM

[1] Includes labor, equipment, and material cost data.

As shown in **Table 1-1**, of the 208 total sites and 624 total data points (i.e., three data points per site), for FY 2014-15 there were 248 instances of insufficient data. Overall, Districts 6 and 1 were found to have the best, most available data while Districts 11 and 5 were found to have the largest relative percentages of insufficient data; 73.3 and 66.7 percent of relative possible data points, respectively.

Although this analysis provides a summary of data sufficiency, the extent to which data was sufficient varies by data element, district, and site. As such, each cost data element, namely, utilities, in-house M&R, and outsourced M&R cost, requires additional analysis.

Detailed Utilities Cost Data Sufficiency

Table 1-2 shows the number of sites with insufficient utility cost data in PM for FY 2014-15. Identifying the variation in the number and percent of sites with insufficient data serves to provide an indication on where variations in data collection methodologies occur across districts.

Table 1-2: Sufficiency of Site Utilities Cost Data by District

District	Total Sites in District	Sites with Insufficient Data	% with Insufficient Data
1	18	1	5.6%
2	11	1	9.1%
3	15	2	13.3%
4	24	4	16.7%
5	17	17	100.0%
6	17	1	5.9%
7	24	0	0.0%
8	17	0	0.0%
9	12	0	0.0%
10	20	2	10.0%
11	20	18	90.0%
12	13	1	7.7%
Total	**208**	**47**	**22.6%**

Source: OFM

As shown in **Table 1-2**, there were 47 sites, or 22.6 percent of all sites, that were found to have insufficient utilities cost data. However, the extent to which data was found to be sufficient or insufficient was generally a district-specific condition. For example, Districts 7, 8, and 9 were able to report sufficient data for all sites while Districts 5 and 11 were found to have widespread insufficient data, 100.0 and 90.0 percent, respectively. Further analysis of District 8 practices identified that its success was attributable to regularly performing reconciliations within the District 8 Finance Office.

Although some districts have processes in place, there is no ODOT-wide control process in place to monitor PM usage or ensure that it is being used in a uniform manner. Lack of a prescribed process contributes significantly to the insufficient data issue. For example, ODOT's Central Office does not check to ensure districts are reporting utility information into PM. While administrators can access PM information, it is not consistently organized and does not allow for easy review. All PM data is included in a single tab in a spreadsheet that is not organized by district, site, or fiscal year reported. In addition, utility data must be entered once in AA and again in PM, creating a duplication of effort. Utility costs entered into AA, and subsequently OAKS, include all utility costs from a district, whereas PM collects data at the site level. For example, AA and OAKS includes costs for street lights which are not relevant to management in analyzing the performance of full-service garages and outpost.

Detailed In-House M&R Cost Data Sufficiency

In-house M&R cost data is another critical component of facilities data necessary for effective O&M. ODOT tracks in-house M&R costs using EIMS where the cost of labor, materials, and equipment is broken out and tracked on a site-specific basis using site codes. To develop a total in-house M&R cost by site, three separate reports must be aggregated by site code. In order to track data for EIMS, a work order is created in the system by facility employees at the district level, and the resources needed to complete the work are tracked by the facility employees performing the work. Each active site reported at least a portion of in-house M&R data in FY 2014-15, with all active sites reporting labor and all but one reporting equipment data; however, tracking of materials used for facilities maintenance was less comprehensive than labor and equipment.

Table 1-3 shows the number of sites with insufficient in-house M&R cost data for FY 2014-15. Identifying the variation in the number and percent of sites with insufficient data serves to provide an indication of where variations in data collection methodologies occur across districts.

Table 1-3: Sufficiency of Site In-House M&R Cost Data by District

District	Total Sites in District	Sites with Insufficient Data	% with Insufficient Data
1	18	1	5.6%
2	11	0	0.0%
3	15	3	20.0%
4	24	7	29.2%
5	17	0	0.0%
6	17	1	5.9%
7	24	3	12.5%
8	17	0	0.0%
9	12	4	33.3%
10	20	8	40.0%
11	20	6	30.0%
12	13	2	15.4%
Total	**208**	**35**	**16.8%**

Source: OFM

As shown in **Table 1-3**, there were 35 sites, or 16.8 percent of all sites, that were found to have insufficient in-house M&R cost data. However, the extent to which data was found to be sufficient was, with the exception of insufficient equipment data at one site in District 3, exclusively focused on materials data. In addition, evidence of insufficient data was more evenly spread across all districts. For example, Districts 5 and 8 were able to report sufficient data for all sites while Districts 10, 9, and 11 were found to have the highest percentage of sites with insufficient data, 40.0, 33.3, and 30.0 percent, respectively. ODOT reported that one potential reason for the insufficient data is the learning curve associated with the EIMS system given that FY 2014-15 was the first full year of use. As a result, not all of the necessary data may have been entered into the system.

Further examination identified variances across districts in how data is reported. For example, in District 1, data is submitted using paper cards completed daily and to a specific, assigned

employee who then enters all information. Each card includes a record of the resources used to complete a work order, and upon entering the data, the assigned employee conducts an informal review to make sure missing or incorrect data points are identified and corrected. As a result, District 1 generally has shown an ability to generate sufficient data. In contrast, some other districts have employees submit data directly into EIMS without any review and/or reconciliation process, increasing the risk of incomplete or inaccurate data submissions.

Detailed Outsourced M&R Cost Data Sufficiency

Outsourced M&R cost data is another critical component of facilities data necessary for effective O&M. ODOT does not internally track outsourced M&R costs at the site level because there is not currently a database or information management system in place to do so. Specifically, EIMS is not set up to track outsourced M&R costs, and OAKS does not track those costs by site. OAKS instead records the costs as a general purchased service cost tied to the district or county. This means that, in OAKS, all other purchased services, including those not associated with M&R, could be mistakenly included with outsourced M&R costs. As a result, the only method of tracing outsourced M&R costs back to a site is by reviewing the notes made in the purchase order at the time the purchase was approved. Management does not routinely require sites to perform this analysis, but a few sites voluntarily conduct this internal cost review.

Table 1-4 shows the number of sites with insufficient outsourced M&R cost data for FY 2014-15. Identifying the variation in the number and percent of sites with insufficient data serves to provide an indication on where variations in data collection methodologies occur between districts.

Table 1-4: Sufficiency of Site Outsourced M&R Cost Data by District

District	Total Sites in District	Sites with Insufficient Data	% with Insufficient Data
1	18	4	22.2%
2	11	11	100.0%
3	15	15	100.0%
4	24	24	100.0%
5	17	17	100.0%
6	17	0	0.0%
7	24	24	100.0%
8	17	17	100.0%
9	12	12	100.0%
10	20	9	45.0%
11	20	20	100.0%
12	13	13	100.0%
Total	**208**	**166**	**79.8%**

Source: OFM

As shown in **Table 1-4**, there were 166 sites, or 79.8 percent of all sites, that were found to have insufficient outsourced M&R cost data. Most districts and sites were found to have no sufficient data. The exceptions were Districts 6, which had no sites with insufficient data, and Districts 1 and 10, which had 22.2 and 45.0 percent of sites with insufficient data, respectively.

Table 1-5 shows average in-house and outsourced M&R costs per square foot, as well as average total cost per square foot, for full-service garages and outposts in Districts 1, 6, and 10 where sufficient data was available for FY 2014-15. Outsourced M&R as a percentage of total cost is also shown to demonstrate the potential magnitude of insufficient data as a percentage of M&R.

Table 1-5: M&R Costs by Site Type

Site Type	Avg. M&R Cost per Sq. Ft.		Avg. Total Cost per Sq. Ft.	% Outsourced
	In-House	Outsourced		
Full-Service Garage	$0.54	$0.50	**$1.04**	**48.1%**
Outpost	$0.90	$0.41	**$1.31**	**31.3%**

Source: OFM

As shown in **Table 1-5**, of those sites that report data, outsourced M&R costs accounted for 48.1 percent of total M&R costs at full-service garages and 31.3 percent at outposts. Although outsourced M&R costs represent a significant portion of the overall cost, none of ODOT's current data systems are set up to automatically track these costs on a site-level basis.

Summary O&M Cost and Potential Magnitude of Insufficient Data

Table 1-6 shows the estimated impact of insufficient data on calculating total O&M costs across ODOT. The table was calculated by taking the cost per square foot for each O&M cost data point and extrapolating the cost using the total square footage of deficient sites. Identifying the estimated cost of insufficient cost data highlights the impact these costs potentially could have on ODOT's facility management decisions.

Table 1-6: Impact of Insufficient Site Data

Data Type	Sites with Sufficient Data			Sites with Insufficient Data	
	Total Cost	Total Sq. Ft.	Cost per Sq. Ft.	Total Sq. Ft.[1]	Estimated Total Cost
Utilities	$5,195,053	4,966,540	$1.05	1,470,032	$1,543,534
In-House M&R	$4,194,897	4,909,092	$0.85	560,027	$476,023
Outsourced M&R	$781,129	1,390,511	$0.56	5,046,061	$2,825,794
Total Estimated O&M Cost for Sites with Insufficient Data					**$4,845,351**

Source: OFM

[1] Includes all full-service garages, outposts, and district headquarters sites.

As shown in **Table 1-6**, sites with insufficient data are estimated to have underreported costs between $476,023 for in-house M&R to over $2.8 million for outsourced M&R. Overall, there is a total estimated magnitude of more than $4.8 million in potentially underreported O&M cost data.

The Government Finance Officers Association (GFOA) *Best Practice: Asset Maintenance and Replacement* (GFOA, 2010) recommends that "governments establish a system for assessing their assets and then appropriately plan and budget for any capital maintenance and replacement needs." To do so, GFOA recommends developing a policy and process with a complete inventory and periodic measurement of the physical condition of the capital asset, including:

- Maintenance history;
- Replacement costs;
- Operating cost information;
- Usage statistics;
- Original useful life; and
- Remaining useful life.

Without the ability to calculate an accurate operating and maintenance cost at the site level, ODOT would find it difficult to develop an effective facilities lifecycle cost model and the corresponding replacement process recommended by GFOA. ODOT should implement a process to facilitate site-level data tracking, quality assurance, and aggregation for management decision-making in order to better understand the true cost of facilities O&M. In doing so, at minimum, ODOT should consider developing policies and procedures that are already working well for a limited number of districts.

Conclusion

ODOT lacks complete, accurate operating cost data for all facilities. Furthermore, even when accurate data is collected there are system limitations that hinder ODOT's ability to effectively leverage the data without cumbersome duplication of effort. At the same time, ODOT must still engage in capital planning and budgeting as these activities are critical to sustainable, effective capital asset management. The end result is that there is an increased risk of well-intended, but less than fully informed, decisions leading to unintended, inefficient or ineffective outcomes. Developing a consistently applied, uniform process to gather, aggregate, and analyze site-specific cost data will better inform ODOT leadership and allow for critical decision to be made while also minimizing associated risk.

Recommendation R1: ODOT should implement a uniform process that allows for the accurate and timely collection of utility and site O&M data and information, including:

- **Utilities – Including water, gas and electric;**
- **In-House O&M – Including labor, equipment and materials; and**
- **Outsourced O&M – Including any and all costs for outsourced maintenance.**

Financial Implication R1: N/A

Additional Consideration

In addition to standardizing the data collection process, the Department may also benefit from improving the technology used to capture O&M data. In 2016, ODOT, along with the Ohio Department of Administrative Services and Office of Budget and Management, issued a request for proposals (RFP) for an integrated data system to replace existing, outdated databases and information management systems, including AA. The system proposed in the RFP is an enhanced version of OAKS that, if implemented, will create a single system to allow for easier comparison between financial and human capital data and fleet and facilities management data. As of the start of FY 2016-17, ODOT had not yet selected a final contract service provider. Although the RFP was initiated and developed independently from this performance audit, the

system described in the RFP would provide the Department with the capability to fully address the identified data sufficiency concerns, as well as to fully implement the recommendation found within this section of the performance audit.

R2. Operations Data Quality

Section Overview

This section of the performance audit focuses on analyzing the quality and significance of snow and ice control data generated by the Ohio Department of Transportation (ODOT or the Department) for use in the facilities planning process. The objective of this section is to assess the quality and determine the suitability of this data for use in the facilities planning process.

Recommendation Overview

Recommendation R2: ODOT should implement a uniform process that allows for the accurate and timely collection of operations data and information, including:

- **Routes – Including snow and ice control route assignments, treated lane miles, and deadhead miles;**
- **Equipment – Including route truck assignments, plow truck salt and materials capacity, and plow truck cost per mile; and**
- **Weather Events – Including route cycle times, historical weather event data, and historical route cycles per event data.**

Financial Implication R2: N/A

Background

The mission of the Division of Operations (DO, or the Division) is to "support the safe and efficient movement of people, goods, and services throughout Ohio's multi-modal transportation system."

Operations Support Facilities

In order to fulfill this mission, the Division performs a variety of operational functions, which are primarily based out of district headquarter garages, full-service garages, outposts, and yards. The size and scope of structures at these sites depend on the extent to which they are expected to support operational functions through the housing of employees and equipment, as well as storage of salt and materials.

Generally, each site type has a location, service window (e.g., year-round or seasonal service), and mix of service offerings that support ODOT-wide operations. These site types include:

- **District Headquarter Garages –** There are 12 of these facilities.
- **Full-Service Garages** – There are 99 of these sites and each is typically located near a population center and/or a major transportation hub. These sites offer year-round, full-service operational support in the form of equipment and salt and materials storage, mechanical services, and administrative offices.
- **Outposts** – There are 100 outposts which are primarily smaller sites with less equipment and salt and materials storage capacity. Outposts serve as seasonal sites that support snow and ice control by enabling plow trucks to be housed in more remote areas. This reduces deadhead mileage by being located closer to the beginning of rural snow and ice control routes.[12]
- **Yards** – There are 26 yards which serve mainly as salt and materials storage in support of operations. These facilities are dispersed throughout the state, enabling ODOT snow plow trucks to refill snow and ice control salt and materials without returning to the site from which they were deployed, thus reducing deadhead mileage.

As noted, outposts and yards are primarily used for snow and ice control. However, they account for a total of 126 facilities, or 53.2 percent of total facilities. Although not all sites are the same size and composition (see **Report Background**), the significant number of sites across these two types helps to illustrate the connection that snow and ice control has on ODOT and DO. This connection will be further analyzed throughout this section of the performance audit.

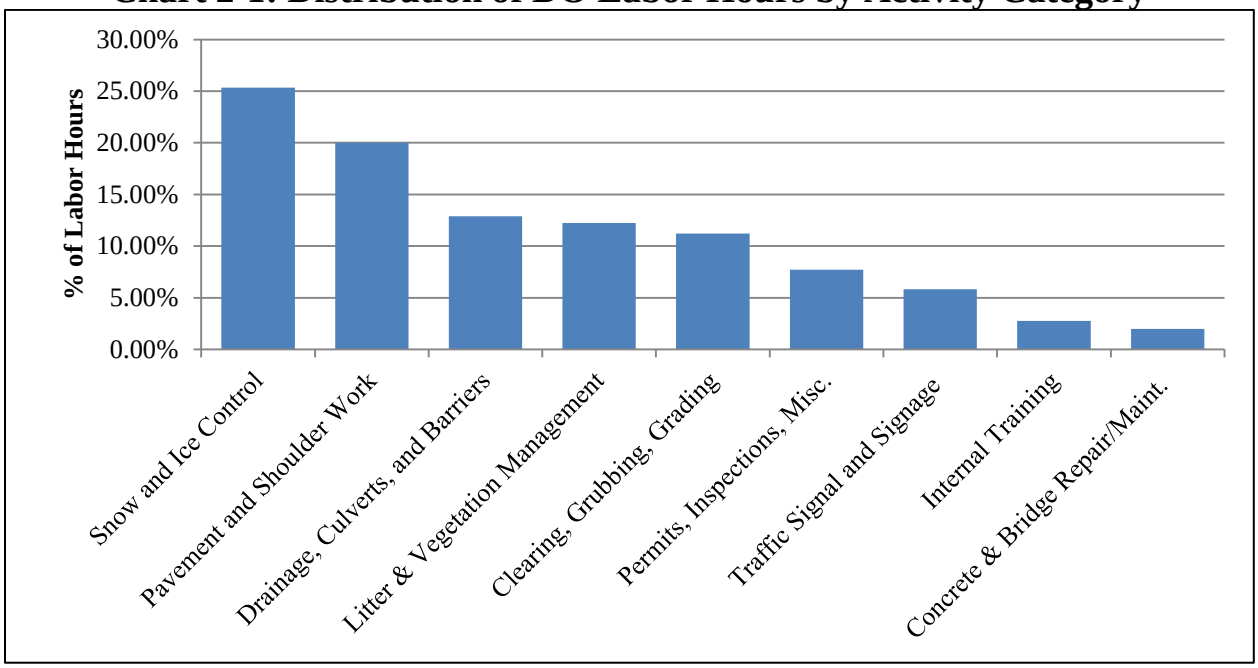
Operations Data and Information Tracking

For management purposes, data on Department-wide operations is tracked in the Enterprise Information Management System (EIMS). Specific to DO, EIMS tracks labor, equipment, and material usage in four, distinct business-area modules, including: roadways, facilities, fleet, and construction. The roadway module includes 133 unique activity codes, each of which represents a purpose-based task. The purpose of the activity codes is to define and categorize the types of work performed by ODOT employees so that the data associated with those activity codes will be more meaningful.

[12] Snow and ice control routes are the individual portions of state-managed roadways for which a driver is responsible. These sections of roadway are broken up by county, assigned priority level based on traffic intensity, and managed to internal time and quality specifications set by ODOT. Additionally, to reach the beginning of a route will often require some travel before plowing or treatment can begin. The distance traveled by a truck from the site to the route beginning, and from the route end back to the site, is known as deadhead mileage.

Chart 2-1 shows a distribution of total DO labor hours by activity category (i.e., logical groupings of similar activity codes) for roadway services for fiscal year (FY) 2014-15. Analyzing labor hours by activity provides an indication of the relative frequency of snow and ice control activities.

Chart 2-1: Distribution of DO Labor Hours by Activity Category



Source: ODOT

As shown in **Chart 2-1**, snow and ice control represented the largest single category of Division labor hours at 25.3 percent for FY 2014-15. Furthermore, the top five categories accounted for 81.6 percent of the total labor hours. These categories represent operational activities which have the most impact on facility needs, with snow and ice control having the largest impact due to the complex, logistical nature of service delivery.

The extent to which snow and ice control impacts operations and support needs is evident in the *Executive Summary of ODOT Snow and Ice Best Practices* (ODOT, 2011) which states that:

> "…to effectively and efficiently address the needs for snow and ice removal on 43,000 lane miles of highways, [ODOT] has at its disposal 1,700 plow trucks, 3,000 employees, and 650,000 tons of salt stored at 200 locations around the state. Depending on the severity of the weather, each winter ODOT uses between 300,000 and 900,000 tons of salt with an average yearly usage of 600,000 tons. In total, snow and ice control comprises 40 to 45 percent of the annual operating expense with approximately $50 million spent annually on labor, equipment, and materials."[13]

[13] Since 2011 ODOT has increased the size of the plow truck fleet and now has just over 1,800 trucks.

Partnership with University of Akron

Furthermore, snow and ice control has such an impact on ODOT operations that the Department has been in partnership with the University of Akron's College of Engineering (the University) for multiple studies since FY 2009-10.

The first study has the University testing and evaluating Global Position System (GPS), telematics and Automatic Vehicle Location (AVL) sensors on plow trucks in Districts 2 and 10 in order to obtain up-to-date route and equipment data and information.[14] The University anticipates reporting the results of these studies in FY 2016-17.

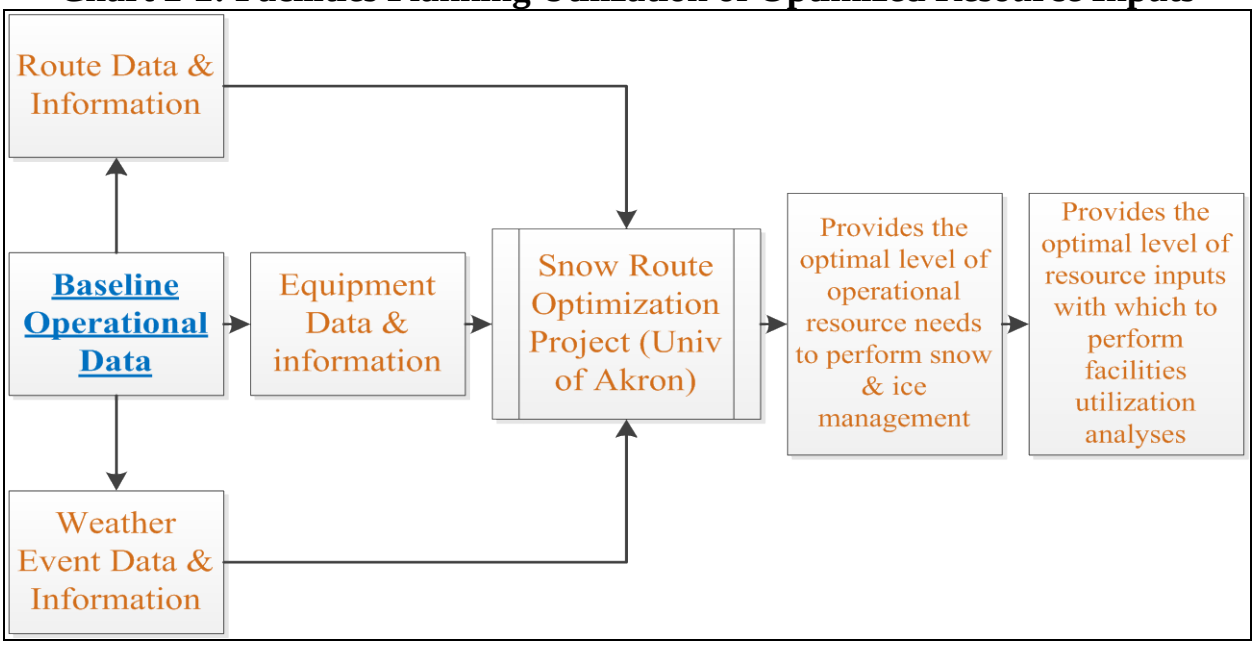
A second study has the University researching route optimization for ODOT snow plow trucks. The study is planned to be a two-phase approach starting with a Phase 1 pilot study involving Districts 1, 2, and 10. To date, according to ODOT, the Phase 1 pilot study has successfully utilized routing, equipment, and labor data and information, in concert with a Geographic Information System (GIS) and algorithms designed to model more efficient routes. Initial field testing has shown that the modeled routes are valid to a statistically significant extent. Once complete, the success of Phase 1 will determine whether Phase 2, which will involve similar analyses of the remaining districts, will be undertaken.

Opportunity for Operations to Inform Facilities Planning

Chart 2-2 shows the conceptual process by which baseline snow and ice control data and information can inform facilities planning decisions leading to more optimal outcomes.

[14] Telematics, which encompasses a combination of vehicle-based computer and wireless communications technologies, is a relatively new data collection solution within the sphere of fleet management. Additionally, further explanation regarding route and equipment data and information is discussed on page 32 (information in the methodology portion of this section) of this report.

Chart 2-2: Facilities Planning Utilization of Optimized Resource Inputs



Source: AOS and ODOT

As shown in **Chart 2-2**, the comprehensive aggregation of baseline operational data enables ODOT to perform facilities utilization analyses. Without collection and analysis of Department-wide, operational resource inputs, ODOT does not fully take full advantage of the most data-driven facilities information in its decision-making process.

The demand for space is created by operational support inputs such as fleet size, personnel, and overall treated snow and ice control route miles. **Table 2-1** shows a breakdown of the typical buildings, and average size of each, that are found at full-service garages and outposts.

Table 2-1: Typical Buildings by Type

Full-Service Garage		Outpost	
Building Type	**Avg. Sq. Ft.**	**Building Type**	**Avg. Sq. Ft.**
Truck Storage [1]	21,000	Combined Truck Storage/Admin/Wash Bay [1]	6,300
Administrative Section [2]	4,000	Cold Storage Structure [1]	5,000
Mechanical Services Section [1]	4,500	Salt Storage Structure [3]	4,800
Cold Storage Structure [1]	5,000	Material Storage Structure [3]	2,400
Salt Storage Structure [3]	7,200		
Material Storage Structure [3]	2,400		
Vehicle Wash Bay	1,400		

Source: ODOT

Note: As previously noted, a yard is similar to an outpost, but is primarily used on for salt and material storage. As such these building are suitably interchangeable.

[1] Actual size of the building will vary based on fleet size projections at time of construction planning.

[2] Actual size of the building will vary based on personnel projections at time of construction planning.

[3] Actual size of the building will vary based on route miles and salt and materials usage projections at time of construction planning.

As shown in **Table 2-1**, in supporting ODOT operations, full-service garages and outposts often share common building types (e.g., truck, salt, cold and materials storage); however, the structure of those buildings will vary by site type. Additionally, the actual size of these buildings can vary depending on fleet size, number of staff, total lane miles managed and salt and materials usage. As ODOT's fulfillment of roadway services is a resource-intensive undertaking, optimized facilities planning involves fully understanding how those resources effect facilities requirements.

Methodology

In order to undertake a baseline analysis of operational resource needs, the following snow and ice control data was requested from all districts and counties for FY 2014-15:[15]

Route Data and Information

- **Treated lane miles –** Including a detailed beginning and ending point for each route to establish total lane mileage currently managed through plowing and/or treating roads.
- **Deadhead miles** – Including documentation of the distance between the site from which each plow truck originates and the beginning of the route in order to establish a baseline of current deadhead miles for each route.

Equipment Data and Information

- **Plow truck salt and materials capacity, application rates, and plow size** – Including each county's inventory of plows by size, truck bed or tank capacity, and application rate of salt and materials used in snow and ice control for each truck.
- **Truck assignments** – Including the identification of equipment associated with each route within a county.

Weather Event Data and Information

- **Cycle times to complete routes –** Including the average time for an individual plow truck to complete one treatment of an entire route.
- **Historical weather data –** Including data detailing the number and type of weather events experienced around the state in order to gauge historical, seasonal workload.
- **Comprehensive cost per mile of operation for each truck** – Including per truck mileage, engine hours, parts, labor, fuel, and salt and materials cost.

This data request was fulfilled to varying degrees across districts. Specifically, five districts provided at least partial data, while seven districts provided no data. Additionally, a portion of the counties within some districts maintained requested data elements, while others in that district did not.

Utilizing ODOT's stated square footage requirements of equipment storage and the average construction cost of full-service garage facilities in FY 2014-15, an example analysis was created

[15] Historical weather data was requested going back 5 to 10 years to get a representative average.

in order to model cost/benefit calculations that could be useful Department-wide once all of the appropriate data is made available.

Analysis

Data and Information Aggregation

Table 2-2 shows the number of counties within each district and, of those, the number of counties which responded to the data request across the three relevant categories needed to establish a baseline level of demand for service.

Table 2-2: Response to Operations Data Request by District

District	Counties in District	Number of Counties Responding		
		Route Data and Information	Equipment Data and Information	Weather Event Data and Information
1	8	0	0	0
2	8	8	0	5
3	8	0	0	0
4	6	0	0	0
5	7	7	7	0
6	8	8	0	8
7	9	0	0	0
8	7	0	0	0
9	8	0	0	0
10	9	9	9	9
11	7	7	7	7
12	3	0	0	0

Source: ODOT and performance audit data request
Note: Shading represents data sets where counties did not respond to the data request or responded that the data was unavailable.

As shown in **Table 2-2**, only Districts 10 and 11 provided full responses to the data request across all three categories, while Districts 2, 5, and 6 provided responses to the data request in at least one data and information category. Districts 1, 3, 4, 7, 8, 9, and 12 did not respond with data in any category.

The five districts that returned data sets did so in varying formats. While the responding districts returned usable data, much of it was not aggregated and/or disseminated in a uniform manner. Some examples of where data lacked continuity across counties are as follows:

- Route descriptions that included component mileages for each section of a route;
- Route end points that indicate the ODOT site out of which the route is originated; and
- Truck type data that indicates whether a single-axle truck or a tandem-axle truck is assigned to a specific route.

Identified inconsistencies suggest the lack of a structured process to collect, track, and document key operational information. Without detailed and uniform data, baseline workload and

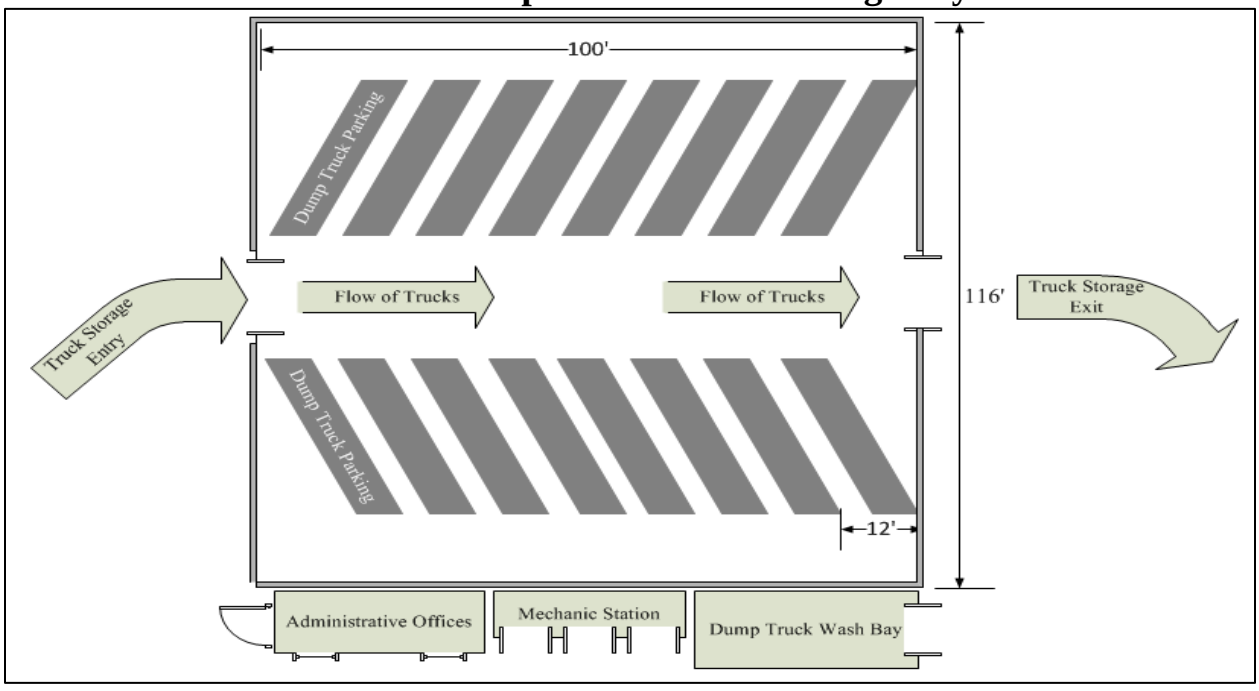
performance data analyses cannot be conducted, hampering ODOT's ability to make efficient and effective facilities planning and construction decisions that would enable it to optimize snow and ice control resource deployment.

Data and Information Use

The efficient execution of facilities planning requires a comprehensive understanding of operational needs and, as noted, the predominant operational need is snow and ice control. A key factor in snow and ice control is the operation of a fleet of more than 1,800 dump trucks, including single and tandem axle, which are used for plowing on designated routes. These trucks are stored inside and operated out of full-service garages and, as such, each garage is built to provide storage for all trucks within the county.[16]

Exhibit 2-3 shows an example layout of a full-service garage. This visual representation of a building layout is vital to understanding the manner in which equipment, such as trucks, can impact the demand for space. Furthermore, the trucks being stored and maneuvered in these buildings are of considerable size, and even incremental changes in the number of trucks expected to be housed in a particular location could lead to significant changes in square footage required for that site.

Exhibit 2-3: Example Full-Service Garage Layout



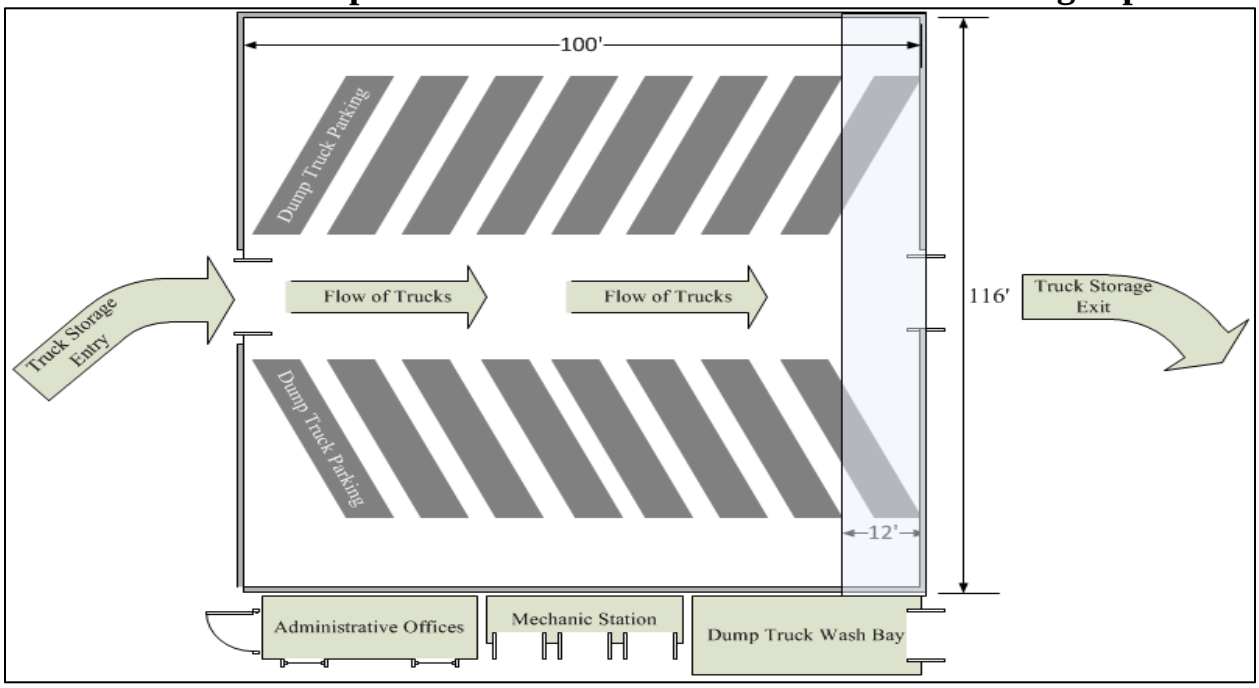
Source: ODOT
Note 1: The example shown is conceptually based on the actual architectural drawings for the recently constructed Crawford County Full-Service Garage.
Note 2: Dimensions not drawn to scale.

[16] Some trucks are stored and operated out of outposts, but only on a seasonal or as-needed basis.

As shown in **Exhibit 2-3**, the truck storage area of 11,600 square feet represents the vast majority of the built structure and includes space to both maneuver and park all trucks.

Exhibit 2-4 shows the same example layout but with a semi-transparent overlay representing the truck storage area which could be eliminated from future construction through a reduction of two routes and corresponding plow trucks. This depiction of diminished spatial requirements illustrates the specific link between operational resource needs and demand for building space.

Exhibit 2-4: Example Effect of Fleet Reduction on Truck Storage Space



Source: ODOT
Note: Dimensions not drawn to scale.

As shown in **Exhibit 2-4**, through a reduction of two trucks, the truck storage area could be reduced by nearly 1,400 square feet when constructing a new or replacement building.

Table 2-3 shows an example of the impact that a reduction of fleet size, and corresponding reduction in square footage of the truck storage area, could have on the cost of sites construction. This type of analysis is important as it illustrates the potentially significant impact that small operating changes could have in the context of ODOT's ongoing facilities planning and capital outlay process (see **Capital Planning and Budgeting**).

Table 2-3: Example Effect of Fleet Reduction on Facilities Cost

Original Total Truck Storage Construction	
Total trucks stored	16
Building length	100 feet
Building width	116 feet
Total area of building	11,600 feet
Construction cost per square foot [1]	$164
Total construction cost	**$1,902,400**
Construction Avoidance Through Fleet Reduction	
Number of reduced trucks	2
Parking space width	12 feet
Building width	116 feet
Sq. Ft. of two parking spaces	1,392
Construction cost per square foot [1]	$164
Reduced construction cost	**$228,288**
Percent reduction	**12.0%**

Source: ODOT and performance audit example

[1] The cost of any new construction includes both fixed costs and variable costs (i.e., those costs that increase or decrease based on incremental changes to building square footage). This calculation is meant to demonstrate the manner in which changes in operations could impact facilities construction needs and cost. Though conceptually accurate, this is an example, not a projection, of actual savings that would be realized if ODOT were to eliminate routes and vehicles and thereby construct a smaller building in the future.

As shown in **Table 2-3**, optimizing routes and reducing a small number of trucks offers the potential to reduce the necessary operating area, and thus the construction cost, of any replacement site. This example shows that small changes at one building can result in significant savings and helps to demonstrate the potential impact that these small changes could have when applied to all 99 full-service garages.

To make more informed decisions in the facilities planning process, ODOT should develop data gathering practices that allow for the calculation of operational data at all sites. These calculations should take into account those areas of operation which drive demand for sites and should be used in such a way that most appropriately inform facilities planning decisions.

Conclusion

ODOT lacks a standardized way in which to track snow and ice control data across all districts. As operational resources are proven drivers of facility construction requirements, lacking complete and accurate data inputs limits the Department's ability to effectively leverage data in the facilities planning process. Since it is still necessary for ODOT to undertake a facilities capital planning process as part of sound management practices, the Department is not currently realizing its full potential when doing so. The end result is that there is an increased risk of well-intended, but less than fully informed, decisions leading to, inefficient or ineffective outcomes. Developing a consistently applied, uniform process to gather, aggregate, and analyze operational data will better inform ODOT leadership and allow for critical decisions to be made while also minimizing associated risk.

Recommendation R2: ODOT should implement a uniform process that allows for the accurate and timely collection of operations data and information, including:

- **Routes – Including snow and ice control route assignments, treated lane miles, and deadhead miles;**
- **Equipment – Including route truck assignments, plow truck salt and materials capacity, and plow truck cost per mile; and**
- **Weather Events – Including route cycle times, historical weather event data, and historical route cycles per event data.**

Financial Implication R2: N/A

R3. Operations Support Cost/Benefit Analysis

Section Overview

This section of the performance audit focuses on developing a cost/benefit analysis model for the Ohio Department of Transportation's (ODOT, or the Department) support sites to better inform facilities planning. Specifically, a model was developed using current-state cost and operating data from the Laurelville Outpost, located in Hocking County within ODOT District 10. This model is intended to serve as an example of the types of analysis that ODOT could use in a future data-driven facilities planning process if the structure of operational data collection efforts are enhanced (see **Operational Data Quality**).

Recommendation Overview

Recommendation R3: ODOT should incorporate formal cost/benefit analyses into the facilities planning process in order to identify and implement opportunities for greater efficiency and effectiveness. These analyses should use data and information from operations, primarily snow and ice control (**see Operational Data Quality**), **as well as facilities** (**see Data Quality**), **to assess the business needs and evaluate the relative costs and benefits of alternative facility options.**

One opportunity already identified is to repurpose the Laurelville Outpost, which has surpassed its estimated useful life, as a yard in order to reduce overhead costs while still meeting operational needs.

Financial Implication R3: By repurposing the Laurelville Outpost site as a yard rather than reconstructing an outpost, ODOT can avoid considerable construction and annual site maintenance costs. However, in obtaining this benefit, the Department will incur additional operating costs. The net result is that the Department will realize an average annual net savings of **$65,000**.

Background

As part of its Master Planning Process, ODOT makes replacement decisions based on age, operational support capabilities, visual inspections, and budget limitations (see **Report Background**). However, the Department currently lacks a standardized, uniformly-applied method for distilling complex decision points down into quantitative, data-driven alternatives. Creating this type of practice would provide more structured options from which to choose. It is through these quantitative analyses that the Department could determine the most cost-effective facilities that would maintain support of a high quality delivery of service. In this manner, the Department would be better equipped to weigh quantitative cost inputs against qualitative, service delivery outcomes.

ODOT currently utilizes outposts and yards to support full-service garage operations. In the past, ODOT has sought to balance its operational support options as part of a broader effort to streamline operations. In certain instances, the Department has done so by replacing outposts with yards or even completely foregoing a support site at all. However, that decision making process was typically on an as-needed basis (e.g., as imminent facilities replacement needs were aligned with available funding).

The Laurelville Outpost in Hocking County provides an example of a current opportunity for ODOT to use a strategic cost/benefit analysis to evaluate these options and formulate a replacement plan. The Laurelville Outpost has already exceeded its estimated useful life of 45 years as set forth by the Ohio Department of Administrative Services (DAS) and the Ohio Office of Budget and Management (OBM). However, ODOT has yet to develop any formal plans for this site (see **Capital Planning and Budgeting**). The Laurelville Outpost is a supporting site to the Hocking County Full-Service Garage (HCFSG) which will not require extensive facilities replacement or recapitalization in the near-term.

In general, when faced with this type of condition, ODOT has three main options, including:

- **Reconstruct the Outpost** – Outposts are typically smaller than full-service garages, with fewer and/or smaller equipment and materials storage buildings. Outposts are utilized in a seasonal capacity, supporting snow and ice control by enabling plow trucks to be temporarily housed in more remote areas. The use of outposts reduces deadhead mileage by making snow and ice control routes located far from full-service garages more readily accessible.[17] Reconstruction of an outpost involves a substantial investment of time and money in its planning, construction, and annual site maintenance, but doing so enables

[17] Snow and ice control routes are segments of state-managed roadways. These sections of roadway are broken up by county, assigned priority level based on traffic intensity, and managed to internal time and quality specifications set by ODOT. Additionally, the beginning of some routes will require a certain amount of travel from the ODOT site before plowing or treatment can begin. The distance traveled by a truck from a site to the point in time treatment of a route begins is known as deadhead mileage.

ODOT to maintain a constant level of service by supporting consistent and routinely shorter cycle times by minimizing deadhead.[18]

- **Repurpose the Site as a Yard** – Yards are typically smaller than both full-service garages and outposts and are dispersed state-wide to provide snow plow trucks the opportunity to refill salt and materials more conveniently. This enables a truck housed far from the beginning of its route to forego deadhead mileage it would otherwise incur returning to its base of operation each cycle to refill on materials. Among ODOT's types of sites, yards require the least amount of investment in planning, construction, and annual site maintenance. This is due to the fact that yards focus solely on materials storage rather than also providing mechanical services, truck storage, equipment storage, and/or administrative presence.

- **Eliminate Use of the Site** – As previously noted, an alternative option is for ODOT to eliminate a site from support operations entirely. In this scenario all snow and ice control operations would be run out of the originating full-service garage.

Methodology

This section of the performance audit, **Operations Support Cost/Benefit Analysis**, seeks to develop a cost/benefit analysis model to better inform facilities planning for support sites. Data and information necessary to develop the model was obtained from ODOT's Office of Facilities Management, the Enterprise Information Management System, and supplemented by information from District 10 and Hocking County leadership. Primary analysis focused on current site location, type, and use data from FY 2015-16 as well as cost and operating data from FY 2014-15, the last full year of data available at the time of this analysis.

For modeling purposes, the Laurelville Outpost in Hocking County was selected based on the following factors:

- **Age** – Facilities that are close to, or exceed, the DAS and OBM estimated useful life of 45 years;
- **Planned Replacement** – Facilities that are not already scheduled to be replaced (see **Capital Planning and Budgeting**); and
- **Available Data and Information** – Facilities with necessary operations and cost data and information readily available (see **Operational Data Quality**).

This cost/benefit analysis was supported by six main sub-analyses, organized into four main categories, including:

[18] Cycle time is the measure of how long it takes a snow plow truck to complete one snow and ice control route from the time it leaves a full-service garage, outpost, or yard until the end of the route.

Site Utilization Scenario Options

- This sub-analysis identifies the options for support of snow and ice control which are available to ODOT at the Laurelville site and the conceptual costs and benefits associated with each.

Deadhead Cost Components

- This sub-analysis calculates Hocking County-specific costs per deadhead mile. To begin, this entails calculating a regular labor cost per mile and an overtime labor cost per mile. Then, each cost per mile has an average equipment rate applied to obtain a total regular cost per mile and a total overtime per mile.[19]

Deadhead Cost by Site Utilization Scenario

- This sub-analysis first calculates the current-state cost of deadhead mileage incurred for all routes in Hocking County per cycle, per weather event, and per snow and ice control season.
- Second, this sub-analysis calculates a future-state cost of deadhead mileage for all routes in Hocking County when utilizing the Laurelville site as a yard. This scenario assumes all snow and ice routes will originate out of the HCFSG. Like the current state, these costs were also calculated per cycle, per weather event, and per snow and ice control season.
- Finally, this sub-analysis calculates an alternative future-state cost of deadhead mileage for all routes in Hocking County assuming that all snow and ice control routes originate out of the HCFSG with no operational support from a yard or outpost.

Cost Differential of Site Utilization Scenarios

- This sub-analysis first calculates ODOT's cost to construct and maintain a yard, coupled with the additional deadhead mileage incurred from utilizing the Laurelville site as a yard.
- Second, the sub-analysis calculates the cost of reconstructing and maintaining a new Laurelville Outpost in order to maintain the current-state deadhead mileage and cost.
- Finally, the sub-analysis compares the cost of the two scenarios to assess which scenario provides the most cost-effective option.

[19] Each year, ODOT's Office of Equipment Management calculates standard equipment rates by dividing total miles driven by the fiscal year total cost of each type of equipment used. Cost components of this calculation include fuel, parts, labor, overhead, and depreciation.

Analysis

Site Utilization Scenario Options

The initial step toward performing this analysis was to identify the effects that ODOT's various site-utilization scenario options have on snow and ice control so that they can be properly assessed as part of a cost/benefit model. All three scenarios are comprised of direct economic costs and benefits. As a result, ODOT must fully calculate and consider these costs, allowing the subsequent net annual and lifecycle benefits to inform its facilities planning process.

- ***Scenario A – Reconstruct the Outpost***

The purpose of the current Laurelville Outpost is to keep deadhead mileage low on two specific snow and ice control routes in Hocking County. The benefit of keeping deadhead mileage low is two-fold – cost avoidance and shorter cycle times. Deadhead mileage represents non-productive cost and lost time, as such, ODOT has historically operated a substantial number of outposts in order to minimize this cost.[20] Additionally, maintaining shorter cycle times enables ODOT to more easily address internal qualitative goals.[21] Currently ODOT continues to prioritize these operational benefits by temporarily housing two trucks at the Laurelville Outpost, which provide service on two nearby snow routes. However, in order to maintain the status quo with regard to generating these perceived benefits, ODOT must invest money in planning, reconstruction, and annual site maintenance of the Laurelville Outpost.

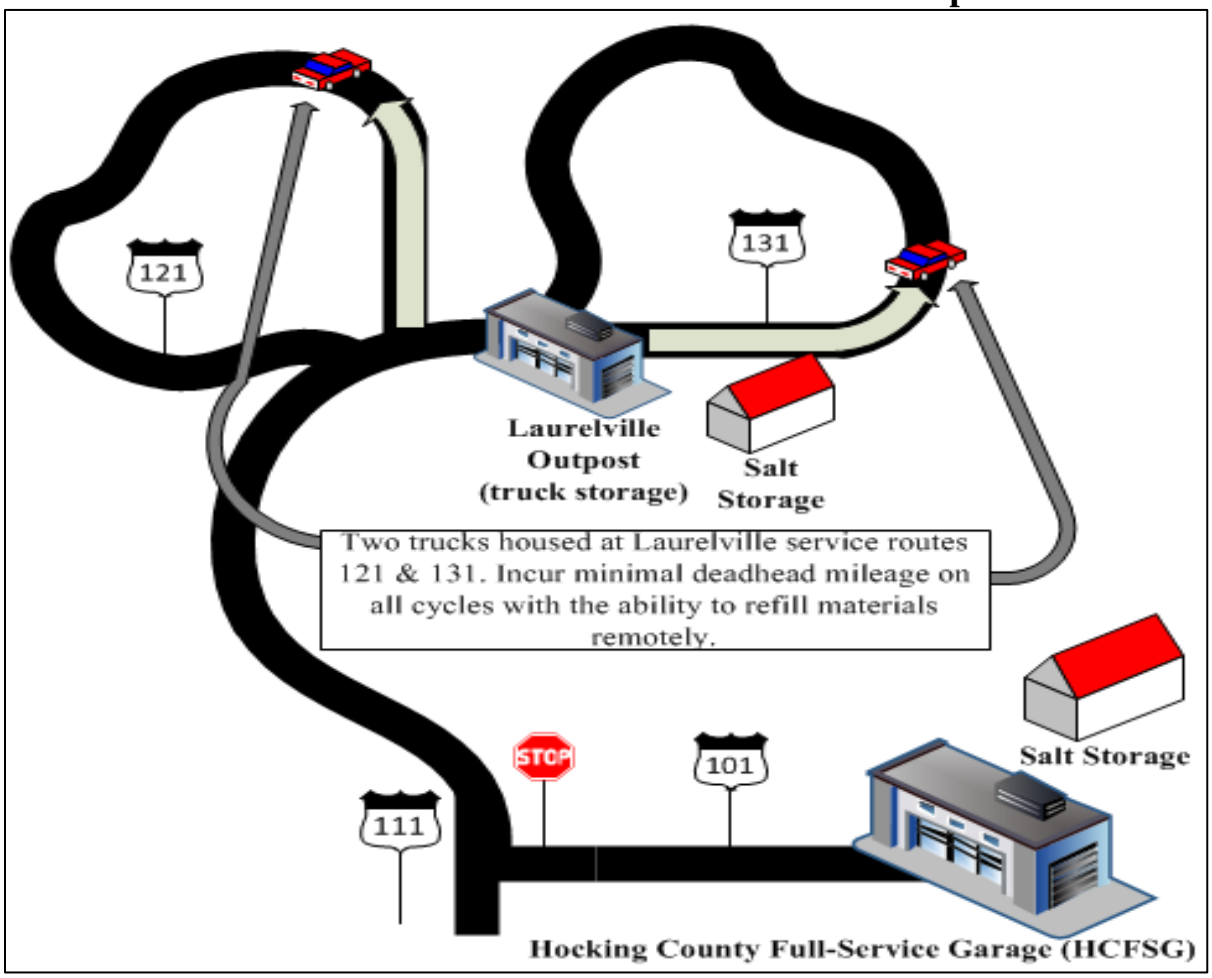
Exhibit 3-1 shows an illustration of the manner in which current-state snow and ice control is undertaken on the two routes supported by the Laurelville Outpost.[22] This visual representation is important to understanding the complex relationship between operations and support sites.

[20] There are currently 100 outposts across the state.

[21] Goals include maintaining clear pavement when practical and maintaining traffic speeds and movement on roadways throughout a weather event.

[22] During a snow and ice control weather events, ODOT typically deploys personnel in two, 12-hour shifts in order to provide consistent route coverage.

Exhibit 3-1: Scenario A – Current-State Laurelville Outpost Utilization



Source: ODOT and OPT
Note: Map features and scale are representational only.

As shown in **Exhibit 3-1**, the two trucks which perform snow and ice control on state routes 121 and 131 are temporarily stored at, and originate from, the Laurelville Outpost during the snow and ice control season. In addition to storage, the Laurelville Outpost provides efficient access to salt and materials during weather events which help to minimize the potential for deadhead.

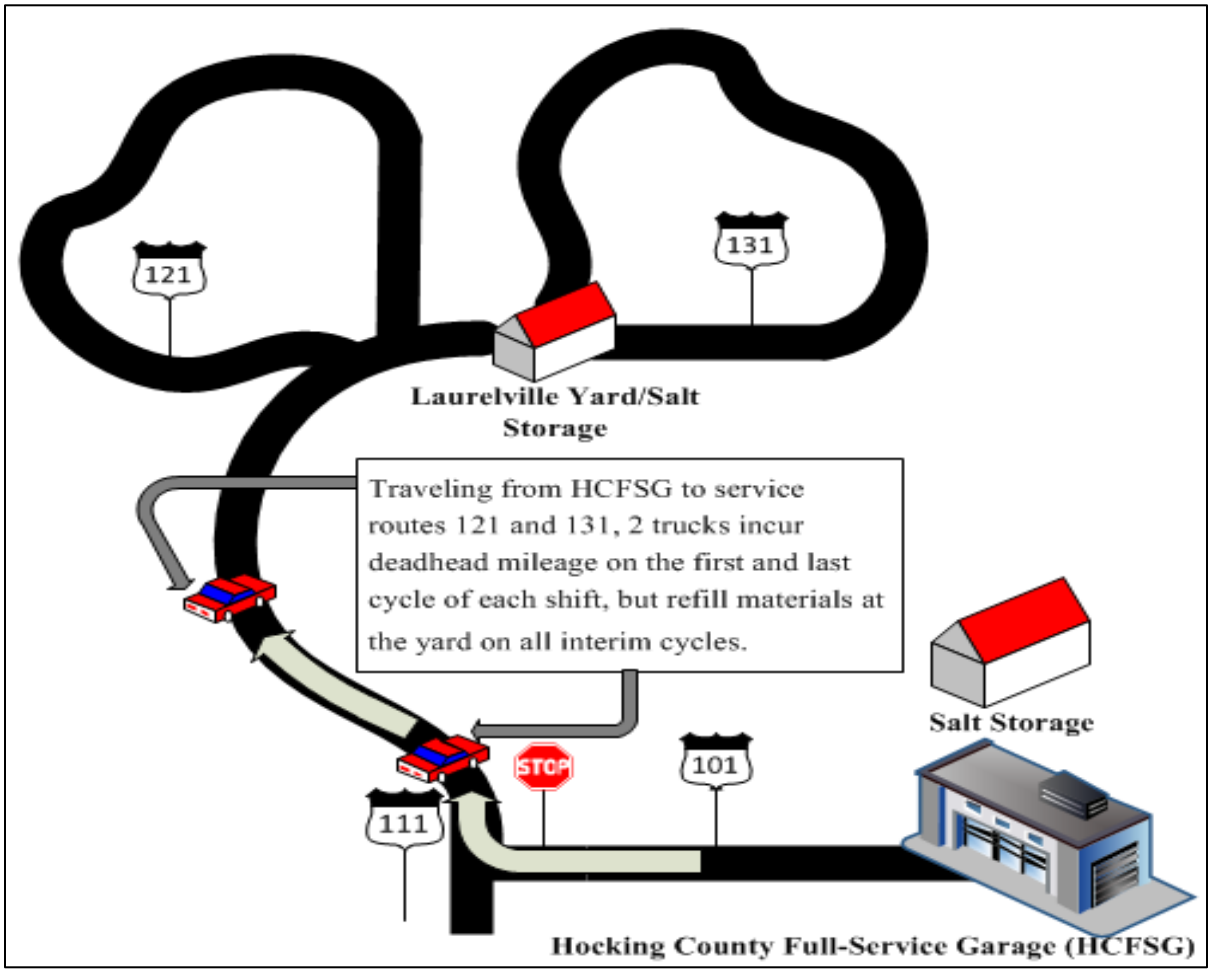
- ***Scenario B – Repurpose the Site as A Yard***

As previously noted, a yard serves a similar support function as an outpost (i.e., access to salt and materials to minimize deadhead), but typically with fewer buildings and no truck storage. If the Laurelville site were repurposed as a yard, the two routes could still benefit from the reduced deadhead associated with refilling at this location. The trucks would be stored at the HCFSG, so deadhead mileage and cost would be incurred on the first and last cycles of each shift. These trucks would utilize the Laurelville Yard to refill on snow and ice control materials during a weather event on all interim cycles. Thus, all interim cycles would incur the same deadhead mileage and cost as is currently incurred utilizing the Laurelville Outpost. In this scenario,

ODOT would realize the benefit of a reduced investment in planning, construction, and annual site maintenance which result from having fewer and smaller buildings on the site.

Exhibit 3-2 shows an illustration of the potential snow and ice scenario with the two snow routes being supported by a Laurelville Yard. This visual representation is important to understanding the complex relationship between operations and facilities and serves as a tangible demonstration of an option that ODOT could seek to repurpose the Laurelville site.

Exhibit 3-2: Scenario B – Future-State Laurelville Yard Utilization



Source: ODOT and OPT
Note: Map features and scale are representational only.

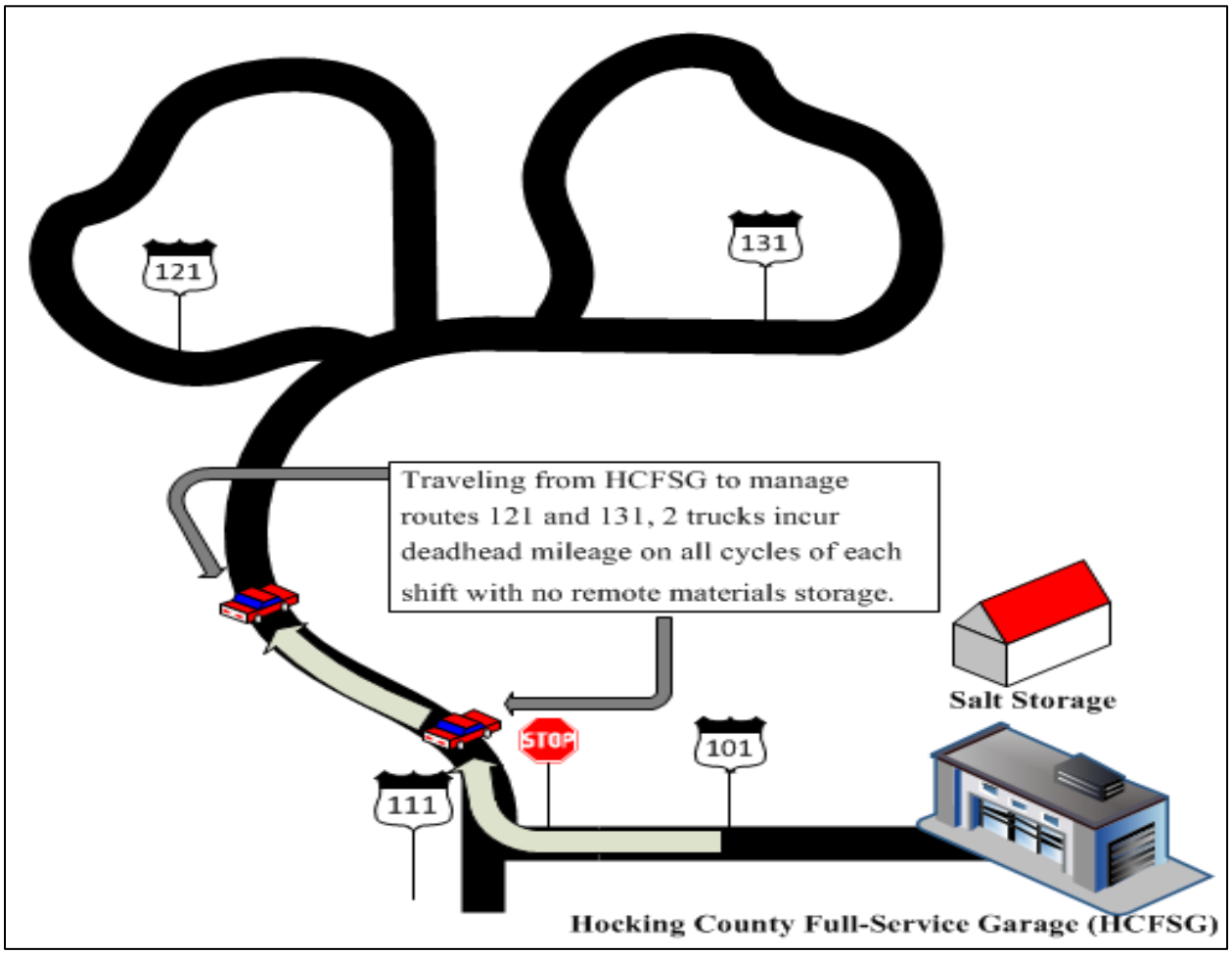
As shown in **Exhibit 3-2**, the two trucks which perform snow and ice control on routes 121 and 131 would be stored at, and originate from, the HCFSG. These trucks would incur deadhead mileage to begin their first cycle while traveling to the beginning of the routes, as well as at the end of their last cycle while traveling back to the HCFSG for storage.

- ***Scenario C – Eliminate Use of the Site***

Alternatively, eliminating the use of this site entirely would require all operations to originate from, and be supported by, the HCFSG. This is similar to Scenario B in that all truck storage would be at the HCFSG, but would significantly increase deadhead, relative to Scenario B, by requiring the two trucks to return to the HCFSG for salt and materials between each interim cycle. This scenario would enable the Department to fully avoid the costs of planning, construction, and annual site maintenance of an operations support site. However, deadhead mileage and cost on the two routes would increase on all cycles, and the ability to respond in a timely manner, an ODOT measure of service quality, would be diminished.

Exhibit 3-3 shows an illustration of the manner in which future-state snow and ice control could be undertaken with the two snow routes being fully operated out of and supported by the HCFSG. This visual representation is important to understanding the complex relationship between operations and facilities and serves as a tangible demonstration of the way ODOT could divest itself from operations support at the Laurelville site.

Exhibit 3-3: Scenario C –Future-State No Laurelville Site Utilization



Source: ODOT and OPT
Note: Map features and scale are representational only.

As shown in **Exhibit 3-3**, the two trucks which perform snow and ice control on routes 121 and 131 would be stored at, and originate from, the HCFSG. With no operational support, aside from the HCFSG, these trucks would incur deadhead mileage on all cycles by returning to the HCFSG to refill on salt and materials.

As these scenarios show, there are tradeoffs between operational needs and cost implications that influence the overall cost effectiveness of decisions concerning capital planning for support sites.

Deadhead Cost Components

As shown, there are scenarios (i.e., Scenarios B and C) which would increase deadhead mileage on two routes. It is important to note that deadhead mileage is variable while treated mileage is fixed since routes are fixed regardless of a truck's originating or support location.[23] As such, this analysis only focuses on the occurrence and cost of deadhead mileage as it is the only portion which varies based on site utilization.

Table 3-1 shows Hocking County's average labor, including regular and overtime, and equipment costs per mile, as well as a total average cost per mile for FY 2014-15. In addition, the difference in the total average cost per mile for regular wages versus overtime wages is shown to demonstrate the potential for variability during a weather event when overtime is more likely to be incurred. Wage type becomes a factor in the analysis as overtime labor is used to calculate costs of deadhead mileage in the future state. This is due to greater utilization of overtime labor being a potential way in which ODOT could choose to mitigate increased cycle times on the first and last cycles of the two snow routes currently supported by the Laurelville Outpost.

Table 3-1: Calculation of Total Cost per Deadhead Mile

Labor Cost per Mile	Cost
Regular labor cost per mile	**$0.64**
Overtime labor cost per mile	**$0.97**
Equipment Cost per Mile	**Cost**
Single axle dump truck cost per mile	$2.85
Tandem axle dump truck cost per mile	$3.00
Average equipment cost per mile	**$2.93**
Total Cost per Mile	**Cost**
Regular - Labor and equipment cost per mile	**$3.57**
Overtime - Labor and equipment cost per mile	**$3.89**
Cost Difference per Mile	**$0.32**

Source: ODOT

[23] Treated lane mileage is the sum of mileage accrued when a snow and ice truck is servicing a route by plowing snow and/or applying snow and ice control materials. Due to the cost of salt and materials each treated mile is significantly more costly than a deadhead mile.

As shown in **Table 3-1**, the average overtime cost per mile was $3.89, which was $0.32, or 9.0 percent, more per mile than the regular cost per mile of $3.57. As truck and equipment cost are constant, regardless of regular or overtime, this difference is due to each overtime labor hour being 50.0 percent more costly than each regular labor hour. Showing the calculation of the regular labor and equipment cost per mile as well as the overtime labor and equipment cost per mile are integral to understanding the components which make up the total costs of deadhead mileage.

Deadhead Cost by Site Utilization Scenario

Table 3-2 shows current-state deadhead mileage and cost for all truck routes in Hocking County. This provides a baseline measure of current deadhead cost and mileage against which alternative, future-state scenarios will be compared.

Table 3-2: Scenario A Deadhead Cost by Route

Route Number	Miles per Route	Cost per Cycle	Cost per Event [1]	Cost per Season [2]
1	0.0	$0.00	$0.00	$0.00
2	3.6	$12.84	$102.72	$3,595.20
3	3.6	$12.84	$102.72	$3,595.20
4	24.0	$85.58	$684.64	$23,962.40
5	6.0	$21.40	$171.20	$5,992.00
6	8.0	$28.53	$228.24	$7,988.40
7	14.0	$49.92	$399.36	$13,977.60
8	23.0	$82.02	$656.16	$22,965.60
9	12.0	$42.79	$342.32	$11,981.20
10	12.0	$42.79	$342.32	$11,981.20
11	0.0	$0.00	$0.00	$0.00
12	6.0	$21.40	$171.20	$5,992.00
			Total Current State	**$112,030.80**

Source: ODOT

[1] District 10 leadership indicated eight cycles per event as a representative average. Therefore, the cost per event was calculated by multiplying each route's cost per cycle by eight cycles.

[2] District 10 leadership indicated 35 weather events per season as a representative average. Therefore, the cost per season was calculated by multiplying each route's cost per event by 35 events.

As shown in **Table 3-2**, the total deadhead mileage cost incurred by Hocking County snow and ice control activities is estimated to cost just over $112,000 each season.

Table 3-3 shows two future-state options and how those options affect a limited number of routes (i.e., only routes 11 and 12). Both future-state options involve originating routes 11 and 12 from the HCFSG, but the first option shows the impact of completely eliminating a support site while the second option shows the impact of using the Laurelville site as a yard.[24] These

[24] In the future-state scenarios, the Department may incur additional overtime pay in order to maintain the current-state quality of service delivery given higher cycle times. Based on this assumption, the conservative measure was taken to calculate all future-state deadhead cost at the overtime labor and equipment cost per mile.

scenarios are important as they show the key operating cost differences associated with different support site alternatives.

Table 3-3: Scenarios B and C Deadhead Cost Impact

	Miles per Route	Cost per Cycle	Cost per Event	Cost per Season
Scenario B - Originating from the HCFSG and Utilizing a Yard on the Laurelville Site [1]				
Current-State Total Routes 1 through 10	106.2	$378.71	$3,029.68	$106,038.80
Future-State Route 11	40.8	$158.85	$635.40	$22,239.00
Future-State Route 12	46.8	$182.20	$728.80	$25,508.00
Total Scenario B	**193.8**	**$719.76**	**$4,393.88**	**$153,785.80**
Difference Versus Scenario A	**81.6**	**$319.66**	**$1,193.00**	**$41,755.00**
Scenario C - Originating from the HCFSG with No Support Site [2]				
Current-State Total Routes 1 through 10	106.2	$378.71	$3,029.68	$106,038.80
Future-State Route 11	40.8	$158.85	$1,270.80	$44,478.00
Future-State Route 12	46.8	$182.20	$1,457.60	$51,016.00
Total Scenario C	**193.8**	**$719.76**	**$5,758.08**	**$201,532.80**
Difference Versus Scenario A	**81.6**	**$319.66**	**$2,557.20**	**$89,502.00**

Source: ODOT

[1] Deadhead cost per cycle was multiplied by only four cycles per event in Scenario B. This results from the fact that deadhead mileage would only be incurred on the first and last trips of each shift, with two shifts in a work day. The cost per season was still calculated by multiplying each route's cost per event by 35 events.

[2] Scenario C uses the same eight cycles per event and 35 weather events per season multipliers that were used in Scenario A.

As shown in **Table 3-3**, under Scenario B, when all routes originate from the HCFSG, but utilize a yard at the Laurelville site, total deadhead cost per season increases by $41,756, or 37.3 percent. Alternatively, under Scenario C, when all operations use only the HCFSG, total deadhead cost per season increases by $89,502, or 79.8 percent. The key difference between Scenario B and C is that Scenario C projects that the Department will incur deadhead mileage and cost on all cycles of a weather event, rather than just the first and last cycles of each shift during an event.

Based on the substantial annual relative cost preference of Scenario B versus Scenario C, further analysis on long-term cost differential was limited to Scenario B versus the re-built outpost option of Scenario A.

Cost Differential of Site Utilization Scenarios

Table 3-4 shows a cost/benefit analysis that weighs the operational and financial merits of continuing to undertake snow and ice control by operating the Laurelville site as an outpost versus repurposing the site as a yard. Given the current age of the site, both scenarios account for upcoming capital replacement needs; however, the yard scenario will require a change to current operations and, as such, will result in different route and deadhead mileages. In summary, this analysis shows the long-term cost/benefit of building a more costly, but more operationally efficient outpost, versus a less costly, but also less operationally efficient yard.

Table 3-4: Cost/Benefit of New Outpost or Use of Yard

Cost Implication of Deadhead Mileage	Repurposed Yard	Re-built Outpost
Average annual additional deadhead mileage cost	**$41,755**	**$0**
Lifecycle additional deadhead mileage cost [1]	**$1,878,975**	**$0**
Cost Implication of New Salt and Materials Storage Structures		
Total interest and cost to construct salt and materials storage structure	$224,545	$224,545
Cost of salt and materials storage structure re-build [2]	$293,558	$293,558
Lifecycle cost of maintenance on salt and materials storage structure	$494,968	$494,968
Lifecycle total cost of ownership for salt and materials storage structure	**$1,013,071**	**$1,013,071**
Cost Implication of Remaining Outpost Structures		
Total interest and cost to construct new outpost equipment and personnel structures	$0	$1,499,667
Lifecycle cost of maintenance on outpost equipment and personnel structures	$0	$3,305,740
Lifecycle Total Cost of Ownership for new outpost structures	**$0**	**$4,805,407**
Total Cost Implication of Site Decision		
Total Lifecycle Cost of Construction, Interest, and Maintenance	$1,013,071	$5,818,478
Total Lifecycle Cost of Additional Deadhead Mileage	$1,878,975	$0
Total Lifecycle Cost of Site Utilization	**$2,892,046**	**$5,818,478**
Total Savings/(Loss) Over 45 Year Lifecycle of Repurposed Yard		**$2,926,432**
Average Annual Savings/(Loss) Over 45 Year Lifecycle		**$65,031**

Source: ODOT
Note: Cost figures are shown in non-inflation adjusted dollars.
[1] Lifecycle cost is estimated over 45 years commensurate with the expected useful life of the site.
[2] ODOT salt and materials storage structures have a DAS estimated useful life of 15 years. Over the 45 year lifecycle of an outpost, which is the baseline for this analysis, the salt and materials storage structures would need to be re-constructed twice. However, the two re-builds have subtracted out the initial cost of concrete slab on which to build as the concrete slab has an estimated useful life of 50 years.

As shown in **Table 3-4**, the lifecycle cost savings of utilizing the Laurelville site as a yard versus constructing a new outpost would be more than $2.9 million or an average of $65,000 per year over 45 years.

Conclusion

ODOT currently lacks a standardized, uniformly-applied method for distilling complex operational and capital planning decision points down into quantitative, data-driven alternatives. Evaluating sites to assess the relative cost/benefit of alternatives could result in significant efficiencies over the lifecycle of each site. By discontinuing the operation of the Laurelville Outpost in favor of a yard on the same site, the Department would incur additional deadhead miles and cost but would ultimately gain a net benefit of reduced overall expenditures due to decreases in construction, annual site maintenance, and operating costs.

Recommendation Overview

Recommendation R3: ODOT should incorporate formal cost/benefit analyses into the facilities planning process in order to identify and implement opportunities for greater efficiency and effectiveness. These analyses should use data and information from operations, primarily snow and ice control (**see Operational Data Quality**), **as well as facilities** (**see Data Quality**), **to assess the business needs and evaluate the relative costs and benefits of alternative facility options.**

One opportunity already identified is to repurpose the Laurelville Outpost, which has surpassed its estimated useful life, as a yard in order to reduce overhead costs while still meeting operational needs.

Financial Implication R3: By repurposing the Laurelville Outpost site as a yard rather than reconstructing an outpost, ODOT can avoid considerable construction and annual site maintenance costs. However, in obtaining this benefit the Department will incur additional operating costs. The net result is that the Department will realize an average annual net savings of $**65,000**.

R4. Capital Planning and Budgeting

Section Overview

This section analyzes the Ohio Department of Transportation's (ODOT, or the Department) facilities realignment progress to date and opportunities for continuous improvement through the following five sub-analyses:

- **Site Replacement Age fiscal year (FY) 2010-11 through FY 2017-18 –** This sub-analysis provides a detailed overview for the overall age of the Department's building portfolio, taking into account planned replacements through FY 2018-19.
- **Facility Condition Index and Deferred Maintenance –** This sub-analysis uses facilities assessment to calculate the cost of deferred maintenance. In addition, this section will analyze the relationship between major component replacements and facility age.
- **Future Capital Budgeting –** This sub-analysis compares the Department's expected capital budgeting after FY 2018-19 to the projected need for capital expenditures.
- **Data Optimized Prioritization –** This sub-analysis explores the potential benefits of using an industry standard method to prioritize capital investments in the future.
- **Cost/Benefit of Replacement Strategies –** This sub-analysis compares the relative costs and benefits of various site replacement strategies.

Recommendation Overview

Recommendation R4: ODOT should develop a consistently applied, data-driven process to guide capital planning and budgeting decisions. The process should involve input from key stakeholders, including Central Office, district, and county leadership, in order to identify key metrics to assess which sites are most critical to the Department's mission. At a minimum, the process should include a standardized method to:

- **Evaluate each site's conditions and assessing deferred maintenance;**
- **Evaluate each site's purpose in meeting the Department's mission; and**
- **Compare all sites, as well as alternative options, such as replacing outposts with yards where possible, in order to optimize capital investment.**

Financial Implication R4: Employing this type of data-driven approach could result in average annual savings of up to **$3.5 million** by replacing 34 outposts with less-costly yards.

Background

ODOT is responsible for 337 statewide operational and support locations and sites. The Department's sites serve a variety of purposes including communications, traveler safety, and supporting ODOT's operations (e.g., highway maintenance and snow and ice control). Of these sites, 199, or 59.2 percent, are full-service garages and outposts which are used to support highway maintenance and snow and ice control. Because full-service garages and outposts support highways, the construction of full-service garages and outposts followed historical highway construction trends. As a result, 57 full-service garages and outposts, or 28.6 percent, were built during the 1960s (i.e., when the interstate highway system was being built), and a total of 69 sites, or 34.7 percent, were built before 1969 (see **Report Background**).

DAS and OBM recognize that most buildings have an estimated useful life of 45 years. Buildings nearing the end of the useful lifecycle can be expected to require either a significant capital reinvestment to replace aging components (i.e., Heating Ventilation Air Conditioning (HVAC) systems, plumbing, etc.) or a full replacement. Because of the connection between site age and expected capital investments, a calculation of site age is a logical first step in any analysis of capital planning and/or budgeting.

Table 4-1 shows a breakdown of age ranges for full-service garages and outposts over the last four calendar years (CY), CY 2014 through CY 2016. By showing four consecutive years, this table provides context on how the count of sites in each age range has changed over time.

Table 4-1: Full-Service Garages and Outposts by Age

	CY 2014		CY 2015		CY 2016		CY 2017	
Age	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Full-Service Garages								
0 to 10	20	20.2%	24	24.2%	31	31.3%	30	30.6%
11 to 20	15	15.2%	14	14.1%	19	19.2%	19	19.4%
21 to 30	25	25.3%	24	24.2%	20	20.2%	18	18.4%
31 to 40	10	10.1%	11	11.1%	13	13.1%	15	15.3%
40 to 45	8	8.1%	8	8.1%	5	5.1%	2	2.0%
45+	21	21.2%	18	18.2%	11	11.1%	14	14.3%
Sub-Total	**99**	**100.0%**	**99**	**100.0%**	**99**	**100.0%**	**98**	**100.0%**
Outposts								
0 to 10	4	4.0%	4	4.0%	8	8.0%	8	8.1%
11 to 20	7	7.1%	5	5.1%	4	4.0%	4	4.0%
21 to 30	16	16.2%	18	18.2%	19	19.0%	16	16.2%
31 to 40	6	6.1%	5	5.1%	2	2.0%	5	5.1%
40-45	12	12.1%	13	13.1%	9	9.0%	6	6.1%
45+	54	54.5%	54	54.5%	58	58.0%	60	60.6%
Sub-Total	**99**	**100.0%**	**99**	**100.0%**	**100**	**100.0%**	**99**	**100.0%**
Total	**198**	**N/A**	**198**	**N/A**	**199**	**N/A**	**197**	**N/A**

Source: ODOT

As shown on **Table 4-1**, 14 full-service garages, or 14.3 percent, and 60 outposts, or 60.6 percent will be over 45 years of age by CY 2017. Many full-service garages have been built in the past ten years and older facilities are more evenly distributed in age. In contrast, over half of the outposts are currently above the expected useful life of 45 years. The relatively advanced age of outposts means that any efforts to address the Department's capital planning and budgeting will necessarily have to address a large number of outposts.

In order to address the challenges of planning and budgeting for such a large and complex portfolio of aging sites, the Department undertook a Master Planning Process starting in FY 2010-11. The process was multi-faceted, involving input from employees involved in operations and facilities management. In addition to seeking input from internal facility users, ODOT also contracted with the University of Akron to assess the benefits of using Global Positioning System/Automatic Vehicle Location to optimize snow and ice control (see **Operations Support Cost/Benefit Analysis**). Overall, the Department sought to replace aging sites, reduce costs by using more effective construction techniques, replace outposts with yards, and align the entire portfolio of sites to match current operational demands. Because snow and ice control was recognized as a core function of ODOT, the operational demands of snow and control were prioritized in the planning process.

To finance the Master Planning Process, the Department raised a total of $200 million through the sale of two bonds in FY 2013-14 and FY 2016-17 (see **Report Background**). The Department projects that all bond funds will be expended by the end of FY 2018-19. After the bond funds are expended, the Department will return to its historic practice of funding capital replacements from the Highway Operation Fund, which also funds Department operations more generally.

Table 4-2 shows actual and planned full-service garage replacements from FY 2013-14 through FY 2017-18.

Table 4-2: Full-Service Garages Actual and Planned Replacements

District	Site Name	Fiscal Year
2	Lucas County Full-Service Garage	2013-14
3	Wayne County Full-Service Garage	2013-14
11	Jefferson County Full-Service Garage	2013-14
12	Euclid Full-service Garage	2013-14
6	Madison County Full-Service Garage	2014-15
9	Highland County Full-Service Garage	2014-15
3	Crawford County Full-Service Garage	2015-16
8	Warren County Full-Service Garage	2015-16
10	Athens County Full-Service Garage	2015-16
11	Columbiana County Full-Service Garage	2015-16
1	Paulding County Full-Service Garage	2016-17
2	Fulton County Full-Service Garage	2016-17
2	Sandusky County Full-Service Garage	2016-17
5	Coshocton County Full-Service Garage	2016-17
6	Fayette County Full-Service Garage	2016-17
7	Darke County Full-Service Garage	2016-17
9	Adams County Full-Service Garage	2016-17
9	Brown County Full-Service Garage	2016-17
11	Tuscarawas County Full-Service Garage	2016-17
3	Medina County Full-Service Garage	2017-18
4	Portage County Full-Service Garage	2017-18
8	Greene County Full-Service Garage	2017-18
10	Washington County Full-Service Garage	2017-18
10	Monroe County Full-Service Garage	2017-18
11	Carroll County Full-Service Garage	2017-18
5	Perry County Full-Service Garage	2017-18
6	Union County Full-Service Garage	2017-18
7	Lyons Road Full-Service Garage	2017-18

Source: ODOT
Note: The exact locations that will be replaced and the exact date of construction may be subject to change.

As shown in **Table 4-2**, the Department either has either already replaced or has budgeted for the replacement of 28 full-service garages through FY 2017-18.

Table 4-3 shows similar data for outposts.

Table 4-3: Outposts Actual and Planned Replacements

District	Site Name	Fiscal Year
1	Forest Outpost	2013-14
4	North Lima Outpost	2013-14
5	Dresden Outpost	2014-15
6	Chesterville Outpost	2015-16
12	Warrensville Outpost	2015-16
1	Hicksville Outpost	2016-17
2	North Baltimore/Van Buren Shared Outpost	2016-17
3	Grafton Outpost	2016-17
8	Wright State Outpost[1]	2016-17
4	Stark Outpost	2017-18

Source: ODOT
Note: The exact locations that will be replaced and the exact date of construction may be subject to change.
[1] This is a shared project between ODOT and Wright State University.

As shown in **Table 4-3**, the Department either has either already replaced or has budgeted for the replacement of 10 outposts through FY 2017-18. Due to the relatively advanced age, outposts will continue to constitute the bulk of sites that are at or beyond 45 years of age. By FY 2017-18 there will be 60 outposts at or above 45 years of age.

When considered together, **Table 4-2** and **Table 4-3**, show that the Department either has constructed or has plans to construct 28 full-service garages and 10 outposts between FY 2013-14 and FY 2017-18. ODOT also projects spending a total of $1.6 million to acquire land for future projects. Overall, the Department has either spent or is projected to spend more than $265.5 million on site replacement and/or construction between FY 2013-14 and FY 2017-18.

Table 4-4 shows the effect of the Master Planning Process on the count and percent distribution of each type of site statewide beginning in FY 2012-13, prior to the infusion of bond funds and as compared to FY 2016-17. Showing how the count and type of facilities is projected to change over time, this table helps demonstrate whether the Department is aligning with the goal of increasing the use of yards.

Table 4-4: Site Realignment Before and After Bond Period

	FY 2012-13		FY 2016-17	
	Count	%	Count	%
Full-service	100	42.9%	98	41.5%
Outpost	100	42.9%	99	41.9%
Yard	21	9.0%	27	11.4%
Headquarters	12	5.2%	12	5.1%
Total	**233**	**100.0%**	**236**	**100.0%**

Source: ODOT

As shown in **Table 4-4**, from FY 2012-13 to FY 2016-17, ODOT experienced a net increase of three total sites, from 233 to 236. However, the net increase was the direct result of six additional yards, offset by a decrease of two full-service garages and one outpost. In FY 2012-13, yards

represented 9.0 percent of all active sites involved in snow and ice control. By FY 2016-17, yards will account for 11.4 percent of all snow and ice control sites. In this manner, ODOT is on track to meet the goal of increasing the use of yards; however, ODOT does not currently have any further, specific plans to decommission additional outposts in favor of yards. While additional opportunities to do so exist, each opportunity should be closely evaluated through a data-driven, cost/benefit approach (see **Operations Support Cost/Benefit Analysis**).

As part of the Master Planning Process, the Department conducted site condition assessments on 77 full-service garages and 93 outposts from FY 2010-11 through FY 2012-13. Sites were selected for assessment based on two criteria:

- Over seven years of age; and
- Not already slated for replacement.

Site condition assessments consisted of technical evaluations of the buildings and component systems (e.g., HVAC, electrical, plumbing, etc.). ODOT's practice has been to make replacement decisions using visual inspections and in consultation with district management. However, the Department has not, as of yet, applied a consistent, quantitative method to evaluate all possible replacement decisions before making a selection. In addition, the Department may lack key data that, if available, would be helpful in informing more data-driven capital planning decisions (see **Data Quality** and **Operations Data Quality**).

Table 4-5 shows the number of full-service garages and outposts that received an assessment compared to facilities selected for replacement between FY 2012-13 and FY 2017-18. By showing facilities replaced without a formal assessment, this table helps to demonstrate the magnitude of the risk that the Department could make a sub-optimal replacement decision.

Table 4-5: Full-Service Garages and Outposts Assessed

Full-Service Garages	Replaced	Not Replaced	Total	% Replaced
Assessed	15	62	77	19.5%
Not Assessed	18	4	22	81.8%
Sub-Total	**33**	**66**	**99**	**33.3%**
Outposts				
Assessed	5	88	93	5.4%
Not Assessed	4	2	6	66.7%
Sub-Total	**9**	**90**	**99**	**9.1%**
Total Sites	**42**	**156**	**198**	**21.2%**

Source: ODOT

As shown in **Table 4-5**, 18, or 55.0 percent, of full-service garages and 4, or 44.4 percent, of outposts replaced were not formally assessed during the Master Planning Process. The selection and replacement of a relatively large number of facilities with no assessments suggests that the Department may have incurred potentially unnecessary risk of sub-optimizing new construction during the most recent phase of the Master Planning Process.

ODOT has made significant efforts to meet the needs for new construction since the Master Planning Process began in FY 2010-11. Between FY 2013-14 and FY 2016-17, the Department has spent or is projected to spend $265.8 million to replace a total of 28 full-service garages and 10 outposts and acquire additional land. Furthermore, the Department has added a net of three yards, which were used to reduce the total portfolio of outposts. In addition to new construction, the Department also completed a total of 170 site assessments. This review of ODOT's recent progress also shows that while significant progress has been made, the Department could have additional opportunities to create a more rigorous, consistently applied, data-driven process. Following analysis will focus on the potential for the Department to improve the data-driven management of the capital planning and budgeting process.

Methodology

This section, **Capital Planning and Budgeting** analyzes ODOT's facilities realignment progress to date and identifies opportunities for continuous improvement and a more data-driven capital planning and budgeting process. The scope of this analysis is specifically focused on full-service garages and outposts as these sites are instrumental to snow and ice control.[25] The analysis is divided into five sub-sections with descriptions as follows.

Site Replacement Age

Each ODOT site is made up of a number of buildings (e.g., garages, salt barns, etc.) and each building has an expected useful life. As such, the first step in this analysis was establishing a full inventory of ODOT's sites, including the age of each building. The timeframe for data sources is primarily FY 2015-16, but a rolling site inventory was also created for FY 2012-13 through FY 2017-18 based on recently completed and planned construction projects. A list of the recent construction projects with completion dates and estimated costs was obtained from ODOT. Any available final costs for these recent projects was obtained from the Ohio Facilities Construction Commission (OFCC) in order to determine the per square foot costs of the most recent projects. The completed inventory includes the following elements:

- Site type (e.g., full-service garage, outpost, yard, etc.);
- Cost of construction, when available;
- Location, including district and county;
- Acquisition date; and
- Square footage.

[25] This report focuses on sites involved in snow and ice control rather than all buildings or assets. ODOT has other central office and district headquarters buildings as well as significant infrastructure (e.g., bridges, roadways, etc.), land, equipment, and other types of assets which were outside the scope of this performance audit and were not evaluated in this report but do represent current and future capital and maintenance and repair needs. Furthermore, though they were not evaluated in this performance audit, similar conditions such as those identified in this performance audit (e.g., historical lack of a comprehensive management plan, assets exceeding estimated useful life, lack of plan for future site condition assessments, etc.) appear to apply to other facilities and assets. The asset management leading practices identified in this report should be applied to all other operational areas within the Department as appropriate.

Analysis of the current inventory focuses on evaluating current practices and projecting the likely need for capital replacement during the current timeframe (i.e., FY 2016-17) and the timeframe following the expenditure of the bond funding (i.e., post FY 2018-19). As part of the Master Planning Process, in 2013 ODOT calculated the average age of all sites with the goal of keeping the average age of all sites at 25 years of age in order to balance the need for capital investment. In this analysis, the 25 year goal was applied to each district as well as each type of site. Furthermore, recent replacements were also evaluated to calculate the actual age at replacement under current practice, which was then compared to the expected useful life recognized by OBM and DAS. Finally, an analysis was conducted to project how many sites would be at or beyond replacement age by FY 2018-19.

Future Capital Budgeting

Using the detailed information on the existing facilities portfolio, projections were made concerning the type and size of facilities that would need to be replaced each year for the 45 years following the end of the bond funded construction period (i.e., post FY 2018-19). The projected capital needs were then compared to the projected capital budget for FY 2018-19 through FY 2021-22, developed based on a continuation of recent trends, to assess the extent to which likely available funding would be sufficient to address likely capital needs.

Facility Condition Index (FCI) and Deferred Maintenance (DM)

During FY 2011-12 and FY 2012-13, the Department undertook a thorough assessment of 77 full-service garages and 93 outposts. Sites that were more than seven years of age and not already slated for replacement were selected for assessment. For each site, the assessments evaluated each component (e.g., HVAC system, plumbing, roof, asphalt, salt barns, etc.), including the structure itself. The assessment of each component also included an estimate of the remaining useful life and an estimated replacement cost. Components that required no attention for the foreseeable future were noted as such. Each component that required attention was ranked in the following order of priority:

- **Priority 1:** Components in this category require immediate action to return the site to normal operation, to stop accelerated deterioration or to correct a cited safety hazard.
- **Priority 2:** Components in this category will become critical within one year. Items in this category include intermittent interruptions, rapid deterioration, and/or potential safety hazards.
- **Priority 3:** Components in this category include conditions that require appropriate attention to prevent predictable deterioration or potential downtime and associated damage or higher costs if further deferred.
- **Priority 4:** Components in this category include items that represent a sensible improvement to existing conditions. These items are not required for the most basic function of the site; however, these projects will either improve overall use and/or reduce long-term maintenance.
- **Priority 5:** Components in this category have fulfilled their useful life and need to be replaced.

The assessment data was used to calculate a total amount of deferred maintenance for each site. *Policy on Deferred Maintenance, Current Replacement Value and Site Condition Index in Life-Cycle Cost Management* (U.S. Department of Interior (DOI), May 2008) stipulates the following regarding DM:

> "Deferred maintenance is maintenance work that is deferred to a future budget cycle, or postponed, until funds become available. The failure to perform needed inspections, lubrication, repair, maintenance, and renewal through normal maintenance practice results in deferred maintenance. The under-budgeting of regular maintenance accumulates into a number of familiar needs: roof repairs, masonry repointing, faulty heating and ventilation, and air conditioning (HVAC) and control systems. These are familiar examples that accumulate into problems requiring major funding to correct."

DM was calculated by taking the total value of priority one, two, and five replacements for each site identified using the facilities assessments from FY 2010-11 through FY 2012-13. Deferred maintenance calculations were then used to calculate a site FCI. The FCI is calculated by dividing the estimated replacement cost by the current level of deferred maintenance.

Data Optimized Prioritization

To demonstrate one tool that could be used to guide a future data-driven capital planning and budgeting process, an Asset Priority Index (API) was created. The calculated FCI was used as one input in the index based on criteria similar to that used by the DOI. According to *Asset Priority Index Guidance* (DOI, 2005), the process for evaluation involves the following steps for each asset:

- **Asset Status** – Assets are evaluated as being active, inactive, or excess. Assets determined to be excess require disposition.
- **Mission Dependency** – This criterion measures how critical an asset is to the mission, based on an 80 point scale with a score of 80 indicating that asset is essential to the mission. For the DOI, National Park Service mission dependency considers factors such as the importance to the mission, resource protection, visitor use, installation operations, and program support.
- **Substitutability** – This criterion evaluates the ability to satisfy operational requirements with an alternative asset. Substitutability is rated on a 20 point scale, with a score of 20 indicating that an asset has no substitute.

For this analysis, asset status was determined by limiting the analysis to facilities that were active. Mission dependency was determined using the square footage of the site garage, which was used as a proxy for capacity because the square footage determines the number of trucks that can be kept at the structure and therefore determines the number of lane miles that can be serviced. Finally, substitutability was determined by measuring the distance to the next closest site. Taken together, these factors resulted in a priority score, which was then used along with FCI to compare full-service garages to one another statewide.

Cost/Benefit Replacement Decisions

This final section of analysis uses a projection of Department capital construction needs for FY 2019-20 through FY 2028-29 and analyzes the potential that the Department will be able to meet its replacement need given recent trends in new construction expenditures. The section highlights potential limitations and includes alternative scenarios for meeting the site needs in a cost-effective manner for FY 2019-20 through FY 2028-29.

Analysis

Site Replacement Age FY 2010-11 though FY 2017-18

ODOT recognizes that the OBM and DAS useful life expectancy of 45 years can be a useful data point when evaluating sites for replacement. However, during recent replacement planning, the Department has made an effort to avoid creating and/or perpetuating a "bubble" of similarly aged sites and buildings which would create an unnecessary replacement burden all within the same timeframe. One strategy the Department uses to avoid these "bubbles" is to try to keep the average age of all sites at or below 25 years in each district.

Table 4-6 shows the average age of all full-service garages and outposts by district for planned CY 2017. While **Table 4-1** previously showed aggregated age by site type, this analysis provides additional insight into district-to-district variation in age over time and provides an indication as to the success of achieving an average age of 25 years in each district.

Table 4-6: Average Site Age by District by Year

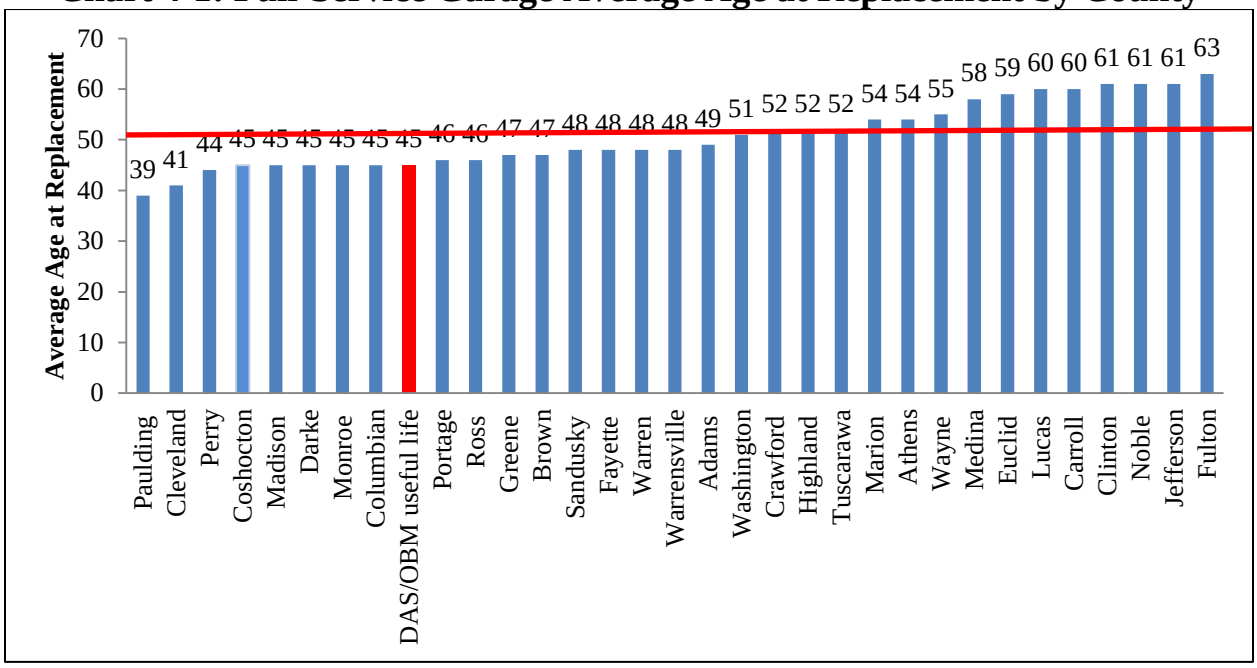
	All Sites		Full-service-Garages	Outposts
District	CY 2017	Difference vs. Goal	CY 2017	CY 2017
1	31.3	6.3	27.7	34.0
2	21.0	(4.0)	17.9	49.0
3	36.8	11.8	31.5	42.0
4	38.6	13.6	28.8	42.0
5	35.9	10.9	20.8	44.1
6	23.9	(1.1)	22.1	28.8
7	37.3	12.3	19.9	48.5
8	30.8	5.8	31.3	29.7
9	17.7	(7.3)	10.5	32.0
10	30.9	5.9	23.2	38.6
11	32.5	7.5	13.7	44.5
12	34.9	9.9	16.2	57.4

Source: ODOT

As shown in **Table 4-6**, the Department will not consistently meet an average site age of 25 years in each district for CY 2017. This is largely due to the high number and relatively advanced age of outposts. This analysis further demonstrates that outposts will continue to be a significant capital planning and budgeting challenge for ODOT in the future.

Chart 4-1 and **Chart 4-2** show the breakdown of the average age of all full-service garages and outposts by county at the time of actual or planned replacement in FY 2010-11 through FY 2017-18.[26] In addition, replacement age is compared to the DAS and OBM expected useful life of 45 years for a building (as represented by the bright red column). The charts also compare all replacements to the average age at replacement (as represented by the red horizontal line). This information is important because it provides an indication of the actual ages at which the Department has been replacing facilities as well as the degree of variation in replacement decisions between counties.

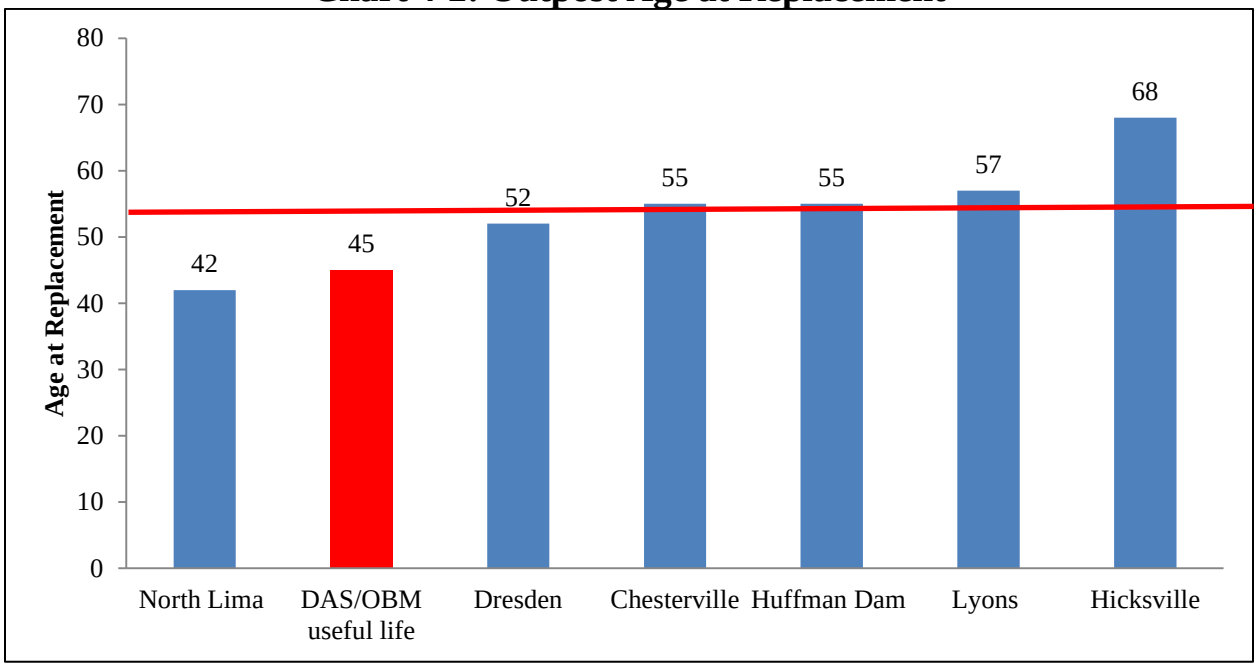
Chart 4-1: Full-Service Garage Average Age at Replacement by County



Source: ODOT
Note: Union County was excluded from this chart because the exact age of the original site was not available.

[26] Age was determined by the age of the garage, which are the primary structures on these sites.

Chart 4-2: Outpost Age at Replacement



Source: ODOT
Note: Middletown was excluded from this chart because the exact age of the original site was not available.

As shown in **Chart 4-1** and **Chart 4-2**, full-service-garages have been, or are planned to be, replaced between 39 and 63 years of age, with an average of 50.9 years, and outposts have been replaced between 42 and 68 years of age, with an average age of 54.8 years. In addition, of the 33 full-service garages replaced or planned for replacement between FY 2010-11 and FY 2017-18, 24 sites, or 72.7 percent, were older than 45 years of age. Similarly, of the six outposts replaced or planned for replacement from FY 2010-11 and FY 2017-18, five sites, or 83.3 percent, were over 45 years of age.

Although a distribution of site replacements by age provides a high-level indication of potential replacement needs, as well as resource alignment toward meeting those needs, ODOT lacks a formal, consistent, and data-driven process to provide specific site replacement guidance. For the most recent replacements, information used in the determination process was primarily gathered through a combination of site visits and formal assessments conducted on the oldest buildings or those identified by district managers as high priority.

The Department has been able to make significant progress during the Master Planning Process, and this progress has been bolstered through the infusion of bond funds. However, the Department will have expended all current bond funds by the end of FY 2018-19 and, thereafter, will face the challenge of continuing to replace aging sites.

Table 4-7 shows the number of full-service garages and outposts that are not currently budgeted for replacement but are at or over 45 years as of CY 2016, as well as those that will be at or over 45 years of age by CY 2019. This helps to inform how the challenge of addressing an aging number of sites will increase over the near term due to the presence of a bubble.

Table 4-7: Sites with No Replacement Plan

	Full-service Garages	Outpost
Site not budgeted for replacement	66	90
CY 2016		
Total at or above 45 years	7	49
Percent at or above 45 years	10.6%	54.4%
CY 2019		
Total at or above 45 years	9	62
Percent at or above 45 years	13.6%	68.9%

Source: ODOT

As shown in **Table 4-7**, there are 66 full-service garages and 90 outposts that are not currently budgeted for replacement. In addition, many of these sites are already at or over 45 years of age or will be in the next several years, including:

- As of CY 2016 there were a total of seven full-service garages that were over 45 years of age and also were not budgeted for replacement. By CY 2019 there will be a total of nine full-service garages, meeting these same conditions; and
- As of CY 2016 there were a total of 49 outposts that were not budgeted for replacement. By CY 2019 there will be a total of 62 outposts, meeting these same conditions.

This breakdown shows that ODOT has a substantial number of facilities that will have exceeded the DAS and OBM expected useful life of 45 years. Without developing a plan to address these aging facilities, ODOT risks incurring higher maintenance costs.

Future Capital Budgeting

The relatively advanced age of full-service garages and outposts, combined with the Department's concerns that full-service garages constructed before 1989 may be functionally obsolete, creates a significant future capital budgeting challenge. As previously noted, the current bond-funds are expected to be fully expended by the end of FY 2018-19. At that time, the Department is likely to continue its historical practice of largely paying for capital needs from Highway Operating Funds without the aid of bond revenue. Given that the Department's ability to engage in timely and effective capital planning and replacement is partly constrained by available resources, projected resources and needs, in the post bond-funded period are further analyzed to identify the likelihood of potential gaps.

ODOT's concern about the potential obsolescence of older full-service garages is driven primarily by the need to store larger trucks. Specifically, as the Department has moved from single- to tandem-axle dump trucks, more space has been required to accommodate the larger tandem-axle trucks. For example, each single-axle truck requires 455 square feet of storage while

a tandem-axle truck requires 600 hundred square feet of storage. In terms of workload, tandem-axle trucks alternatively carry a larger payload, resulting in a longer potential range for snow and ice control. Secondary factors contributing to larger sites also include separate maintenance areas and wash bays. Separate maintenance bays can reduce utility expenses because mechanics can adjust the temperature of their work area without having to heat or cool the entire truck storage area, as is the case with older sites. Finally, separate wash bays can have two benefits: first, a separate wash bay allows drivers to promptly remove salt and other debris from trucks, which helps to decrease the threat of rust damage; and second, a separate wash bay allows drivers to wash their trucks away from the main truck storage area, which prevents water damage to other surfaces in the garage.

Table 4-8 shows a comparison of current square footage and replacement square footage for sites replaced during the realignment process. By showing current and replaced sites along with the costs of construction, this table illustrates how the Department's preference for larger sites impacts construction.

Table 4-8: Site Replacement Square Footage and Cost

Full-Service Garages	**Current Median**	**Replacement Median**	**Difference**	**% Difference**
Square Footage	34,422	50,355	15,933	46.3%
Cost per Sq. Ft.[1]	$164.19	$164.19	N/A	N/A
Replacement Cost	**$5,651,748**	**$8,267,787**	**$2,616,039**	**46.3%**
Outposts	**Current Median**	**Replacement Median**	**Difference**	**% Difference**
Square Footage	10,991	13,769	2,778	25.3%
Cost per Sq. Ft.	$136.19	$136.19	N/A	N/A
Replacement Cost	**$1,496,864**	**$1,875,200**	**$378,336**	**25.3%**

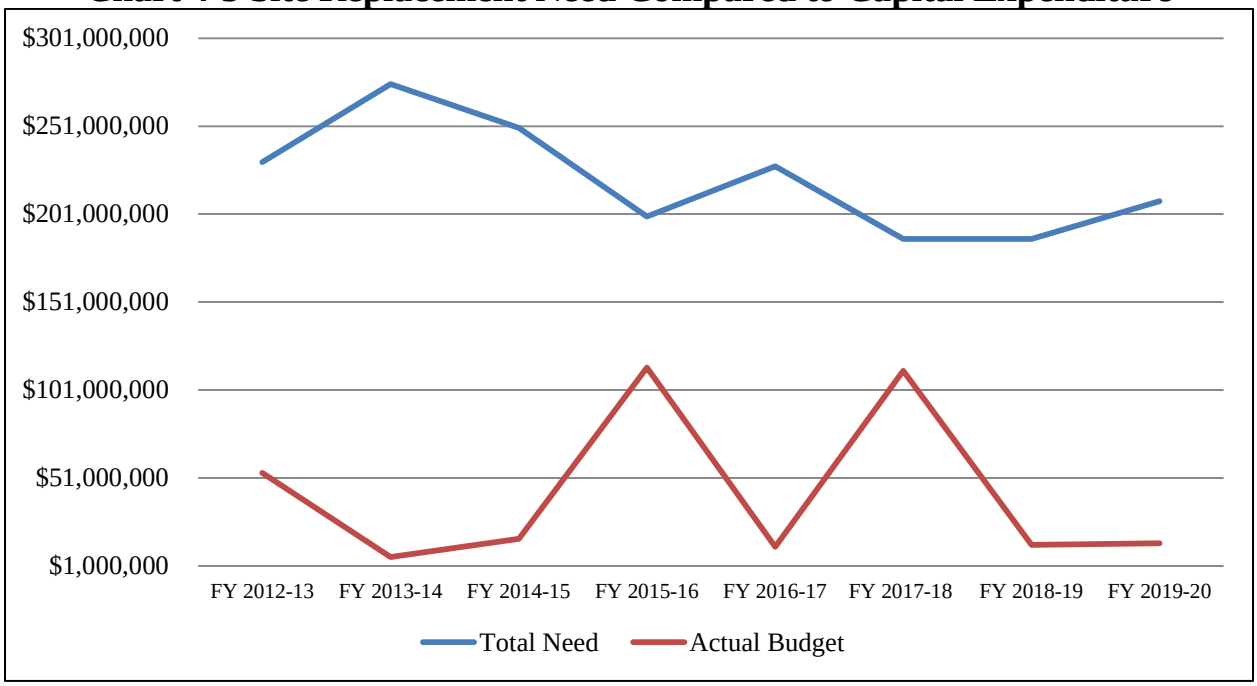
Source: ODOT

[1] Cost per square foot are used to compare the possibility of rebuilding a site of the exact same size today compared to building a site the same size as the median replacement. For this reason, the cost per square foot is based on the median of recent projects.

As shown on **Table 4-8**, the increase in size of full-service garages will increase construction cost by $2.6 million and the cost of outposts by approximately $378,000 per site.

Chart 4-3 shows the total need for site replacement and the total capital expenditures for FY 2012-13 through FY 2019-20. By showing the need and the capital expenditures, the chart illustrates how close the Department's capital expenditures have come to meeting the capital need.

Chart 4-3 Site Replacement Need Compared to Capital Expenditure



Source: ODOT

As shown on **Chart 4-3**, the Department's capital expenditures have fallen short of the replacement needs during every year of the facilities realignment project and are likely to continue to do so for the foreseeable future. Again, this is due to a combination of the significant backlog of replacements that were needed prior to the start of the realignment project as well as the move toward larger, more expensive replacements. The Department is projected to be over $158.3 million short on needed capital expenditures each year during the period of time covered by bond funding.

Facility Condition Index and Deferred Maintenance

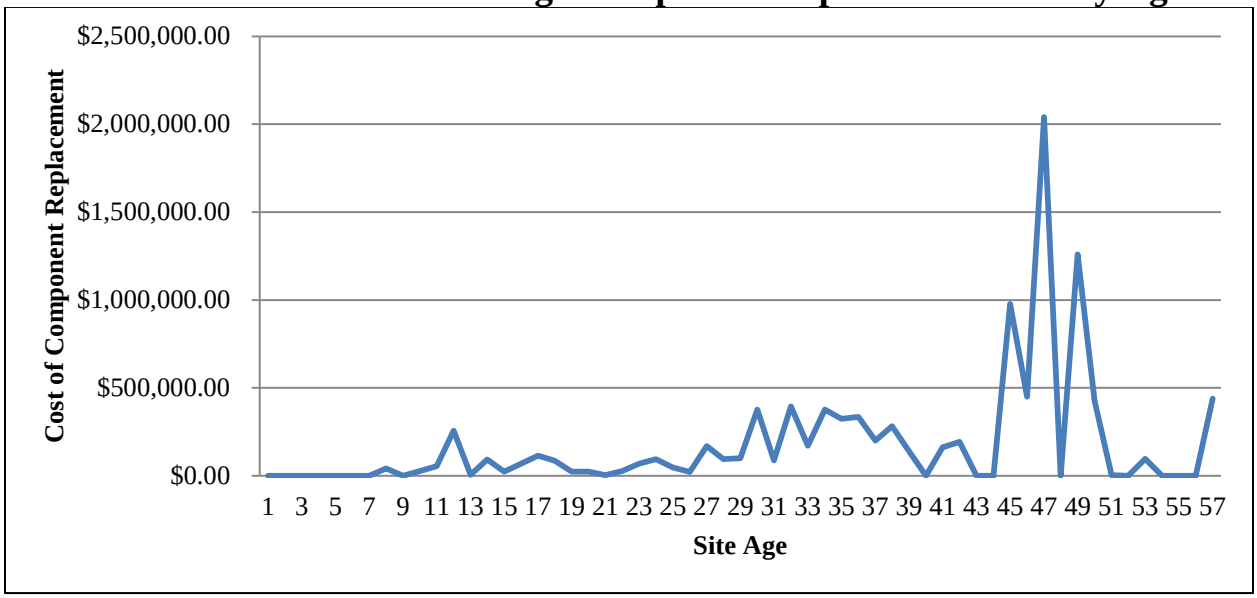
In addition to a construction backlog, delaying the construction of new sites may also contribute to the deferred maintenance backlog. To help calculate needed deferred maintenance, the Department conducted site assessments on 77 full-service garages and 93 outposts between FY 2011-12 and FY 2012-13. Site assessments identified preservation work needed in order to maintain the facility at an acceptable level. In total, the assessment identified $17.5 million in deferred maintenance for full-service garages and $37.3 million for outposts. In total, $52.8 million in deferred maintenance costs were identified.

Asset Lifecycle Model for Total Cost of Ownership Management: A Framework for Facilities Lifecycle Cost Management (International Facilities Management Association (IFMA), June 2002), defines deferred maintenance as "the total dollar amount of existing maintenance repairs and required replacements (capital renewal), not accomplished when they should have been, not funded in the current fiscal year or otherwise delayed to the future." The IFMA also stipulates the following:

> "Facilities and equipment are in a constant state of degradation. While identified deficiencies/requirements are being corrected, other deficiencies/requirements are continuously being created over time. The rate of deterioration may be expressed as a percentage of current replacement value per year. While degradation rates vary as a function of multiple variables such as building type, current conditions, geographic location, etc., a benchmark deterioration rate for a reasonably well maintained site is approximately 2.5% per annum…The site condition index (FCI) can be used as a comparative metric to help monitor degradation rates."

Chart 4-4 shows the cost of component replacement (e.g., Heating Ventilation Air Conditioning (HVAC) systems, electrical systems, roofs, etc.) based on assessments completed from FY 2010-11 through FY 2012-13. By showing component replacement costs over the entire life of a site, this analysis identifies the points in the lifecycle when costs increase significantly.

Chart 4-4: Full-Service Garage Component Replacement Cost by Age



Source: ODOT
Note: The oldest full-service garage with sufficient component replacement data for use in this analysis was 57 years.

As shown in **Chart 4-4**, component replacement costs spike between 40 and 50 years. In order to pinpoint the cause of this spike, assessment data was used to identify the actual five most common types of replacement/repairs for facilities between 45 and 50 years of age. **Table 4-9** shows the five most common types of component replacement that occur between 45 and 50 years of age based on what was identified in ODOT's site assessments.

Table 4-9: Major Component Replacements Sites at 45-50 Years of Age

Full-service Garages		
Category	**Replacement Age[1]**	**Average Cost[2]**
HVAC	50	$813,448
Electrical	50	$516,986
Plumbing	50	$503,580
Envelope	47	$435,172
Roof	50	$191,690
	Total	**$2,460,876**
Outposts		
Category	**Replacement Age**	**Average Cost**
HVAC	48	$83,482
Envelope	48	$81,922
Electrical	48	$55,581
Plumbing	47	$15,681
Roof	48	$11,547
	Total	**$248,213**

Source: ODOT

[1] This is only indicative of replacements that may occur between 45-50 years and not of component replacements that may occur at early points during the useful life of a building. For example, both the HVAC and roof can be expected to incur significant costs well before the building reaches 50 years of age.

[2] Average cost may not represent the full cost of component replacement during the life of a building; instead, it is only the costs that could be incurred to keep the building operational beyond 45-50 years.

As shown in **Table 4-9**, the five most common types of repairs that occur between 45 and 50 years of age are plumbing, electrical, HVAC, roof repairs, and the building envelope, which is a blanket term for elements of the site that perform load bearing functions or that block the flow of energy. In addition to the high cost of major site refurbishments, the relatively long lifecycle (i.e., age at replacement) of these sites and components places a greater emphasis on the proactive, strategic nature of capital replacement decisions. Specifically, replacing a major component in an aging building may not result in a longer lifecycle for the building itself. For example, replacing an HVAC system in a full-service garage will cost $16,269 per year if the Department keeps the facility for an additional 50 years. If the Department keeps the facility for less than 50 years; however, the annualized cost will increase.

One way to simplify the analysis of component replacement costs is to use a Facilities Condition Index (FCI) to compare one site to another. *Site Condition Index, Other Metrics, Improve Asset Management at National Park Service* (Facilities Net, 2013)[27] defines facilities condition index as "current maintenance, repair and replacement deficiencies divided by current replacement value of the site." Although ODOT did not calculate a FCI to guide site replacement decisions, a FCI was calculated for the report using the assessment data provided by ODOT. FCI is calculated by dividing the cost of deferred maintenance by the replacement cost, which results in a score between zero and one. While a score of closer to 0.0 indicates better condition, the formal breakdown is as follows:

[27] Facilities Net is an online facility management industry resource.

- ≤0.100: Good Condition
- 0.101–0.150: Fair Condition
- 0.151–0.500: Poor Condition
- > 0.500: Serious Condition

Table 4-10 shows the FCI ratings for full-service garages and outposts that were assessed and either replaced or are scheduled for replacement. The FCI provides a useful metric to allow for comparisons of the relative condition of each site that was both assessed and replaced.

Table 4-10: FCI of Assessed and Replaced Sites

Site	Type	Replaced	Replacement Cost	Deferred Maintenance	FCI	Condition
Sandusky	FS	2017	$2,658,203	$2,094,625	0.79	Serious
Columbiana	FS	2015	$3,733,141	$1,939,306	0.52	Serious
Chesterville	OP	2015	$1,756,084	$457,099	0.26	Poor
Paulding	FS	2017	$3,507,579	$897,677	0.26	Poor
Hicksville	OP	2017	$516,075	$114,051	0.22	Poor
Cleveland	FS	2017	$1,452,179	$300,518	0.21	Poor
Middletown	OP	2018	$2,217,452	$299,340	0.13	Fair
Darke	FS	2017	$3,556,847	$407,574	0.11	Fair
Lyons	OP	2018	$3,429,638	$272,720	0.08	Good
Union	FS	2018	$3,082,125	$194,975	0.06	Good
Fayette	FS	2017	$3,968,972	$177,794	0.04	Good
Ross	FS	2016	$2,722,624	$82,630	0.03	Good
Washington	OP	2018	$3,880,966	$71,068	0.02	Good
Brown	FS	2016	$2,851,409	$48,500	0.02	Good
Monroe	FS	2018	$3,491,066	$58,348	0.02	Good
Jeffersonville	OP	2017	$2,817,526	$40,000	0.01	Good
Greene	FS	2018	$3,867,290	$39,000	0.01	Good
Perry	FS	2018	$3,255,182	$7,250	0.00	Good
Coshocton	FS	2017	$3,399,200	$3,750	0.00	Good
		Total	**$56,163,558**	**$7,506,225**		

Source: ODOT

Note: Planned replacements may be subject to change.

As shown in **Table 4-10**, 13 full-service garages and six outposts were both assessed and scheduled to be replaced during the Master Planning Process. Replaced sites had FCIs ranging from a high of 0.79, meaning that the cost of repairs was equal to about 79 percent of the replacement cost, to a low of zero in the case of Perry and Coshocton, which were selected for replacement based on site age rather than deferred maintenance needs. Overall, the median FCI of replaced facilities was 0.06. In addition, while two replaced sites were in serious condition, 11 of 19, or 57.9 percent, were in good condition when replaced. ODOT does not use FCI to choose facilities for replacement; instead, the Department relies on input from county and district leadership about the conditions of facilities within each district. In total, the Department's decision to replace the 13full-service garages and six outposts helped eliminate over $7.5 million in identified deferred maintenance. However, without the use of a standard metric to compare all

potential replacements, the Department cannot be certain that replacement decisions resulted in the most efficient use of capital funding to address deferred maintenance needs.

Table 4-11 shows FCI scores for full-service garages without budgeted replacements by FY 2018-19 and **Table 4-12** shows outposts using the same parameters. These analyses serve to determine the number of facilities with FCI scores suggesting that replacement or major refurbishment could be necessary in the near future.

Table 4-11: FCI for Full-Service Garages without Budgeted Replacement

Full-Service Garage	Replacement Cost	Deferred Maintenance	FCI	Condition
Wyandot	$4,216,077	$2,110,727	0.50	Poor
Wilmington	$1,353,917	$439,724	0.32	Poor
Geauga	$3,669,374	$1,079,806	0.29	Poor
Miami	$1,069,660	$293,873	0.27	Poor
Wood	$4,512,072	$1,178,959	0.26	Poor
Henry	$3,247,160	$780,406	0.24	Poor
Trumbull	$3,501,874	$838,902	0.24	Poor
Pickaway	$4,357,317	$855,069	0.20	Poor
Hilliard	$2,461,926	$445,144	0.18	Poor
Eaton	$1,867,371	$326,280	0.17	Poor
Fifth	$3,018,338	$490,228	0.16	Poor
Ottawa	$5,073,832	$796,028	0.16	Poor
Lorain	$3,327,337	$495,874	0.15	Poor
Morgan	$4,319,925	$560,700	0.13	Fair
Cuyahoga	$3,962,019	$476,936	0.12	Fair
Clark	$3,154,709	$327,073	0.10	Good
Miamitown	$1,451,655	$147,030	0.10	Good
Total	**$54,564,563**	**$11,642,759**		

Source: ODOT

As shown in **Table 4-11**, 13 full-service garages, or 76.5 percent, had a FCI identifying them as being in poor condition. Specifically, the Wyandot Full-Service Garage had a FCI of 0.50, significantly higher than any other garage without a replacement plan.

Table 4-12: FCI for Outposts without Budgeted Replacements

Outpost	Replacement	Deferred Maintenance	FCI	Condition
Duncan Falls	$1,060,146	$453,142	0.43	Poor
Avon	$1,583,119	$669,978	0.42	Poor
Lexington	$2,956,549	$1,218,217	0.41	Poor
Brownsville	$1,705,408	$676,195	0.40	Poor
Interchange/Norton	$3,067,445	$1,014,651	0.33	Poor
Carey	$1,247,800	$405,142	0.32	Poor
Vermillion	$1,574,988	$505,387	0.32	Poor
Old Washington	$1,809,454	$577,677	0.32	Poor
Brookfield	$1,721,339	$540,167	0.31	Poor
Baltimore	$1,253,307	$382,934	0.31	Poor
Twinsburg	$1,974,451	$588,475	0.30	Poor
Bailey Road	$1,794,534	$515,356	0.29	Poor
Yale	$1,866,521	$520,680	0.28	Poor
Vrooman Road	$1,824,439	$502,009	0.28	Poor
Perrysville	$1,522,190	$394,919	0.26	Poor
North Salem	$1,589,335	$409,908	0.26	Poor
Etna	$1,511,878	$380,496	0.25	Poor
West Farmington	$1,815,227	$456,697	0.25	Poor
Lima/4th St.	$1,840,113	$460,976	0.25	Poor
Roundhead	$690,951	$171,413	0.25	Poor
Burbank	$1,931,610	$459,433	0.24	Poor
Laurelville	$1,074,039	$255,350	0.24	Poor
Beaverdam	$1,623,229	$371,140	0.23	Poor
Gustavus	$2,069,265	$446,957	0.22	Poor
Rome	$1,623,173	$340,197	0.21	Poor
Conneaut	$2,420,872	$499,696	0.21	Poor
Toronto	$1,201,484	$243,994	0.20	Poor
Drakesburg	$2,135,125	$415,898	0.19	Poor
Fredricktown	$440,504	$77,280	0.18	Poor
Moxahala	$426,684	$74,721	0.18	Poor
Dorset	$2,173,392	$380,224	0.17	Poor
Sebring	$1,608,468	$265,707	0.17	Poor
Edison Bridge	$1,620,337	$253,752	0.16	Poor
Greensburg-Airport	$1,980,621	$292,703	0.15	Fair
Belle Valley	$1,602,276	$224,350	0.14	Fair
Parkman	$1,401,054	$196,007	0.14	Fair
Montville	$1,636,289	$223,013	0.14	Fair
Harperfield	$2,107,143	$245,535	0.12	Fair
Plymouth	$943,289	$108,889	0.12	Fair
Munson	$805,870	$86,728	0.11	Fair
Findlay	$1,907,996	$198,248	0.10	Good
Wheelersburg	$1,600,793	$163,086	0.10	Good
Total	**$68,742,707**	**$16,667,327**		

Source: ODOT

As shown in **Table 4-12**, 33 outposts, or 78.5 percent, that currently are not budgeted for replacements, have a FCI rating them as poor condition.

The decisions presented in **Table 4-10**, when considered in light of data presented in **Table 4-11** and **Table 4-12**, provide further information and show that there were potentially alternative options for replacement that could have been financially preferable based on consideration of FCI. In contrast to the median FCI of 0.06 in **Table 4-10**, non-replaced full-service garages had an overall median FCI of 0.18 and non-replaced outposts had a median FCI of 0.24.

Data Optimized Prioritization

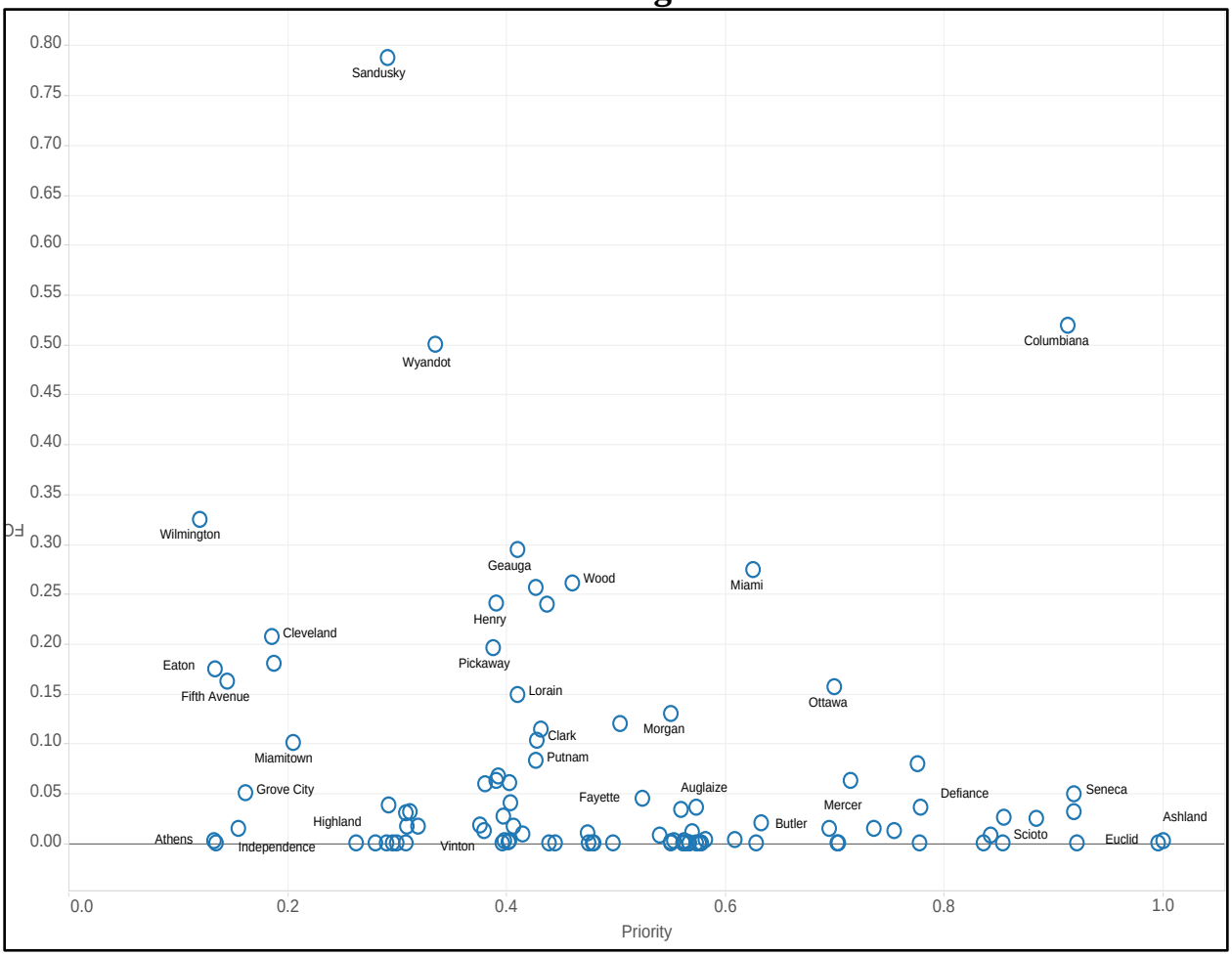
FCI can provide a logical means to compare potential replacement sites. However, the value of FCI as an input in a decision-making process can be enhanced by using FCI scores along with an asset priority index (API). API is a tool used to identify the "relative importance" of an asset. *A Call to Action: Preparing for A Second Century of Stewardship and Engagement* (NPS, 2013) states the following:

> "The API and FCI work together to create powerful metrics that assess both the priority and condition of an asset in relation to other assets within a park's portfolio. This relationship provides management staff with information that assists in identifying and prioritizing maintenance work at each park. When the API and FCI graphs combine, the result is a graph that helps determine the maintenance, repair, and/or rehabilitation needed for each asset. This graph can help parks prioritize where limited resources should be allocated."

To assist with the creation of an API, the NPS used a team of employees from different functional areas (e.g. natural resources, cultural resources, law enforcement, administrative, and facilities management) to evaluate each asset.

In order to calculate an API for ODOT, a priority was calculated for each full-service garage based on available data, including the site size, location, etc. APIs were not calculated for outposts due to a lack of data (see **Operations Data Quality**). **Chart 4-5** shows API/FCI charts for full-service garages for FY 2011-12 (prior to the start of the capital campaign). By showing the pre-realignment process sites compared by condition and priority, this analysis illustrates what areas in which the Department's capital funds could have been most impactful during the realignment process.

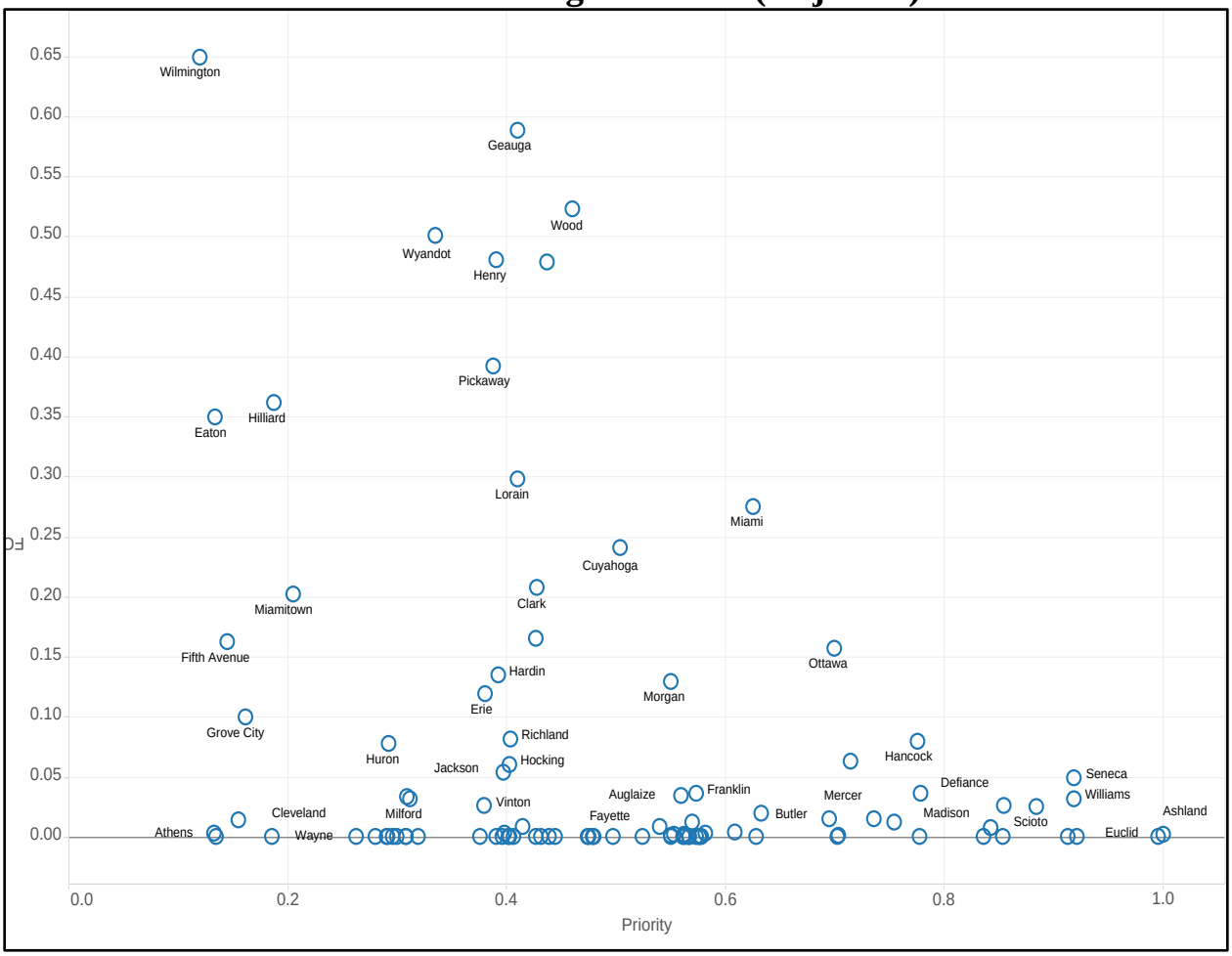
Chart 4-5: Full-Service Garage API/FCI FY 2011-12



Source: ODOT, AOS
Note: Facilities with low FCI scores were not labeled.

As shown in **Chart 4-5**, when the realignment process began, the Columbiana Full-Service Garage was the highest priority site with the worst condition as measured by FCI. As shown on **Table 4-2**, this site is scheduled for replacement during FY 2016-17. **Chart 4-6** shows an FCI/API index updated to include planned replacements by FY 2019-20. In addition, the FCI is adjusted to account for sites that are functionally obsolete (see **Methodology**). Adjusting the FCI this way accounts for sites that may have little deferred maintenance but may still make sense for replacement based on functional needs.

Chart 4-6: Full-Service Garage API/FCI (Adjusted) FY 2019-20



Source: ODOT, AOS
Note: Facilities with low FCI scores were not labeled.

As shown in **Chart 4-6**, with the FCI adjusted to account for obsolescence concerns, the Wood Full-Service Garage and Geauga Full-Service Garage both show the most immediate need for attention. Taken together, **Chart 4-5** and **Chart 4-6**, demonstrate one possible way that the Department could use a uniform, data-driven process to measure both the need for facilities replacement and a given site's relative importance to Department operations. By measuring in both dimensions, ODOT would be able to assure that capital investment is made in the most effective manner.

The information presented in **Chart 4-5** and **Chart 4-6** represents a snapshot in time based on assessments performed from FY 2010-11 through FY 2012-13 and on planned construction effective in FY 2015-16 through FY 2017-18. Cross-functional teams, similar to those used by the NPS, could help the Department to evaluate each site in terms of asset status, mission criticality, and substitutability. In addition, the Department could benefit from updating the facilities assessments on a regular basis to create up-to-date FCI calculations for use in future planning.

The Department has already made efforts to involve multiple stake holders in the site replacement process but has not yet created a formal system to compare asset priority across districts. In order to maximize the value of FCI, the calculations will need to be combined with the internally developed API to prioritize capital investment across the Department. In addition to repair/replace decisions, a well-developed API/FCI chart could also be used to make decisions about decommissioning facilities and/or alternative service delivery options. Options that the Department may be able to better evaluate using an API/FCI chart include:

- **Shared Services** – Sharing services should be explored for any site that is approaching replacement. For example, ODOT has recently participated in the construction of a shared outpost near Wright State University. The costs of construction and maintenance for the site will be split between the Department and Wright State University.
- **Outpost Reduction** – **Table 4-7** shows the largest number of sites without replacement plans is concentrated among outposts. Converting outposts to yards whenever possible could reduce construction and maintenance needs while still allowing the Department to gain many of the same operational support benefits (see **Operations Support Cost/Benefit Analysis**).

Cost/Benefit Replacement Decisions

Given the constraints on the capital budget and the need for site replacement and new construction, the Department may need to consider options for either increasing the funding available for new construction or reducing the number and type of sites down to a more manageable level. Given that revenue is largely outside of the Department's control, the first step to making informed decisions about reducing the number of sites is to clarify the options available in light of demand for replacement construction in the near future.

Table 4-13 shows the number and type of sites that can be constructed during 10 fiscal years immediately following the end of the bond period (i.e., FY 2019-20 through FY 2028-29). By showing the number of sites needed and the number of sites that can be constructed given the budgetary constraints, this table helps to illustrate the exact challenges that the Department is likely to face.

Table 4-13: Projected Construction Needs and Budget Capacity

Average Annual Capital Budget [1]			**$14,000,000**
Total Available Capital Budget-10 Years			**$140,000,000**
Maximum Full-Service Garage Capacity			17
Maximum Outpost Capacity			75
Maximum Yard Capacity			623
One-to-One Replacement Costs			
	Full-Service Garages	**Outpost**	**Yard**
Total Sites Needed FY 2019-20 through FY 2028-29	16	69	N/A
Cost per New Site by Type	$8,267,705	$1,875,200	$224,554
Total Cost FY 2019-20 through FY 2028-29	$132,283,280	$129,388,800	N/A
Total Capital Budget Need			**$261,672,080**
Expected Budget Capacity Over/Under Need			**($121,672,080)**

Source: ODOT
[1] Based on budget projections from FY 2018-19 through FY 2020-21.

As shown in **Table 4-13**, ODOT would have to increase expected new construction expenditures by nearly $121.7 million, or an average of $12.5 million per year, to meet all full-service garage and outpost replacement needs over the 10-years following the bond-funded period.

One option that may help the Department realign the site portfolio to a level that can be better supported by the projected new construction funding is to convert outposts that are due for replacement to yards. Yards can be an acceptable alternative to outposts by providing salt and materials storage to support snow and ice control (see **Operations Support Cost/Benefit Analysis**).

Table 4-14 shows a sensitivity analysis with five scenarios whereby the Department converts and/or constructs additional yards to help fill the gap in the capital construction budget between FY 2019-20 and FY 2028-29. Given that full-service garages are the key operating locations for ODOT districts, each of the five scenarios prioritizes funds to meet capital replacement for these sites first. The remaining budget is then divided over a combination of outposts and yards in order to demonstrate the possible combinations available within the projected budget capacity, as well as resulting savings from converting more costly outposts to less costly yards.

Table 4-14: Outpost to Yard Conversion Scenario

Category	45 Years of Component Replacement		
45 Year Cost per Outpost [1]			$5,231,808
45 year Cost per Yard			$626,506
Difference			$4,605,302
Annual Savings from Converting Outpost to Yard			$102,340
	Full-Service Garages	**Outposts**	**Yards**
Scenario 1	**16**	**4**	**0**
Total Construction Cost by Site Type	$132,283,280	$7,500,800	$0
Scenario Total Construction Cost			$139,784,080
Remaining Budget Surplus/(Deficit)			$215,920
Average Annual Savings from Outpost to Yard Conversions			**$0.00**
Scenario 2	**16**	**3**	**9**
Total Construction Cost by Site Type	$132,283,280	$5,625,600	$2,020,986
Scenario Total Construction Cost			$139,929,866
Remaining Budget Surplus/(Deficit)			$70,134
Average Annual Savings from Outpost to Yard Conversions			**$921,060**
Scenario 3	**16**	**2**	**17**
Total Construction Cost by Site Type	$132,283,280	$3,750,400	$3,817,418
Scenario Total Construction Cost			$139,851,098
Remaining Budget Surplus/(Deficit)			$148,902
Average Annual Savings from Outpost to Yard Conversions			**$1,739,780**
Scenario 4	**16**	**1**	**26**
Total Construction Cost by Site Type	$132,283,280	$1,875,200	$5,838,404
Scenario Total Construction Cost			$139,996,884
Remaining Budget Surplus/(Deficit)			$3,116
Average Annual Savings from Outpost to Yard Conversions			**$2,660,840**
Scenario 5	**16**	**0**	**34**
Total Construction Cost by Site Type	$132,283,280	$0	$7,634,836
Scenario Total Construction Cost			$139,918,116
Remaining Budget Surplus/(Deficit)			$81,884
Average Annual Savings from Outpost to Yard Conversions			**$3,479,560**

Source: ODOT

[1] Includes component replacement costs for an outpost equal to 6.2 percent of construction costs.

As shown on **Table 4-14**, under the given assumptions, ODOT can fully fund necessary full-service garage replacements. In addition, the Department can allocate the remainder of the capital budget to replace/convert several combinations of outposts and yards with results ranging from an average annual savings of $921,000 by converting nine existing outposts to yards to up to $3.5 million by converting 34 outposts to yards.

In order to make the best decisions concerning which outposts could be converted to a yard and which should remain as an outpost, the Department would need to employ a cost/benefit

methodology to choose the optimum outposts for conversion (see **Operations Support Cost/Benefit Analysis**). In addition, the Department would also need to improve data collection efforts in order to fully evaluate the cost/benefit of outpost operations or alternative service delivery models (see **Operations Data Quality**).

Conclusion

The Master Planning Process, which commenced in CY 2011, has resulted in the replacement of 28 full-service garages and 10 outposts. As a result of these replacements, the average age of ODOT's full-service garages is projected to decrease from 26.6 years in CY 2013 to 22.0 years in CY 2018. Despite this progress, the Department still faces challenges, such as:

- **A Growing Number of Aging Sites** – Due to historical construction patterns, the Department will see a "bubble" of sites reaching the end of expected useful life in in the near future. In total, there will be 16 full-service garages and 69 outposts that will be at or beyond their expected useful life by FY 2028-29.
- **A Capital Budget with Insufficient Capacity to Meet Needs** – The Department has not historically had a capital budget capacity sufficient to keep up with the demand for full-service garage and outpost replacements. Without exploring alternative options, such as reducing and/or replacing outposts with yards, ODOT would need to increase the expected capital budget by $121.7 million, based on the estimated capital construction needs between FY 2019-20 and FY 2028-29 (see **Table 4-13**).

A consistently applied, data-driven capital planning and budgeting process will assist ODOT in maximizing available resources by helping guide decision making regarding the number and type of sites needed to support Department operations.

Recommendation R4: ODOT should develop a consistently applied, data-driven process to guide capital planning and budgeting decisions. The process should involve input from key stakeholders, including Central Office, district, and county leadership, in order to identify key metrics to assess which sites are most critical to the Department's mission. At a minimum, the process should include a standardized method to:

- **Evaluate each site's conditions and assessing deferred maintenance;**
- **Evaluate each site's purpose in meeting the Department's mission; and**
- **Compare all sites, as well as alternative options, such as replacing outposts with yards where possible, in order to optimize capital investment.**

Financial Implication R4: Employing this type of data-driven approach could result in average annual savings of up to **$3.5 million**, by replacing 34 outposts with less-costly yards.

VIII. Audit Scope and Objectives Overview

Generally accepted government auditing standards 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.

AOS and ODOT signed a letter of engagement effective September 18th, 2015. The original letter of engagement led to OPT planning and scoping work, in consultation with ODOT, which identified the single scope area of **Capital Planning and Budgeting**.

Based on the agreed upon scope, OPT developed objectives designed to identify improvements to economy, efficiency, and/or effectiveness. **Table VIII-1** shows the objectives assessed in this performance audit and references the corresponding recommendation(s) when applicable.

Table VIII-1: Audit Objectives and Recommendations

Objective	Recommendation(s)
Capital Planning and Budgeting	
What opportunities exist to improve the facilities capital planning process in relation to leading practices and/or industry standards?	**R1, R2, R3,** and **R4**

Note: Although assessment of internal controls was not specifically an objective of this performance audit, they were considered and evaluated when applicable to the scope and objective.

IX. Abbreviated Terms and Acronyms

AOS – Auditor of State
API – Asset Priority Index
DAS – Ohio Department of Administrative Services
DOI – Department of the Interior
EMS – Equipment Management System
FCI – Facilities Condition Index
FY – Fiscal Year
FYTD – Fiscal Year-To-Date
GAGAS – Generally Accepted Government Auditing Standards
GAO – Government Accountability Office
HCFSG – Hocking County Full Service Garage
IFMA – International Facilities Management Association
NPS – National Park Service
OAC – Ohio Administrative Code
ODOT or the Department – Ohio Department of Transportation
OFCC – Ohio Facilities Construction Commission
OMB – Office of Management and Budget
OPT – Ohio Performance Team
ORC – Ohio Revised Code
The Director – The Director of Transportation

X. ODOT Response

The letter that follows is ODOT's official response to the performance audit. Throughout the audit process, staff met with Department 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.

OHIO DEPARTMENT OF TRANSPORTATION
CENTRAL OFFICE • 1980 WEST BROAD STREET • COLUMBUS, OH 43223
JOHN R. KASICH, GOVERNOR • JERRY WRAY, DIRECTOR

Division of Facilities & Equipment Management
Office of Statewide Facilities Operations
ODOT Performance Audit Response
September 2016

The Division of Facilities and Equipment Management, Office of Statewide Facilities Operations would like to thank Auditor Dave Yost and his staff for collaborating with ODOT to perform an audit for the Ohio Department of Transportation. The audit performed at the request of the department will assist ODOT in quantifying the value of its Master Planning Process initiative in relation to the management of its facility assets.

ODOT appreciates the dedication of Scott Anderson, Director of the Ohio Performance Team and his staff to assist ODOT in improving its processes, increasing efficiencies and effectiveness and investing the motor fuel tax efficiently. ODOT would like to recognize the following individuals for making significant contributions to this body of work: Brent Grace, Mark Ingles, Scott Smith and Zachary Reeder.

The significant investment placed in ODOT facility assets has supported the agencies vision to become a long-term, reliable, professional and highly productive organization in addition to making a major impact on the quality of work life for its employees. The recommended acquisition of a robust facility management software program as well as the use of an Asset Priority Index will assist ODOT in making informed and logical decisions with the understanding that its assets are co-dependent and are required to work together to deliver the requisite standard of service.

ODOT will incorporate the recommendations and methodology into formulating an appropriate framework for achieving improved system function. The audit has identified operational, tactical, and strategic consequences and outcomes that maximize the benefit of an investment in building facilities. ODOT will implement the recommended prioritization techniques to assist in determining the replacement methodology, location, type and function of its full service maintenance, outpost and yard facilities.

ODOT would like to acknowledge the partnership with the Auditor's Ohio Performance Team throughout the audit process. ODOT looks forward to future engagements with the team on mutually agreed upon process improvements.

Dave Yost • Auditor of State

OHIO DEPARTMENT OF TRANSPORTATION

FRANKLIN COUNTY

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

Susan Babbitt

CLERK OF THE BUREAU

CERTIFIED
OCTOBER 11, 2016

88 East Broad Street, Fourth Floor, Columbus, Ohio 43215-3506
Phone: 614-466-4514 or 800-282-0370 Fax: 614-466-4490
www.ohioauditor.gov