Dave Yost • Auditor of State

The Auditor of State of Ohio

Ohio Department of Transportation Performance Audit

June 27, 2013

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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). 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 26th, 2011.

This audit includes an objective review and assessment of selected program areas within ODOT in relation to peer 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 Agency, its programs, and service delivery processes for efficiency, cost-effectiveness, and customer responsiveness. The scope of the engagement was confined to the areas of Fleet Management; including utilization, cost optimization, and a review of compressed natural gas and blended biodiesel programs; Regions Review; including a review of structural, aerial, and geotechnical engineering; and Cost/Benefit analysis for external audit, vegetation management, and rest areas.

This report has been provided to ODOT and its contents have been discussed with the program administrators and other appropriate personnel. ODOT is reminded about the Agency's responsibilities for public comment, implementation, and reporting as a result of this performance audit per the requirements outlined under ORC § 117.461 and § 117.462. The Agency is also encouraged to use the results of the performance audit as a resource for improving overall operations and delivery of services.

Sincerely,

Dave Yost
Auditor of State

June 27, 2013

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I. AUDIT OVERVIEW, SCOPE, AND OBJECTIVES

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, the Auditor of State selected the Ohio Department of Transportation (ODOT or the Department) for audit during the state fiscal year (SFY) 2011-12 and SFY 2012-13 Biennium.

Prior to the formal start of the audit AOS and ODOT engaged in a collaborative planning process which included initial meetings, discussion, 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 26, 2011.

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 effectiveness. The operational areas specifically selected for review included regional and headquarter operations review (Regions Review), fleet management, and business area cost / benefit analysis (Cost / Benefit). These operational areas comprise the scope of the audit as reflected in this report.

Based on the established scope, AOS engaged in supplemental planning activities to develop detailed audit objectives for comprehensive analysis. See **Section VII: Audit Objectives Overview** for an overview of scope areas and audit objectives.

This report reflects the results of the detailed analysis performed to meet these objectives in the following areas:

- **Regions Review –** Including: Structural Engineering; Geotechnical Engineering; Aerial Engineering.
- **Fleet Management –** Including: Fleet Utilization and Cost Optimization Blended Biodiesel Cost Analysis, and Compressed Natural Gas Alternative Fuel Vehicles Financial Analysis.
- **Cost / Benefit –** Including: Vegetation Management, Rest Areas, External Audit, and Dump Truck Procurement.

Where supported, the performance audit identified recommendations for improvement. In addition to the written recommendations included in this report AOS also issued verbal recommendations to ODOT for the tracking of vehicles with DAS. Though these verbal recommendations were not included as part of the final audit report they have been formally communicated to ODOT management for in-kind consideration and implementation.

II. METHODOLOGY

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 of ODOT in accordance with generally accepted government auditing standards (GAGAS). These standards require that AOS plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for findings and conclusions based on audit objectives. AOS has determined that the evidence obtained provides a reasonable basis for the findings and conclusions presented in this report based on the audit objectives.

Audit work was conducted between September 2011 and May 2013. 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, AOS 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, government and private sector leading practices, and peer or similar state comparisons. Although AOS staff reviewed all sources of criteria to ensure that use would result in reasonable, appropriate assessments AOS staff reviewed all sources of criteria to ensure that use would result in reasonable, appropriate assessments, but 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.

During the course of the audit, AOS released four interim reports, the contents of which are included in this final report along with heretofore unreleased content. The interim reports were intended to help provide ODOT with the necessary information to begin implementing the report recommendations or to begin developing an implementation strategy for more complex recommendations requiring a high degree of management skill and coordination.[1]

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 recommendations in their entirety.

III. ODOT OVERVIEW

ODOT is a cabinet-level Department and, as such, the Director of the Department is appointed by, and serves at the pleasure of, the Governor. ODOT's operational structure is bifurcated into a consolidated Central Office and 12 semi-autonomous districts.

Central Office operations are grouped to allow for logical oversight by a core team of four Assistant Directors. These Assistant Directors comprise a key management team for ODOT and report directly to the ODOT Director. Operations are divided into 14 unique areas including: Construction Management; Engineering; Planning; Operations; District Deputy Directors; Facilities and Equipment Management; Finance; Human Resources; Information Technology; Chief Legal Counsel / Equal Opportunity; Communications; Jobs and Commerce; Innovative Delivery; and Policy and Legislative Services.

ODOT's 12 semi-autonomous Districts are each overseen by District Deputy Directors and are accountable to ODOT's key management team and Director. However, they are afforded the flexibility to operate each district, and the associated counties within each district, in a manner that is responsive to local operating conditions yet supportive of the Department-wide mission.

ODOT states that its 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 better;
- Improve safety; and
- Enhance capacity."

ODOT self-identifies its core services as:

- Snow and ice removal;

[1] Interim report release dates and content were as follows:

- April 23, 2012 – Fleet Management Part 1 (see **R1.1** through **R1.5**) and Rest Areas (see **R5.1**);
- May 15, 2012 – Biodiesel Financial Analysis (see **R3.1** and **R3.2**);
- September 19, 2012 – Fleet Management Part 2 (see **R1.6** though **R1.11**), New Vehicle and Equipment Demand (see **R1.12**), and Aerial Engineering Analysis (see **R8.1** through **R8.3**); and
- April 25th, 2013 – Vegetation Management (see **R6.1**), Geotechnical Engineering (see **R9.1**-**R9.4**), Structural Engineering (see **R10.1** & **R10.2**) and Compressed Natural Gas (see **R4.1**).

- Annual construction program; and
- Highway maintenance operations.

To carry out its mission, these core functions are performed across ODOT's statewide roadway jurisdiction of 42,991 lane miles. This includes 13,059 lane miles for the priority subsystem (including interstate highways, freeways and multi-lane parts of the National Highway System) and 29,932 lane miles for the general subsystem (two lane highways, outside of cities, that are not part of the priority system). The Department is responsible for the maintenance of 14,234 bridges that comprise 105.7 million square feet of deck area.

To carry out the day-to-day operations and perform these core services ODOT employed a total of 5,642 people. This includes 5,116 full-time permanent and fixed-term staff and an additional 526 part-time and full-time temporary, intermittent, seasonal, and interim employees. These employee counts are as of December 27, 2012. This was the most up-to-date information available from the Ohio Department of Administrative Services (DAS) when the fleet analysis was completed. It is important to note that it is ODOT's practice to hire a large number of seasonal employees in the winter months to perform snow and ice control across the State. This is reflected in the preceding figures in that approximately 10 percent of all ODOT employees are classified as non-permanent.

According to the 2011 Comprehensive Annual Financial Report for the state of Ohio, issued January 20, 2012, the state spent $2.19 billion on transportation governmental activities. According to ODOT's *2012 Introduction to the Department of Transportation Booklet* the Department "is funded mainly by the 18.4/24.4 cent per gallon federal and the 28 cent per gallon state motor fuel taxes." Further, "the state gas tax contributes to funding other governmental agencies and entities as well. In fact, ODOT only receives about 60 percent from the state motor fuel tax. Revenues from these taxes have been flattening the past few years in part due to more fuel efficient cars and people driving less." In response to the challenges posed by the reliance on this flattening revenue source, ODOT further states that it "is focusing on internal improvements and cost savings while pursuing innovative ways to increase [its] revenues. Ideas being discussed to unlock the revenue potential of state-owned assets include: public-private-partnerships, sponsorships and naming rights of transportation facilities."

IV. COMMENT ON ORGANIZATIONAL REALIGNMENT

Ohio Revised Code (ORC) § 117.46 specifically requires AOS to analyze and comment on ODOT's current district alignment. Specifically, § 117.46 states "In conducting the audit of the Department of Transportation, the Auditor shall analyze and comment on the realignment of all transportation districts."

OPT operates within the framework of Generally Accepted Government Auditing Standards (GAGAS), which prescribe an independent and objective analysis that relies on sufficient data to draw conclusions. From a performance auditing perspective, realignment of ODOT's districts is a potential operational solution rather than a goal unto itself. Structural realignment is one option ODOT could use in its broader mission of deploying resources to achieve transportation goals in the most cost-effective manner.

This comment stops short of prescribing a specific number of ODOT districts because of two constraints:

- There are not sufficient data available to analyze ODOT's district-specific output in relation to workload.
- Any decision to realign ODOT's districts must be made in concert with changes in its administration of the capital program, as ODOT's district structure is foundational to how the capital program is currently delivered.

ODOT is currently exploring options to deliver services as one cohesive statewide unit capitalizing and leveraging district strengths and minimizing inefficiencies of a siloed approach. Achieving this goal will yield a future state that is more efficient and streamlined relative to the current structure.

In complying with ORC § 117.46, OPT's comment is organized into three parts:

1. A background overview of ODOT's current organizational structure.
2. Three opportunities to assist ODOT in evaluating a statewide service delivery strategy.
3. A final comment on OPT's requirement to analyze the realignment of transportation districts.

1. ODOT's Organizational Structure

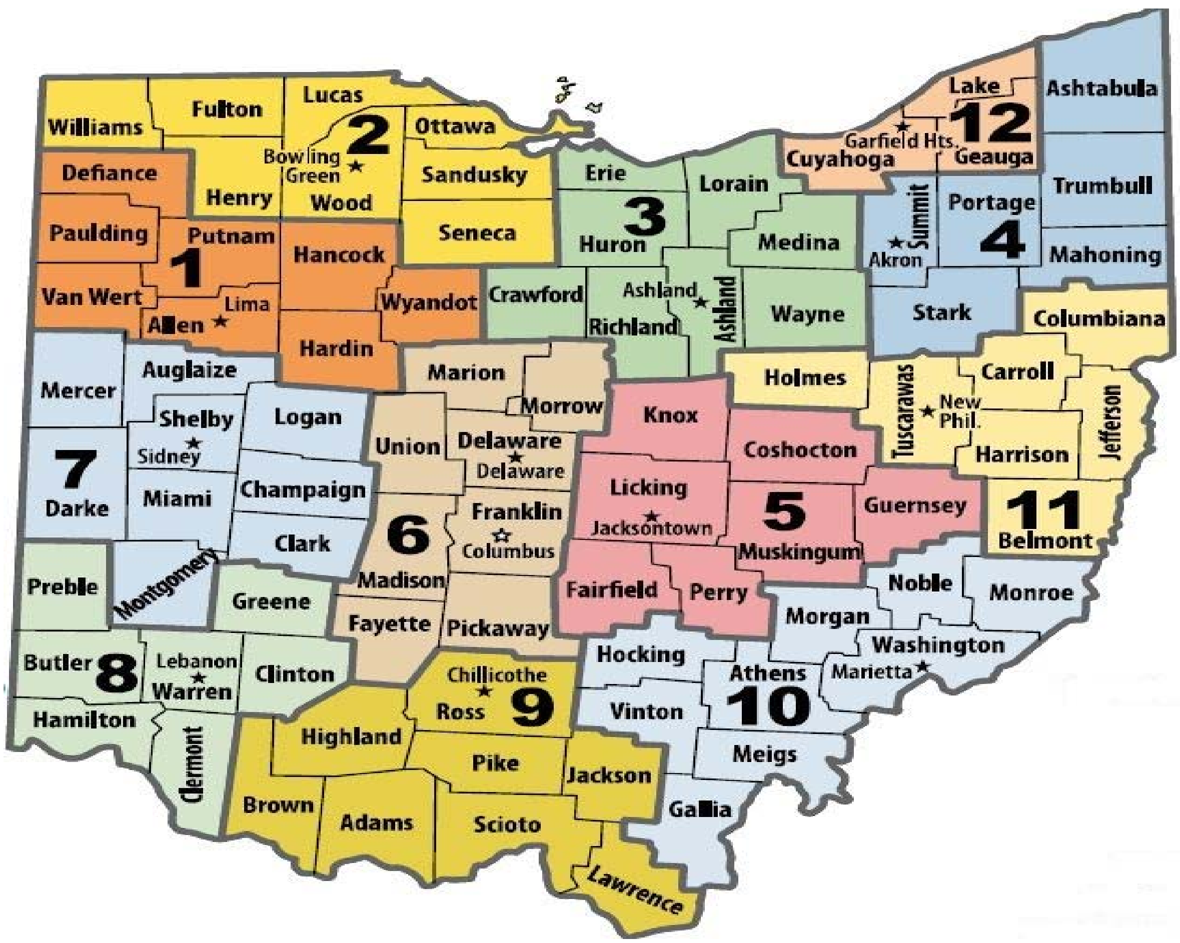
ODOT's current organizational structure consists of three layers-- Central Office, 12 district offices, and 88 county garages. The table on the following page provides a snapshot of the three organizational layers and their core functions, and a map shows the location and county composition of ODOT districts across Ohio.

ODOT's 3 Levels of Organization

CENTRAL OFFICE	12 DISTRICTS	88 COUNTIES
783 Employees	1,905 Employees	2,568 Employees
Core Functions:	**Core Functions:**	**Core Functions:**
Statewide Planning and Administration	Management of County Operations	Highway Maintenance
Supportive Services and Overhead	Administration of Capital Construction Program	Snow Plowing
Fleet, Facilities, & Engineering Coordination		

Source: Employee count compiled from payroll data pulled for period ending April 20, 2013.
Note: Employee counts represent total number of persons, not full-time equivalents. "District" employees here are defined as all those employed in a district outside of the county garages.

ODOT District Locations



Source: ODOT 2013
Note: Stars represent district garage locations.

Central Office

ODOT Central Office (CO) houses the Director of Transportation and his staff. CO sets statewide transportation policy, conducts infrastructure planning, and provides services and technical support in certain areas such as the engineering divisions.

Though many operational decisions are delegated to the 12 districts and the county garages, Ohio Revised Code specifies that the ultimate decision-making authority within ODOT resides in the office of the Director of Transportation (ORC § 5501.14).

Districts

The 12 districts within ODOT are each overseen by a District Deputy Director and perform several functions in carrying out the agency's mission. The majority of ODOT professionals who work on the capital program, such as engineers and construction managers, reside within the districts across Ohio. Districts also provide the business functions that support county-garage operations by supervising highway maintenance planning, providing services such as human resources and accounting, and managing facilities and capital equipment.

The chart below provides a list and count of district-specific positions.

Statewide ODOT Employee Counts for District-Level Positions

JOB FUNCTION	EMPLOYEE COUNT
Accounting	68
Business and Human Services Admin	43
District Bridge	49
District Construction Admin	457
District Deputy Director	59
District Garage	133
District Roadway Services	62
District Testing	73
District Traffic	101
Facilities Operations	127
Highway Management Admin	38
Information Technology	63
Personnel	41
Planning and Engineering	591
Total	**1,905**

Source: Payroll data pulled for period ending April 20, 2013.
Note: Chart captures a count of employees at point in time, which may differ from FTEs due to presence of part-time employees.

County Garages

ODOT's 88 county garages employ the "boots-on-the-ground," people who are responsible for highway maintenance. County garages are responsible for the routine maintenance and upkeep of highways within their jurisdictions, and ODOT also considers snow plowing a core county garage activity.

The basket of services provided by county garages (e.g. pavement repair, snow plowing, and mowing) are fairly uniform across the state. With the exception of a few services unique to major metro areas, one county garage in Ohio will closely resemble the other 87. For this reason, and because county garages operate with minimal day-to-day interaction with district offices, county garages are incidental to the strategy of realigning ODOT's districts. The standardized nature of the county garages would allow them to be interchangeable among neighboring districts under various district realignment scenarios.

2. Opportunities for Organizational Realignment

This comment touches on opportunities in three areas related to ODOT's organizational alignment:

- The relationship between ODOT's Central Office and districts.
- District administration's geographic service area.
- Optimizing the allocation of ODOT's district resources with respect to statewide capital project workload.

Many of these themes will also reappear later in the report within the individual performance audit findings and recommendations.

Relationship between Central Office and Districts

Throughout the course of the engagement, OPT identified multiple instances of lost opportunities that were directly related to, or significantly impacted by, the relationship between ODOT's Central Office and the 12 semi-autonomous districts. Several examples of this kind of inefficiency were occurring with the provision of Central Office services, explained below.

Aerial engineering is a service ODOT Central Office can provide to the districts on an as-needed basis. Districts also have the option of ordering aerial engineering services from outside consultants. ODOT has not historically enforced any guidelines governing when the districts should procure aerial engineering in-house versus when they should procure from outside consultants. This lack of business rules led to a situation where ODOT's fixed assets and human resources in the Office of Aerial Engineering were not being utilized at their full capacity, yet at the same time districts were ordering up equivalent services from outside consultants. Recommendation 6 in this report presents a methodology that will allow ODOT to get the most out of their existing in-house capacity before procuring from outside consultants, resulting in monetary savings. At the time of this report's release, ODOT has already acted on this recommendation.

Another situation where siloed decision-making in the districts led to inefficiencies occurred in ODOT's fleet operations. Toward the beginning of the engagement, OPT found that each district was independently managing its own pool of rolling-stock assets rather than working within an optimal statewide fleet strategy. The fleet-related findings in this report recommend an approach of widespread asset sharing across district boundaries and a consistent fleet cycling strategy. These recommendations are already yielding savings on maintenance and acquisition costs as ODOT has implemented the changes concurrently over the course of OPT's engagement.

Several other scope items in this report, such as recommendations for the Office of Geotechnical Engineering and Office of Structural Engineering, touch on optimizing the interplay between Central Office and districts.

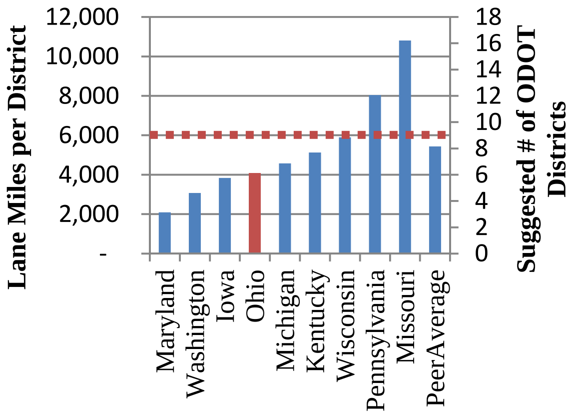
District Administration Geographic Service Area

To estimate at a high level whether ODOT districts have the potential to grow in size or consolidate, OPT completed a benchmarking study against peer states. The states identified as peers were chosen based on their similarity to Ohio in terms of size, weather, governmental structure, and highway system composition.

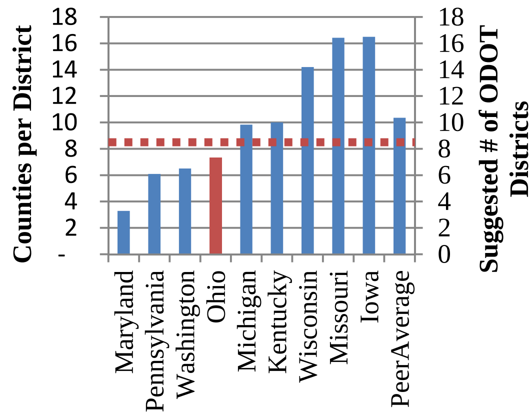
Across various parameters, Ohio's transportation districts are organized into smaller entities than the peer averages. The charts on the following page show both ODOT's district size in relation to peers (the bars associated with the left vertical axis) and the number of districts ODOT would possess if the agency operated at the peer average jurisdictional size for that particular benchmark (the dashed horizontal line associated with the right vertical axis.) Depending on the benchmark used, ODOT would need anywhere between 4 to 9 districts to achieve the peer average district size.

Peer Benchmarks

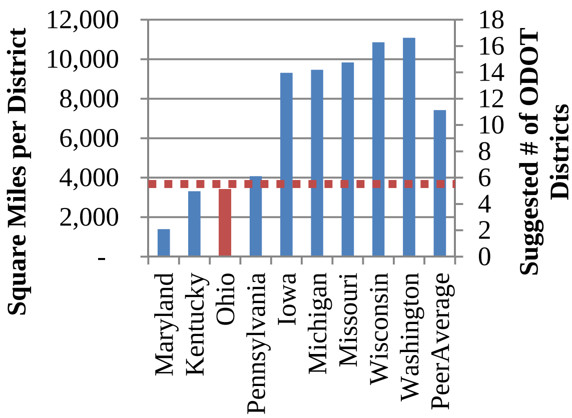
Lane Miles per District



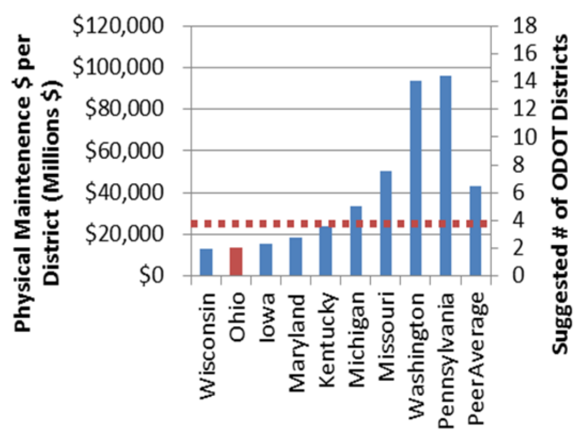
Counties per District



Square Miles per District



Physical Maintenance Dollars per District



Sources: FHWA Highway Statistics and State DOT Websites

Peer benchmarking analysis broadly suggests that ODOT districts could increase their span-of-control, meaning that a District Deputy Director position could handle responsibility for a larger portion of Ohio's roadway system. Such analysis is only one component required in a full analysis of district realignment scenarios, however. Any decision on reorganizing ODOT's district structure will also need to account for the proper level of staffing for the capital and maintenance programs, the location of facilities, and strategy for outsourcing work and the utilization of consultants, among other factors.

Optimization of ODOT's District Resources with respect to Statewide Workload

Matching Resources to Workload

The job functions of district personnel can be broadly divided into two categories:

1. Supporting county garage operations (non-capital program activities); and
2. Administering ODOT's capital program.

The workload in the first category, supporting county garages' maintenance and preservation activity, exhibits a high amount of stability year-over-year. If supporting the non-capital program activity were the only job function performed by district personnel, staffing to match workload would be a very static exercise that could be undertaken by districts independently of one another.

The geographic location of the work being done in ODOT's capital program, however, is highly variable. It is not uncommon for the amount of capital spending in a district to nearly double or halve from one biennium to the next. The table below shows the trend in district capital spending over the last three program years.

Construction Dollars Awarded by District

	2011[1]	2012	2013	2011-2013 Change
District 1	$42,770,792	$56,640,584	$114,566,917	168%
District 2	$89,838,888	$120,028,076	$205,813,433	129%
District 3	$61,709,494	$138,014,044	$120,669,610	96%
District 4	$176,788,690	$157,465,159	$301,981,665	71%
District 5	$54,883,911	$89,248,119	$84,422,518	54%
District 6	$314,789,275	$310,675,480	$127,085,448	(60%)
District 7	$106,205,581	$85,488,661	$249,558,088	135%
District 8	$214,080,413	$149,516,683	$266,337,386	24%
District 9	$59,391,018	$149,559,522	$65,247,028	10%
District 10	$48,758,865	$80,063,144	$62,930,259	29%
District 11	$73,930,833	$107,573,737	$128,021,204	73%
District 12	$375,924,593	$192,738,028	$188,464,548	(50%)

Note: Dollars include ODOT and Local Let projects for Award Years shown.
Source: ODOT Construction Program Summaries 2011-2013
[1]Denotes ODOT program year

ODOT districts have several options available to handle this variability in workload, including:

- Utilizing third-party consultants;
- Sharing workload across district lines;
- Staffing to peak levels of activity; and
- A combination of the above.

Before any data-driven decisions can be made regarding allocation of resources among those options, ODOT management must be able to answer several fundamental questions pertaining to the Department's capability and current state:

- What baseline level of district resources is needed to support the non-capital project activities?
- For various categories and sizes of capital projects:
  - What level of district resources are needed to complete the projects?
  - How does this internal cost compare to the cost of a third-party consultant?
  - Which districts possess a comparative advantage over other districts?

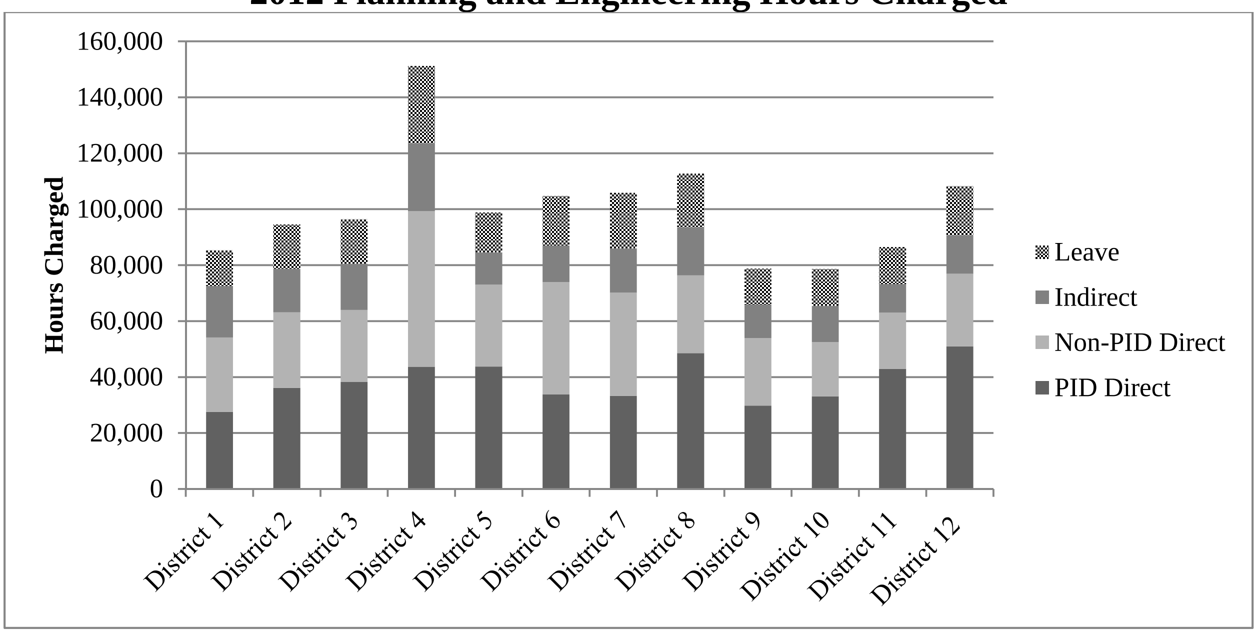
ODOT Districts' Current State

To understand ODOT's current-state approach to staffing district positions and to identify opportunities for efficiency, OPT undertook an in-depth study of the Planning and Engineering (P&E) division. This comment focuses on P&E because ODOT has already devoted in-house resources toward a data-driven analysis of P&E, and because P&E is the single largest district-specific personnel cost-center. The analytical approach used to assess the P&E division should, however, also be directly applicable to other district functions such as Construction Administration.

ODOT's cost-accounting and project management systems can be used to create a high-level picture of P&E activity in the districts. The chart on the following page shows all hours charged in district P&E divisions during 2012. The four categories included are:

- *PID Direct* – Charges directly attributable to a Project ID (PID.) These charges are analogous to billable-hours.
- *Non-PID Direct* – Direct P&E activity for which no PID exists.
- *Indirect* – Administrative and overhead type activities.
- *Leave* – All leave types including vacation, holiday, and sick leave.

2012 Planning and Engineering Hours Charged



Sources: Transportation Management System (TMS), Ellis
Note: Right-of-way (Real Estate) charges are excluded.

This type of cost-accounting output provides a backward-looking picture of P&E activity across the state, defining the broad categories where ODOT is incurring personnel costs. Further detail is required, however, before ODOT's management will be able to use data analytics in ascertaining P&E capability with the intention of optimally allocating resources to workload.

Standardization

Historically district P&E staffing decisions have been driven by estimating and heuristics done by district management. The outcome of this staffing strategy has been to employ something like a "full service shop," meaning a broad and general base of engineering expertise, in every district.

While the experience of district management may be adequate to make proper staffing decisions within their individual districts, this approach limits the ability of senior staff in Central Office to make strategic statewide decisions. In the context of a capital project workload that shifts around the State year-to-year, Central Office has several options available to streamline statewide P&E operations. To implement this streamlining, though, ODOT Central Office will have to take a more direct role in district P&E staffing decisions than historically has been the case.

To make these strategic decisions, ODOT requires quality data and analytics. Decision-makers need visibility into usable measures of P&E capability and output in the districts, and they need to ensure that the districts are reporting this business intelligence in a uniform way across the State.

Within both the PID Direct and the non-PID Direct categories, there are immediate and actionable steps ODOT can take to create data-driven measures of the P&E division's capability and output.

In the PID Direct category ODOT currently collects all the data required to make determinations about historic district P&E capability and output. The remaining task is to turn the raw data into useable business intelligence. ODOT's Transportation Management System (TMS) cost-accounting software captures the internal hours and costs charged to individual projects, and the Ellis project management system categorizes the projects into twenty major categories. By cross-referencing TMS and Ellis, analysts at ODOT can create categories that incorporate project type and project size, and then study the costs to complete projects in these defined categories. With this data compiled, ODOT's management will have visibility into which districts are delivering P&E services most cost-effectively, as well as visibility into which P&E services ODOT delivers at a lower cost than outside consultants. Work on this analysis is already underway in the P&E division with the expectation that it will feed into decisions made before the end of 2013.

In the non-PID direct category of charges, the limitations of ODOT's cost accounting system is prohibiting an in-depth study of district capability. Unlike direct charges associated with a project ID, non-PID Direct charges are not currently grouped into predefined categories similar to 20 major Ellis work types used for PID projects. Interviews across ODOT revealed that there is a very limited and compartmentalized understanding of what activities currently comprise the non-PID direct charges. Opinions have ranged from those who believed the non-PID direct charges were hiding downtime and excess capacity to those who stated these charges were nearly 100 percent core activities

In order to complete a capability analysis similar to what is possible with PID charges; ODOT will need to standardize definitions at the work-order level within the TMS taxonomy. ODOT is currently developing a new cost-accounting system called EMIS to replace TMS, scheduled for completion in 2013, and these new business rules will need to be incorporated. Once districts are reporting their non-PID direct activity in a standardized fashion, ODOT management can begin setting allowable limits within these new categories of expenses.

Optimization

Following the completion of these prerequisite capability analyses, ODOT will possess a robust set of analytics that the executive team can draw on for decision making. Decision-makers will have the data to inform their stated goal of administering the capital program as a single ecosystem rather than as 12 districts operating in silos.

Rather than the historical model of staffing districts with a full complement of services, ODOT can begin taking steps such as:

- District specialization;
- Soft boundaries where capital project workload is shared across district borders;
- Setting upper allowable limits for activities not charged to a project ID; and
- Optimizing the mix of services outsourced to third-party contractors.

3. Final Comment on the Realignment of Transportation Districts

Due to constraints in available data and the interrelationship between capital program delivery and district structure in ODOT’s current state, OPT’s analysis does not prescribe a specific number of districts for ODOT’s organizational structure.

OPT has identified several areas to assist ODOT in evaluating a statewide strategy for service delivery. Concurrent to the engagement, ODOT has already begun implementing many of the recommendations identified during the course of the performance audit, examples of which are detailed in other sections of this audit report.

V. SUMMARY OF RECOMMENDATIONS

The recommendations identified in the report are summarized here. Potential savings are annual except as otherwise noted. Detailed analysis of each recommendation is included in the relevant sections of the report.

Summary of Assessment Areas with Financial Impact

Assessment Area	Financial Impact
Regions Review	
• Aerial Engineering (**R8.1 – R8.3)**	$334,000
• Geotechnical Engineering (**R9.1 - R9.4**)	$233,000
Fleet Management	
• Asset Sale (**R1.1 – R1.11)**	$7,114,000
• Maintenance Savings (**R1.1 – R1.11 & R2.1 & R2.3**)	$1,872,000
• New Asset Cost Avoidance (**R1.12 & R2.2**)	$1,089,000
• Blended Biodiesel (**R3.1 & R3.2)**	$800,000
Cost / Benefit	
• Vegetation Management (**R6.1)**	$4,400,000
• Rest Areas (**R5.1 & R5.2)**	$7,200,000
Total Cost Savings from Performance Audit Recommendations:	**$23,042,000**

Summary of Recommendations with Management Implications

In addition to recommendations with financial implications, the audit also identified management recommendations that do not include financial implications, but are likely to provide improvement to overall operations and otherwise serve management purposes, including in some cases the subsequent identification of cost savings and improvements in efficiency and effectiveness. These areas include:

- Geotechnical Engineering
- Structural Engineering
- Fleet Operating Cost
- Compressed Natural Gas
- Office of External Audit
- Rest Areas

VI. AUDIT RESULTS

The performance audit identified recommendations in the areas of fleet management, fleet operating cost, blended biodiesel, compressed natural gas, rest areas, vegetation management, external audit, aerial engineering, geotechnical engineering, and structural engineering.

See **Section VIII: Acronyms** for a list of acronyms used throughout this report.

1. FLEET MANAGEMENT – FLEET UTILIZATION

FLEET MANAGEMENT PART 1

Heavy Equipment Group 1 Utilization

***Savings*: $3.1M**

Finding 1.1: Nearly 42 percent (178) of ODOT's 424 pieces of heavy equipment are used less than 5 percent of expected seasonally adjusted operational time.

Recommendation 1.1: ODOT should take incremental steps to right-size the heavy equipment fleet by disposing of 178 underutilized pieces of equipment through auction.

Financial Impact 1.1: Disposal of 178 underutilized pieces of heavy equipment could realize approximately **$3,127,000** in direct asset sales and an additional **$89,000** in annual direct maintenance parts cost avoidance.

Tractor Utilization

***Savings:* $1.5M**

Finding 1.2: Nearly 37 percent (206) of ODOT's 560 tractors are used less than 15 percent of expected seasonally adjusted operational time.

Recommendation 1.2: ODOT should take incremental steps to right-size the tractor fleet by disposing of 206 underutilized tractors through auction.

Financial Impact 1.2: Disposal of 206 underutilized tractors could realize approximately **$1,513,000** in direct asset sales and an additional **$123,000** in annual direct maintenance parts cost avoidance.

Vocational Vehicle Utilization

***Savings:* $373,000**

Finding 1.3: Nearly 6 percent (151) of ODOT's 2,522 vocational vehicles are used less than 20 percent of expected operational time.

Recommendation 1.3: ODOT should take incremental steps to right-size the vocational vehicle fleet by disposing of the 151 underutilized vehicles through auction.

Financial Impact 1.3: Disposal of 151 underutilized vehicles could realize approximately **$373,000** in direct asset sales and an additional **$61,000** in annual direct maintenance parts cost avoidance.

Passenger Car Utilization

Savings: **$242,000**

Finding 1.4: Nearly 19 percent (87) of ODOT's 458 passenger cars are used less than 50 percent of expected operational time.

Recommendation 1.4: ODOT should take incremental steps to right-size the passenger car fleet by disposing of 87 underutilized vehicles through auction.

Financial Impact 1.4: Disposal of 87 underutilized vehicles could realize approximately **$242,000** in direct asset sales and an additional **$31,000** in annual direct maintenance parts cost avoidance.

Light Dump Truck Utilization

Savings: **$62,000**

Finding 1.5: Nearly 10 percent (14) of ODOT's 145 light dump trucks are used less than 20 percent of expected operational time.

Recommendation 1.5: ODOT should take incremental steps to right-size the light dump truck fleet by disposing of 14 underutilized vehicles through auction.

Financial Impact 1.5: Disposal of 14 underutilized light dump trucks could realize approximately **$62,000** in direct asset sales and an additional **$21,000** in annual direct maintenance parts cost avoidance

FLEET MANAGEMENT PART 2

Heavy Equipment Group 2 Utilization

***Savings*: $710,000**

Finding 1.6: Nearly 33 percent (91) of ODOT's 273 pieces of heavy equipment are used less than 5 percent of expected seasonally adjusted operational time.

Recommendation 1.6: ODOT should take incremental steps to further right-size the heavy equipment fleet by disposing of 91 underutilized pieces of equipment through auction.

Financial Impact 1.6: Disposal of 91 underutilized pieces of heavy equipment could realize approximately **$710,000** in direct asset sales and an additional **$40,000** in annual direct maintenance parts cost avoidance.

Brush Chipper Utilization

***Savings:* $457,000**

Finding 1.7: Nearly 73 percent (65) of ODOT's 89 brush chippers are used less than 5 percent of available operational time.

Recommendation 1.7: ODOT should take incremental steps to right-size the brush chipper fleet by disposing of 65 underutilized brush chippers through auction.

Financial Impact 1.7: Disposal of 65 underutilized brush chippers could realize approximately **$457,000** in direct asset sales and an additional **$7,000** in annual direct maintenance parts cost avoidance.

Skid Steer Loader Utilization

Savings: **$277,000**

Finding 1.8: Nearly 41 percent (30) of ODOT's 73 skid steer loaders are used less than 5 percent of available operational time.

Recommendation 1.8: ODOT should take incremental steps to right-size the skid steer loader fleet by disposing of 30 underutilized skid steer loaders through auction.

Financial Impact 1.8: Disposal of 30 underutilized skid steer loaders could realize approximately **$277,000** in direct asset sales and an additional **$9,000** in annual direct maintenance parts cost avoidance.

Front End Loader Utilization

Savings: **$212,000**

Finding 1.9: Nearly 4 percent (10) of ODOT's 246 front end loaders are used less than 5 percent of expected seasonally adjusted operational time.

Recommendation 1.9: ODOT should take incremental steps to right-size the front end loader fleet by disposing of 10 underutilized front end loaders through auction.

Financial Impact 1.9: Disposal of 10 underutilized front end loaders could realize approximately **$212,000** in direct asset sales and an additional **$12,000** in annual direct maintenance parts cost avoidance.

Cleaner Vacuum Utilization

Savings: **$122,000**

Finding 1.10: Nearly 35 percent (9) of ODOT's 26 cleaner vacuums are used less than 5 percent of available operational time.

Recommendation 1.10: ODOT should take incremental steps to right-size the cleaner vacuum fleet by disposing of the 9 underutilized cleaner vacuums through auction.

Financial Impact 1.10: Disposal of 9 underutilized cleaner vacuums could realize approximately **$122,000** in direct asset sales and an additional **$3,000** in annual direct maintenance parts cost avoidance.

Truck Tractor Utilization

Savings: **$19,000**

Finding 1.11: Nearly 7 percent (3) of ODOT's 43 truck tractors are used less than 20 percent of expected operational time.

Recommendation 1.11: ODOT should take incremental steps to right-size the truck tractors fleet by disposing of the 3 underutilized truck tractors through auction.

Financial Impact 1.11: Disposal of 3 underutilized truck tractors could realize approximately **$19,000** in direct asset sales and an additional **$6,000** in annual direct maintenance parts cost avoidance.

Reduced New Vehicle and Equipment Demand

Savings: **$837,000**

Finding 1.12: ODOT could avoid purchasing an average of at least 24 new vehicles and pieces of equipment each year by implementing recommendations to right-size the fleet.

Recommendation 1.12: ODOT should ensure that current and future vehicle and equipment replacements take into account a reduced need for vehicles and equipment commensurate with a smaller total fleet.

Financial Impact 1.12: Implementing initial recommendations to right-size the fleet would result in approximately **$837,000** in annual cost savings associated with reduced new vehicle and equipment demand resulting in savings of **$8.4 million** over 10 years.

Total Financial Impact: Part 1 & Part 2 (10 Years)

Totals by Savings Type	Financial Impact
One-Time Sale of Assets	**$7,114,000**
• Fleet Management Part 1	$5,317,000
• Fleet Management Part 2	$1,797,000
10-Year Maintenance Cost Avoidance	**$4,020,000**
• Fleet Management Part 1	$3,250,000
• Fleet Management Part 2	$770,000
10-Year New Asset Cost Avoidance	**$8,370,000**
Total Identified Savings	**$19,504,000**

Source: Recommendations from Fleet Management Part 1, Fleet Management Part 2, and New Vehicle and Equipment Demand

FLEET MANAGEMENT

Fleet Management Part 1: These recommendations were issued as part of the ODOT interim report dated April 23, 2012. No substantive changes have been made to the recommendations.

Fleet Management Part 2: These recommendations were issued as part of the ODOT interim report dated September 19, 2012. No substantive changes have been made to the recommendations.

Background

ODOT is responsible for a variety of tasks and functions that are carried out statewide by both Central Office and district staff. To carryout day-to-day operations, ODOT must acquire and use vehicles and heavy equipment. For example, ODOT's responsibility for snow and ice control requires dump trucks to plow the roads and front end loaders to keep the dump trucks supplied with salt. Another example is ODOT's responsibility for construction activities, which requires backhoes, excavators, rollers, and myriad other types of specialized equipment.

OPT assessed utilization of types and classes of vehicles and equipment based on the general asset value, widespread use across the state, and number of pieces. The categories of equipment and vehicles analyzed and a general description follows:

- **Heavy Equipment Group 1 -** ODOT has 424 pieces of selected heavy equipment in its current fleet selected for this analysis. Types of equipment selected for review in this analysis included: backhoes, excavators, graders, rollers, and crawler tractors. These pieces of heavy equipment are primarily used for construction and maintenance activities.

- **Tractors -** ODOT has 560 tractors in its current fleet. These tractors are primarily used for interstate and roadway mowing. In addition to this in-house service delivery, ODOT also contracts with private service providers for a portion of these mowing services.

- **Vocational Vehicles -** ODOT has 2,522 vocational vehicles in its current fleet. ODOT's vocational vehicles are used year round and are primarily ½ ton, ¾ ton, and 1 ton pickup trucks used to carry out day-to-day work operations, with the majority of vehicles being used to support construction site activities.

- **Passenger Cars -** ODOT has 458 passenger cars in its current fleet. These vehicles are sedans, coupes, and station wagons primarily used year round as general purpose pool cars as needed by ODOT employees.

- **Light Dump Trucks -** ODOT has 145 light dump trucks in its current fleet. ODOT's light dump trucks are typically up-fitted 1 ton pickup trucks which are used year round to carry out day-to-day multi-use operations; for example, hauling concrete one day and highway debris the next.

- **Heavy Equipment Group 2 -** ODOT has 273 pieces of heavy construction equipment in its current fleet selected for this analysis. Types of equipment selected for review in this analysis included construction brooms, bucket trucks, distributors, and crawler and force-feed loaders, milling machines, asphalt reclaimers, seeders, and road wideners. These pieces of heavy equipment are primarily used for construction and maintenance activities.

- **Brush Chippers -** ODOT has 89 brush chippers in its current fleet. These brush chippers are used year round to process trees, brush, and other debris. Use can be driven by either planned activities or activities associated with storm cleanup.
- **Skid Steer Loaders -** ODOT has 73 skid steer loaders in its current fleet. ODOT's skid steer loaders are used year round for both construction and support activities. Skid steer loaders can vary significantly in use and application depending on attachments (e.g., loader, forklift, and/or auger) and need.
- **Front End Loaders -** ODOT has 246 front end loaders in its current fleet. These pieces of equipment are used primarily during the snow and ice control season to load dump trucks but are also used during the summer for activities such as loading aggregate.
- **Cleaner Vacuums -** ODOT has 26 cleaner vacuums in its current fleet. ODOT's cleaner vacuums are either in the form of up-fitted trucks or pull behind trailers. Both types of equipment are primarily used for clearing blocked drainage systems and piping.
- **Truck Tractors -** ODOT has 43 truck tractors in its current fleet. ODOT's truck tractors are typically used for hauling supplies, materials, and equipment between counties, districts, and across the state.

ODOT has developed its own internal policies and procedures governing the use of vehicles and equipment, including, where applicable, minimum annual mileage and minimum annual engine hours for vehicles and equipment. In addition to ODOT's own management practices, the Ohio Department of Administrative Services also has rules in place that restrict ODOT from acquiring additional vehicles without first identifying a vehicle that will be disposed.

Decentralized fleet management leads to an overly large fleet of vehicles and equipment, with generally low utilization. Furthermore, this overly large fleet of vehicles and equipment requires a higher level of support cost (fuel, maintenance parts, maintenance staffing, and overhead cost) than is necessary for efficiently carrying out day-to-day operations.

Methodology and Analysis

Each vehicle and type of equipment included in this utilization analysis was categorized based on the seasonal, or non-seasonal, nature of its use. While weather and season lengths can vary from year to year, OPT worked with ODOT staff to identify a representative construction season (approximately 8.5 months) and a representative snow and ice control season (approximately 3.5 months). Where appropriate, utilization analyses were based on the extent to which seasonal use was a factor. For example, paving equipment is not used during the snow and ice season while snow plows and brine trucks are used much more heavily. Furthermore, all utilization calculations exclude state holidays. Finally, all utilization was calculated using ODOT's own recorded annual mileage and engine hours (where applicable) by unique piece of equipment.

- **Heavy Equipment Group 1 Utilization Analysis:**
  To assess heavy equipment utilization, OPT worked with ODOT staff to identify a reasonable construction season; total hours were based on available days within the construction season. Actual heavy equipment engine hours were applied to the total construction season hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis.[2] OPT found that nearly 42 percent (178) of ODOT's 424 pieces of heavy equipment are used less than 5 percent of expected seasonally adjusted operational time. A 5 percent utilization standard equates to approximately 72 engine hours, or 9 total days, or less per year.

- **Tractor Utilization Analysis:**
  To assess tractor utilization, OPT worked with ODOT staff to identify a reasonable mowing season; total hours were based on available days within the mowing season. Actual tractor engine hours were applied to the total mowing season hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 37 percent (206) of ODOT's 560 tractors were used less than 15 percent of expected seasonally adjusted operational time. A 15 percent utilization standard equates to approximately 165 hours, or 21 total days, or less per year.

- **Vocational Vehicle Utilization Analysis:**
  To assess vocational vehicle utilization, OPT used ODOT's internal guidelines on expected annual vehicle mileage. Actual vehicle mileage was applied to the expected annual vehicle mileage to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 6 percent (151) of ODOT's 2,522 vocational vehicles are used less than 20 percent of expected operational time. A 20 percent utilization standard generally equates to 2,400 miles or less per year.

- **Passenger Cars Utilization Analysis:**
  To assess passenger car utilization, OPT used ODOT's internal guidelines on expected annual vehicle mileage. Actual vehicle mileage was applied to the expected annual vehicle mileage to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 19 percent (87) of ODOT's 458 passenger cars are used less than 50 percent of expected operational time. A 50 percent utilization standard equates to 6,000 miles or less per year.

- **Light Dump Truck Utilization Analysis:**
  To assess light dump truck utilization, OPT used ODOT's internal guidelines on expected annual vehicle mileage and annual engine hours. For vehicles with engine hour meters, both annual mileage and hours were assessed. However, for vehicles without an engine

[2] FY 2011-12 data was collected as of November 29, 2011. Where necessary and appropriate, utilization statistics were prorated to account for a full season of use for FY 2011-12.

hour meter, only annual mileage was assessed. Actual vehicle mileage and engine hours, were applied to the expected annual vehicle mileage and engine hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 10 percent (14) of ODOT's 145 light dump trucks are used less than 20 percent of expected operational time. A 20 percent utilization standard equates to 2,400 miles or less per year or 100 or less engine hours per year.

- **Heavy Equipment Group 2 Utilization Analysis:**
  To assess heavy construction equipment utilization, actual heavy construction equipment engine hours were applied to the total construction season hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 33 percent (91) of ODOT's 273 pieces of heavy construction equipment are used less than 5 percent of expected seasonally adjusted operational time. A 5 percent utilization standard equates to approximately 72 engine hours, or 9 total days, or less per year.

- **Brush Chipper Utilization Analysis:**
  To assess brush chipper utilization, OPT used an annual available operational time of 2,000 hours. Actual brush chipper engine hours were applied to the total annual hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis.
  OPT found that nearly 73 percent (65) of ODOT's 89 brush chippers are used less than 5 percent of available operational time. A 5 percent utilization standard equates to approximately 100 hours, or 13 total days, or less per year.

- **Skid Steer Loader Utilization Analysis:**
  To assess skid steer loader utilization, OPT used an annual available operational time of 2,000 hours. Actual skid steer loader engine hours were applied to the total annual hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 41 percent (30) of ODOT's 73 skid steer loaders are used less than 5 percent of available operational time. A 5 percent utilization standard equates to approximately 100 hours, or 13 total days, or less per year.

- **Front End Loader Utilization Analysis:**
  To assess front end loader utilization, OPT worked with ODOT staff to identify a reasonable snow and ice control season; total hours were based on available days within the snow and ice control season. Actual front end loader engine hours were applied to the total snow and ice control season hours to calculate utilization rates for FY 2009-10 and FY 2010-11.[3] OPT found that nearly 4 percent (10) of ODOT's 246 front end loaders are

[3] To ensure that any recommended disposal of assets would not adversely affect ODOT's ability to provide the core service of snow and ice removal, the analysis and recommendation was based only on the snow and ice control season. Utilization also occurs outside of this season, but such use was not included in the analysis.

used less than 5 percent of expected seasonally adjusted operational time. A 5 percent utilization standard equates to approximately 28 engine hours, less than 4 days per year.

- **Cleaner Vacuum Utilization Analysis:**
  To assess cleaner vacuum utilization, OPT used an annual available operational time of 2,000 hours. Actual cleaner vacuum engine hours were applied to the total annual hours to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 35 percent (9) of ODOT's 26 cleaner vacuums are used less than 5 percent of available operational time. A 5 percent utilization standard equates to approximately 100 hours, or 13 total days, or less per year.

- **Truck Tractor Utilization Analysis:**
  To assess truck tractor utilization, OPT used ODOT's internal guidelines on expected annual truck tractor mileage (10,000 miles per year). Actual truck tractor mileage was applied to the expected annual truck tractor mileage to calculate utilization rates for FY 2010-11 and FY 2011-12 on a prorated basis. OPT found that nearly 7 percent (3) of ODOT's 43 truck tractors are used less than 20 percent of expected operational time. A 20 percent utilization standard equates to 2,000 miles or less per year.

Conclusions

Based on the preceding utilization analyses ODOT should take steps to right-size the fleet of vehicles and equipment by disposing of:

- 269 underutilized pieces of heavy equipment;[4]
- 206 underutilized tractors;
- 151 underutilized vocational vehicles;
- 87 underutilized passenger cars;
- 65 underutilized brush chippers;
- 30 underutilized skid steer loaders;
- 14 underutilized light dump trucks;
- 10 underutilized front end loaders;
- 9 underutilized cleaner vacuums; and
- 3 underutilized truck tractors.

As ODOT implements these recommendations it should target disposal of vehicles and pieces of equipment with chronically low utilization patterns or high annual maintenance cost; which in most cases would typically be those vehicles and pieces of equipment that are already at or beyond projected useful age and engine hours.

[4] This figure is inclusive of Group 1 (178) and Group 2 (91) recommendations.

Fleet Management - Part 1

Recommendation 1.2: ODOT should take incremental steps to right-size the tractor fleet by disposing of 206 underutilized tractors through auction.

Financial Impact 1.2: Disposal of 206 underutilized tractors could realize approximately **$1,513,000** in direct asset sales and an additional **$123,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.1: ODOT should take incremental steps to right-size the heavy equipment fleet by disposing of 178 underutilized pieces of equipment through auction.

Financial Impact 1.1: Disposal of 178 underutilized pieces of heavy equipment could realize approximately **$3,127,000** in direct asset sales and an additional **$88,500** in annual direct maintenance parts cost avoidance.

Recommendation 1.3: ODOT should take incremental steps to right-size the vocational vehicle fleet by disposing of the 151 underutilized vehicles through auction.

Financial Impact 1.3: Disposal of 151 underutilized vehicles could realize approximately **$373,000** in direct asset sales and an additional **$61,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.4: ODOT should take incremental steps to right-size the passenger car fleet by disposing of 87 underutilized vehicles through auction.

Financial Impact 1.4: Disposal of 87 underutilized vehicles could realize approximately **$242,000** in direct asset sales and an additional **$31,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.5: ODOT should take incremental steps to right-size the light dump truck fleet by disposing of 14 underutilized vehicles through auction.

Financial Impact 1.5: Disposal of 14 underutilized light dump trucks could realize approximately **$62,000** in direct asset sales and an additional **$21,200** in annual direct maintenance parts cost avoidance

Fleet Management - Part 2

Recommendation 1.6: ODOT should take incremental steps to further right-size the heavy equipment fleet by disposing of 91 underutilized pieces of equipment through auction.

Financial Impact 1.6: Disposal of 91 underutilized pieces of heavy equipment could realize approximately **$710,000** in direct asset sales and an additional **$40,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.7: ODOT should take incremental steps to right-size the brush chipper fleet by disposing of 65 underutilized brush chippers through auction.

Financial Impact 1.7: Disposal of 65 underutilized brush chippers could realize approximately **$457,000** in direct asset sales and an additional **$7,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.8: ODOT should take incremental steps to right-size the skid steer loader fleet by disposing of 30 underutilized skid steer loaders through auction.

Financial Impact 1.8: Disposal of 30 underutilized skid steer loaders could realize approximately **$277,000** in direct asset sales and an additional **$9,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.9: ODOT should take incremental steps to right-size the front end loader fleet by disposing of 10 underutilized front end loaders through auction.

Financial Impact 1.9: Disposal of 10 underutilized front end loaders could realize approximately **$212,000** in direct asset sales and an additional **$12,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.10: ODOT should take incremental steps to right-size the cleaner vacuum fleet by disposing of 9 underutilized cleaner vacuums through auction.

Financial Impact 1.10: Disposal of 9 underutilized cleaner vacuums could realize approximately **$122,000** in direct asset sales and an additional **$3,000** in annual direct maintenance parts cost avoidance.

Recommendation 1.11: ODOT should take incremental steps to right-size the truck tractor fleet by disposing of 3 underutilized truck tractors through auction.

Financial Impact 1.11: Disposal of 3 underutilized truck tractors could realize approximately **$19,000** in direct asset sales and an additional **$6,000** in annual direct maintenance parts cost avoidance.

New Vehicle and Equipment Demand

Background

ODOT's policy[5] is to evaluate the replacement cycling of passenger cars and vocational vehicles based on general guidelines of 10 years and 120,000 miles. Heavy equipment, depending on type and use, is evaluated based on 10 to 20 years and 1,000 to 5,000 engine hours. Tractors are evaluated for replacement based on 10 years and 2,000 engine hours. The policy includes a note that "The Lifespan or… minimum use should be exceeded prior to being replaced. Any exceptions will be reviewed on an individual basis." Exceptions which are taken into account by the Office of Equipment Management (OEM) can include replacements necessitated by operating cost and condition. ODOT historically has focused management and control of the fleet of vehicles and equipment at the point of purchase. For example, if a district wants to replace a vehicle or piece of equipment it requests the replacement through OEM. OEM then verifies the need for replacement and can approve or deny the request. If OEM approves the request it will then work with the Ohio Department of Administrative Services (DAS) to fulfill the request.

DAS is statutorily responsible, under ORC § 125.832, for all fleet management within the State of Ohio. DAS may delegate varying degrees of day-to-day decision making under OAC 123:6-1-04, based on each agency's capacity to manage as well as overall fleet composition complexity. Because ODOT has a complex vocational fleet, DAS allows ODOT a higher degree of flexibility than for agencies that operate only light vehicles.

While DAS has developed guidelines on light-vehicle replacement (minimum 6 years and 90,000 miles for passenger cars), it does not have minimum replacement guidelines for more complex fleets such as ODOT's. In lieu of more complex fleet management strategies that would be specific to each agency fleet, DAS focuses on control of the total fleet size. For example, when an agency seeks to replace a vehicle DAS requires that it turn in a vehicle for disposal.[6]

Although both ODOT and DAS manage ODOT's total fleet size, there are varying degrees of autonomy and delegated authority afforded within ODOT's decentralized district and county structure. Districts generally use their individual budgets to purchase vehicles and equipment, which requires a certain degree of afforded flexibility. However, putting decision-making power in the districts rather than in a single authority leads to variation in process that reduces overall efficiency and effectiveness of management. For example, opportunities to share vehicles and equipment across districts and counties may have been lost because of the lack of a centralized perspective from which to examine such opportunities. Such lost efficiencies may contribute to low utilization and the maintenance of a larger fleet than necessary.

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[5] Procedure EIP-2095, Equipment Age and Use Evaluation; effective 09/09/2006.

[6] There are infrequent circumstances where an additional vehicle could be approved (i.e., the agency would have to provide a cost benefit case for an additional vehicle). Agencies can also replace vehicles with vehicles of different types or applications, under appropriate cost benefit circumstances.

Methodology and Analysis

OPT performed analysis on ODOT's Equipment Management System data to identify the number of new vehicles and pieces of equipment by type that were purchased over the last five fiscal years by ODOT. In addition, ODOT's purchase price data was used to identify an average purchase price for each vehicle and equipment type. Recommendations for fleet reductions were applied to baseline fleet totals to determine the proportion of total fleet recommended for reduction. To calculate financial impact, the proportion of recommended reductions was applied to the average number of new vehicles and pieces of equipment acquired since the start of FY 2010-11 to identify the minimum number of annual replacements which would be avoided through right sizing the fleet.[7]

Table 1-1 shows the average annual vehicle and equipment needs which will be avoided by implementing performance audit recommendations to right-size the fleet of vehicles and equipment. These units and associated annual cost would have, on average, been incurred by ODOT under a status quo fleet management environment.

[7] For some types of vehicles and equipment there were no purchases within the last two years. These have been excluded from the financial impact presented in this analysis.

Table 1-1: Annual Fleet Replacement Reductions

Overview Recommended Reductions from Interim Report on Fleet Management, April 2012				
	Total Units	**Recommended Reduction**	**Avg. Annual Reduction of New Units Need**	**Annual Purchase Cost Financial Impact** [1]
Heavy Equipment Group 1	424	178	1	$47,719
Tractors	560	206	8	$358,324
Vocational Vehicles	2,522	151	5	$121,824
Passenger Cars	458	87	4	$56,858
Light Dump Trucks	145	14	N/A	N/A
Sub-Total Annual Financial Impact				**$584,725**
Overview Recommended Reductions from Interim Report on Fleet Management, September 2012				
	Total Units	**Recommended Reduction**	**Avg. Annual Reduction of New Units**	**Annual Purchase Cost Financial Impact**
Heavy Equipment Group 2	273	91	3	$141,991
Brush Chippers	89	65	2	$71,172
Skid Steer Loaders	73	30	1	$39,384
Front End Loaders	246	10	N/A	N/A
Cleaner Vacuums	26	9	N/A	N/A
Truck Tractors	43	3	N/A	N/A
Sub-Total Annual Financial Impact				**$252,546**
Total Annual Financial Impact of Replacement Reductions [2]				**$837,271**

Source: ODOT EMS data and performance audit recommendations

Note: Only vehicle and equipment types for which ODOT has purchased an average of one or more units per year since the start of FY 2010-11 were quantified in this analysis. Although ODOT could avoid costs in other groupings and types of vehicles and equipment which are not quantified here, the regularity of the purchase decisions is such that associated financial impacts are not included in this estimation of savings.

[1] Annual financial impact is reflective of purchase cost only.

[2] Full realization of cost avoidance is contingent upon ODOT's full implementation of performance audit recommendations for right-sizing the fleet and subsequently avoiding unnecessary purchase of vehicles and equipment moving forward.

Conclusion

ODOT should ensure that current and future vehicle and equipment replacements take into account a reduced need for vehicle and equipment commensurate with a smaller total fleet. These reductions in the need to replace vehicles should be commensurate with recommendations issued to reduce the overall size of the fleet through equipment and vehicle disposal.

As shown in **Table 1-1,** ODOT could avoid more than $837,000 per year, or approximately $8.4 million over 10 years, in annual fleet acquisition costs by adjusting annual purchase decisions commensurate with performance audit recommendations for fleet right-sizing.

Recommendation 1.12: ODOT should ensure that current and future vehicle and equipment replacements take into account a reduced need for vehicles and equipment commensurate with a smaller total fleet.

Financial Impact 1.12: Implementing initial recommendations to right-size the fleet would result in approximately **$837,000** in annual cost savings associated with reduced new vehicle and equipment demand.

2. FLEET MANAGEMENT - FLEET COST OPTIMIZATION

Savings: $1.3 million

Finding 2.1: Lack of an optimized sourcing strategy for vehicle and equipment maintenance and repairs results in losses of efficiency in both direct cost as well as the opportunity cost of employee time.

Recommendation 2.1: ODOT should optimize the sourcing of common vehicle and equipment maintenance and repair activities in a manner that provides an acceptable level of service at the lowest cost. ODOT should periodically, at least annually, evaluate the cost effectiveness of maintenance and repair activities to ensure that in-house repair costs remain competitive with outsourced costs and vice versa. Finally, ODOT should explore opportunities to aggregate high-volume maintenance and repair activities that could be outsourced at a cost that takes advantage of economies of scale and affords a cost savings relative to in-house service provision.

Financial Impact 2.1: ODOT could realize annual savings of up to **$1.3 million** by optimally sourcing commonly outsourced maintenance and repair activities. In addition to the direct cost savings identified, optimized sourcing of maintenance and repair activities would free up 4.3 FTEs worth of total labor across ODOT which could be redirected to provide services in mission critical areas.

Savings: $252,000

Finding 2.2: ODOT's passenger car fleet replacement policy and practice results in a more costly fleet operation than an optimized cycling policy and practice.

Recommendation 2.2: ODOT should optimize the vehicle replacement policy and practice for its passenger car fleet to minimize the total lifecycle operating cost associated with acquisition, maintenance and repair, and fuel cost while maximizing residual vehicle value.

Financial Impact 2.2: ODOT could realize annual savings of **$252,000**, or approximately **$2.5 million** over 10 years, by setting the passenger car fleet replacement age and mileage at an optimized point that minimizes the overall lifecycle cost of each vehicle.

Savings: $171,000

Finding 2.3: ODOT's vehicle and equipment maintenance and repair labor supply is not optimized to meet labor demand.

Recommendation 2.3: ODOT should analyze the extent to which labor supply variances from district to district are the result of actual labor demand. In doing so ODOT should evaluate the necessity of all supplied direct and indirect labor and should investigate strategies to maximize hands-on, direct productivity of staff while minimizing the need to incur indirect labor. Particular attention should be given to District 12 which appears to be overstaffed by a minimum of 3.0 FTEs. At minimum, ODOT should eliminate the 3.0 FTE position overage identified in District 12.

Financial Impact 2.3: If ODOT were to eliminate 3.0 FTE vehicle and equipment maintenance and repair positions in District 12 it could save **$171,000** annually based on a full annual hours expectation of 2,080, the average District 12 regular hourly rate of $19.38, and an applied benefits percentage of 41.3 percent.

MAINTENANCE AND REPAIR SOURCING OPTIMIZATION

Background

ODOT, operating under delegated fleet management authority from DAS, is responsible for maintenance and repair of its fleet of vehicles and equipment. In providing this service ODOT can choose to use in-house resources or coordinate service delivery through private sector vendors. The determination of appropriate sourcing is made at the district, county, or garage level rather than as a part of an ODOT-wide strategy.

All routine and preventive maintenance is provided based on manufacturer guidelines while non-routine maintenance and repairs are performed on an as-needed basis at the discretion of the districts or their sub-locations. The Office of Equipment Management (OEM) promulgates maintenance and repair activity types and a system of coding which provides a consistent, organized structure to the maintenance and repair data that is entered into the Equipment Management System (EMS). However, OEM does not oversee the day-to-day maintenance and repair activities of the districts.

Table 2-1 shows total outsourced work orders by District and total value of outsourced maintenance and repair activities for FY 2010-11 and FY 2011-12.

Table 2-1: Outsourced Work Orders Overview

	FY 2010-11		FY 2011-12	
District	**Work Orders**	**Direct Cost**	**Work Orders**	**Direct Cost**
District 1	148	$22,029	175	$35,512
District 2	318	$84,893	336	$71,576
District 3	839	$188,834	911	$176,215
District 4	474	$154,696	517	$147,629
District 5	655	$155,933	583	$104,864
District 6	583	$236,038	493	$220,746
District 7	91	$40,380	104	$29,184
District 8	293	$173,102	340	$153,945
District 9	321	$112,497	370	$119,774
District 10	161	$20,545	218	$44,158
District 11	183	$48,339	201	$71,249
District 12	564	$97,439	434	$213,704
Central Office	189	$474,867	167	$66,477
ODOT Total	**4,819**	**$1,809,593**	**4,849**	**$1,455,034**

Source: ODOT EMS data

As shown in **Table 2-1**, ODOT has outsourced a considerable amount of vehicle and equipment maintenance and repair activities. Furthermore, for the two fiscal years analyzed, District 3 outsourced more work orders than any other district. District 3 outsourced 28.1 percent more work orders than the next closest district in FY 2010-11, and 56.3 percent more work in FY 2011-12; in both cases the next closest district is District 5.

The Central Office had the highest dollar value of outsourced work orders in FY 2010-11. However, $421,604, or 88.8 percent, was allocated for work orders associated with single and tandem axle dump truck maintenance and repairs. District 6 had the highest dollar value of outsourced work orders in FY 2011-12. However, $108,618, or 49.2 percent, was allocated for work orders associated with single and tandem axle dump truck maintenance and repairs.

Methodology

ODOT provided data for all vehicle and equipment maintenance and repair activities by district, including the Central Office for FY 2010-11, FY 2011-12, and FYTD 2012-13. In addition, ODOT provided data for all outsourced vehicle and equipment maintenance and repair activities.

Outsourced data was analyzed to identify the most common vehicle and equipment maintenance and repair activities that have been outsourced over the last two complete fiscal years (FY 2010-11 and FY 2011-12). ODOT's in-house cost for these commonly outsourced maintenance and repair types was aggregated and compared to the outsourced cost to assess the extent to which the in-house or outsourced cost was financially optimal.[8]

This analysis is focused on optimal sourcing rather than ODOT's maintenance and repair staffing. As such only the direct cost of in-house labor was taken into account. However, the ODOT overhead rate associated with maintenance and repair parts was included given that insourcing or outsourcing these types of activities can impact inventory and parts management activities. ODOT's in-house cost includes ODOT's current average parts overhead rate of 36.5 percent.

Analysis

Table 2-2 shows the top 10 most commonly outsourced repair types for FY 2010-11 and FY 2011-12 combined.[9] This information is important to direct the analysis toward a comparison of the average cost of a repair that is commonly performed. Although a comprehensive comparison of all outsourced repair types is possible, the sample sizes of outsourced repair types; cost; and

[8] ODOT practice is to require data to be entered into EMS under a specific work order and repair type if the employee performing the work needed more than one hour of time or used more than $50 in parts. This requirement does not preclude more detailed data entry and the ODOT data set does include a substantial number of data points that fit the aforementioned criteria. However, given the uncertainty that the total cost of work performed under $50 is truly reflected in the ODOT maintenance and repair cost information, for the purposes of this analysis, the outsourced maintenance and repair work orders with a value of less than $50 were excluded.

[9] Four repair types were excluded from comparative analysis due to insufficient assurance that the repair type could isolate and provide an apples-to-apples comparison. These repair types, with total outsourced counts for FY 2010-11 and FY 2011-12 combined, include:

- Towing, 572;
- Miscellaneous Repairs, 270;
- Delivery / Pickup of Equipment, 182; and
- Miscellaneous Engine Repairs, 138.

most importantly, average cost, would likely result in inaccurate comparisons due to small sample sizes and lack of sufficient detail in the categorization and classification of repair types.[10]

Table 2-2: Top 10 Most Commonly Outsourced Repair types

Repair Type	Repair Description	Total Services	Total Cost	Avg. Cost
237	Glass Replacement	431	$84,361	$196
267	Tire Replacement - New	398	$72,963	$183
266	Tire Replacement - Used	326	$63,457	$195
125	Suspension and Springs	267	$158,369	$593
126	Wheel Alignment	218	$25,120	$115
361	Hydraulic Cylinders / Pistons	99	$66,427	$671
221	Salt Spreader Control	81	$16,917	$209
309	2-Way Radio	69	$13,089	$190
252	Vehicle Seat	67	$16,245	$242
228	Computer / Sensor	64	$18,622	$291

Source: ODOT EMS data

Table 2-3 shows ODOT's in-house average repair cost for the top 10 most commonly outsourced repair types shown in **Table 2-2**.

Table 2-3: ODOT In-House Avg. Cost for Top 10 Outsourced Repair Types

Repair Type	Repair Description	Total Services	Total Cost	Avg. Cost
237	Glass Replacement	1,952	$534,796	$274
267	Tire Replacement - New	6,847	$3,526,082	$515
266	Tire Replacement - Used	10,313	$854,361	$83
125	Suspension and Springs	2,037	$970,757	$477
126	Wheel Alignment	159	$43,436	$273
361	Hydraulic Cylinders / Pistons	2,396	$660,348	$276
221	Salt Spreader Control	1,300	$130,127	$100
309	2-Way Radio	214	$32,685	$153
252	Vehicle Seat	657	$84,409	$128
228	Computer / Sensor	1,584	$336,101	$212

Source: ODOT EMS data

Table 2-4 shows the difference in the average cost per repair type and the cost savings associated with optimal sourcing of the repair type fully through the identified lowest-cost service provider.

[10] A common rule-of-thumb for sample size is at least a population of 30.

Table 2-4: Optimal Sourcing Cost Savings

Repair Type	Repair Description	Total Services	Optimal Avg. Cost	Optimal Total Cost	Current Total Cost	Optimal Savings
237	Glass Replacement	2,383	$196	$466,434	$619,157	$152,723
267	Tire Replacement - New	7,245	$183	$1,328,192	$3,599,045	$2,270,853
266	Tire Replacement - Used	10,639	$83	$881,368	$917,818	$36,450
125	Suspension and Springs	2,304	$477	$1,097,999	$1,129,126	$31,127
126	Wheel Alignment	377	$115	$43,441	$68,555	$25,115
361	Hydraulic Cylinders / Pistons	2,495	$276	$687,633	$726,775	$39,142
221	Salt Spreader Control	1,381	$100	$138,235	$147,044	$8,809
309	2-Way Radio	283	$153	$43,224	$45,774	$2,550
252	Vehicle Seat	724	$128	$93,017	$100,654	$7,637
228	Computer / Sensor	1,648	$212	$349,681	$354,723	$5,042
FY 2010-11 & FY 2011-12 Total Savings Through Optimal Sourcing						**$2,579,447**
Annual Total Savings Through Optimal Sourcing						**$1,289,724**

Source: ODOT EMS data

As shown in **Table 2-4**, ODOT could save an annual total of approximately $1.3 million based on the average optimal sourcing cost by repair type for FY 2010-11 and FY 2011-12. ODOT's outsourced repair types appear to be more competitive as volume increases. For example, three of the top four repair types shown in **Table 2-4** are optimally outsourced. These data points suggest that ODOT could potentially achieve financial savings through aggregated sourcing and higher volumes.[11]

Table 2-5 shows the net impact on ODOT's direct labor need associated with the completed additional in-house maintenance and repair activities net the direct labor need no longer associated with the outsourced maintenance and repair activities shown in **Table 2-4**.

[11] Although the data suggests that higher volumes could result in more competitive pricing the data was not available to identify specific instances where ODOT had actually implemented this type of sourcing model. Therefore, no additional analysis was able to be performed at this time.

Table 2-5: Optimal Sourcing Labor impact

Repair Type	Repair Description	Optimized Source	ODOT Avg. Labor	Net Labor Change[1]
237	Glass Replacement	Outsourced	1.35	2,632.80
267	Tire Replacement - New	Outsourced	1.55	10,620.30
266	Tire Replacement - Used	In-House	1.21	394.73
125	Suspension and Springs	In-House	2.85	760.16
126	Wheel Alignment	Outsourced	1.78	282.70
361	Hydraulic Cylinders / Pistons	In-House	2.07	204.57
221	Salt Spreader Control	In-House	1.86	150.45
309	2-Way Radio	In-House	2.31	159.15
252	Vehicle Seat	In-House	1.41	94.19
228	Computer / Sensor	In-House	1.46	93.36
Total Outsourced Labor Change				**13,535.80**
Total In-House Labor Change				**1,856.61**
Total Change in Labor Demand				**(11,679.19)**
Annual Change in Labor Demand				**(5,839.59)**
Annual Change in Labor Demand FTEs (65.9% Direct Labor Rate) [2]				**(4.3)**

Source: ODOT EMS data
Note: Shading indicates repair types identified as optimally outsourced.
[1] Net labor change is reflective of the ODOT average labor by repair type multiplied by the differential in total services from the current state to the optimized future state. For example, **Table 2-3** shows that currently 1,952 glass replacements are being completed in-house. **Table 2-4** identifies that these repairs could be optimized through outsourcing. As a result, by outsourcing glass replacement, ODOT can free up 2,633 direct labor hours.
[2] On average, ODOT's fleet and equipment maintenance and repair employees have a direct labor rate of 65.9 percent, indirect labor rate of 20.3 percent, and leave time rate of 13.8 percent.

As shown in **Table 2-5**, ODOT, through optimal sourcing, could reallocate up to 4.3 FTEs worth of total labor capacity to more efficient and effective service delivery.

Conclusion

ODOT sources vehicle and equipment maintenance and repair activities from in-house resources as well as from private sector vendors. Without a coordinated approach to identify, disseminate, and implement sourcing from the lowest-cost provider ODOT is only partially able to take advantage of low cost sourcing opportunities. A coordinated focus on optimized sourcing of these services will result in both cost savings and additional labor availability which can be refocused on mission critical services.

Recommendation 2.1: ODOT should optimize the sourcing of common vehicle and equipment maintenance and repair activities in a manner that provides an acceptable level of service at the lowest cost. ODOT should periodically, at least annually, evaluate the cost effectiveness of maintenance and repair activities to ensure that in-house repair costs remain competitive with outsourced costs and vice versa. Finally, ODOT should explore opportunities to aggregate high-volume maintenance and repair activities that could be outsourced at a cost that takes advantage of economies of scale and affords a cost savings relative to in-house service provision.

Financial Impact 2.1: ODOT could realize annual savings of up to **$1.3 million** by optimally sourcing commonly outsourced maintenance and repair activities. In addition to the direct cost savings identified, optimized sourcing of maintenance and repair activities would free up 4.3 FTEs worth of total labor across ODOT which could be redirected to provide services in mission critical areas.

Additional Considerations

There may be unique circumstances under which the average cost reflected in this analysis does not contextually apply to the situation at hand. Under those circumstances ODOT should exercise discretion and source from the most cost efficient service provider. These exceptions should be routinely analyzed to assess the extent to which efficiencies might be gained through alternate service delivery models.

PASSENGER CAR CYCLING OPTIMIZATION

Background

ODOT's policy[12] is to evaluate the replacement cycling of its passenger car fleet based on general guidelines of 10 years and/or 120,000 miles. The policy includes a note that "The Lifespan or…minimum use should be exceeded prior to being replaced. Any exceptions will be reviewed on an individual basis." Exceptions which are taken into account by the Office of Equipment Management (OEM) can include replacements necessitated by operating cost and condition. In addition, ODOT's policies governing replacement cycling exceed the Ohio Department of Administrative Services' (DAS) recommended replacement guidelines (6 years and/or 90,000 miles) for passenger cars.

Although ODOT has a policy of replacing passenger cars at 10 years and/or 120,000 miles the Department's practice is to cycle passenger cars at a point typically beyond 10 years, 120,000 miles, or both. During the course of this performance audit, in response to recommendations issued across a series of interim reports, ODOT began disposing of vehicles and equipment and reducing new vehicle and equipment acquisitions.[13] As a result, ODOT had disposed of a total of 106 passenger cars during FY 2012-13. For the FY 2012-13 passenger car disposals the average age was 11.2 years and the average mileage was 139,109.[14] Over the last five years ODOT has

[12] Procedure EIP-2095, Equipment Age and Use Evaluation; effective 09/09/2006.

[13] See recommendations on fleet management issued as part of the April 23, 2012 interim report included herein. To fully achieve the recommended reductions ODOT will need to dispose of an additional 12 passenger cars for a final passenger car fleet of 368 vehicles. The financial impact of this recommendation has been adjusted to account for a future-state total of 368 passenger cars.

[14] Although they are reflected in the total number of disposals (i.e., 106) there are two passenger car potential disposals that were identified as statistical outliers for age and mileage. Both vehicles are 1 year old; the first has 18,122 miles and the second has 16,066 miles. These vehicles are not officially disposed of but are being held in a transitional phase to test the market viability of alternative disposal strategies.

disposed of a total of 180 passenger cars with an average age of 10.9 years and an average mileage of 140,423 miles.

Methodology

ODOT provided Equipment Management System (EMS) data for all vehicles in the passenger car fleet. This data was supplemented by a current inventory of all vehicles and equipment across ODOT. The passenger car fleet data included total and annual cost (where applicable) for each vehicle by fiscal year (FY 2008-09 through FYTD 2012-13). Key data points for lifecycle and operating cost included: initial vehicle purchase price, annual maintenance parts direct cost, annual labor direct cost, and annual fuel direct cost. ODOT's current overhead rates for direct parts (average 36.5 percent) and direct fuel (average 2.7 percent) were applied to initial cost data to more fully reflect the burdened avoidable cost. Finally, each vehicle, by year, was analyzed to calculate an average cost per mile by age.

Because ODOT's passenger car fleet is reflective of both mid-size and compact passenger cars National Auto Dealers Association (NADA) data on example vehicle for each size was assessed to develop a composite average residual value curve.[15] This information was used to assess the likely residual value for vehicles across multiple age ranges and total mileages. ODOT's current methodology is to depreciate 90 percent of the value of a vehicle, using straight line depreciation, over a 10-year lifespan.[16] The remaining 10 percent of the vehicle purchase value is assumed to be the vehicle's residual value at the end of its useful life.

The cost per mile by age, average purchase cost, and estimated residual value for each scenario was netted out to calculate an average annual cost per scenario. This equalized basis of comparison (i.e., lifecycle cost per year) was then compared across the multiple scenarios and over time to assess the impact that a change in cycling methodology would have across ODOT's passenger car fleet.

[15] Example passenger cars included the Chevrolet Impala and the Ford Focus. Both vehicles were selected for applicability to ODOT's fleet as well as long production runs (both are 2000 through 2013).

[16] The straight-line depreciation methodology incrementally depreciates an equal amount of value each year over a set timeframe. For example, $10,000 of depreciable value over a 10 year timeframe would equate to $1,000 in depreciation each year. In reality, a new vehicle loses value rapidly over the first year, by as much as 50 percent of total value relative to the purchase price, and then gradually tails off in outer years. The result, over time, is mathematically equivalent to a straight-line depreciation scenario over an extended duration.

Analysis

Table 2-6 shows an overview of ODOT's current passenger car fleet by age and mileage. The current state age and mileage of the passenger car fleet is important to understand how smooth the replacement cycle of passenger cars will be in out years. For example, an inventory bubble at a given age or mileage will exacerbate the budgetary difficulty in allocating sufficient funds to replace vehicles in a timely and consistent manner.

Table 2-6: ODOT Passenger Car Fleet Age and Mileage Overview

Total Passenger Car Fleet	**380**
Passenger Car Age Distribution	
0 to 4 Years	99
5 to 9 Years	**187**
10 or More Years	94
Percentage 10+ Years	**24.7%**
Passenger Car Mileage Distribution	
Up to 40,000 Miles	88
40,001 to 80,000 Miles	75
80,001 to 120,000 Miles	**121**
120,000 Miles or More	96
Percentage 120,000+ Miles	**25.3%**

Source: ODOT EMS data as of May 14, 2013

As shown in **Table 2-6**, of the 380 passenger cars in ODOT's current fleet the most common age range is 5 to 9 years and the most common mileage range is 80,000 to 120,000 miles. Furthermore, 94 passenger cars, or 24.7 percent, are already 10 or more years old and 96 passenger cars, or 25.3 percent, are already at 120,000 or more miles. The data shown in **Table 2-6** indicates that ODOT is currently experiencing a bubble in inventory which is weighted toward older, higher mileage vehicles.

Automotive Fleet (AF), a commercial fleet management trade publication, in part one of a two-part series, *Analyzing the Industry Trend to Extend Replacement Cycles* (AF, May 2010), suggests that "replacing a vehicle in a typical cycle of 55,000-65,000 miles brings the lifecycle cost to its maximum efficiency. No maintenance surprises, better fuel economy (especially in light of newly mandated CAFE standards with fuel engineering), tire pressure monitoring systems, navigation, and sensors can all help extend or maximize vehicle lifecycle." However, "over the past few years, manufacturers have improved quality, warranties, and vehicle dependability, thus making some decisions to extend less-risky fleet assets, especially light-duty trucks. Many fleets are now moving to the 75,000-85,000 mileage replacement parameters as they encounter more pressure from management to hold [off] on capital expenditures." In part two of the series, *Hard and Soft Cost Impacts of Extending Vehicle Cycling* (AF, June 2010), issues associated with extended cycling are identified including: increased maintenance cost, decreased fuel efficiency and increased expense, decreased emissions and idling performance, and increased downtime and loss of productivity due to unplanned repairs.

Table 2-7 shows lifecycle and annual cost for four different cycling scenarios including ODOT's current practice, ODOT's replacement policy, DAS' replacement policy, and an optimized ODOT strategy. Because shorter cycles incur more up-front purchase cost and longer cycles incur more back-end maintenance and repair cost the most meaningful comparison for cycling scenarios is annual lifecycle cost.

Table 2-7: Cycling Scenarios Overview

Scenario 1: ODOT Policy	
Age at Replacement	10 Years
Mileage at Replacement	120,000 Miles
Total Lifecycle Cost	$38,331
Annual Lifecycle Cost	**$3,833**
Scenario 2: ODOT Practice	
Age at Replacement	11 Years
Mileage at Replacement	140,400 Miles
Total Lifecycle Cost	$46,167
Annual Lifecycle Cost	**$4,197**
Scenario 3: DAS Policy	
Age at Replacement	6 Years
Mileage at Replacement	90,000 Miles
Total Lifecycle Cost	$24,478
Annual Lifecycle Cost	**$4,080**
Scenario 4: ODOT Optimized [1]	
Age at Replacement	5 Years
Mileage at Replacement	60,000 Miles
Total Lifecycle Cost	$17,567
Annual Lifecycle Cost	**$3,513**

Source: ODOT EMS data, ODOT replacement policy, and DAS replacement policy
Note: Lifecycle cost includes the net of initial purchase price, total maintenance and repair cost, total fuel cost, and residual value at disposal.
[1] ODOT's annual mileage expectation was held constant at 12,000 miles to avoid disruption in the application, monitoring, and management of consistent mileage expectations across the Department.

As shown in **Table 2-7**, ODOT's current replacement practice is the most expensive scenario while an optimized replacement cycle of 5 years and 60,000 miles is the least expensive scenario.

Table 2-8 shows the magnitude of savings associated with a change in replacement cycle across ODOT's entire passenger car fleet. Given that ODOT's current replacement policy call for a 10 year cycle the comparison between the ODOT current state and the ODOT optimized cycle will be shown as annual savings as well as 10-year cumulative savings.

Table 2-8: Savings from Optimized Passenger car Cycling

Total Passenger Cars	**368**
ODOT Current Practice Annual Cost per Vehicle	$4,197
ODOT Current Practice Annual Total Cost	$1,544,512
Optimized Cycle Annual Cost per Vehicle	$3,513
Optimized Cycle Annual Total Cost	$1,292,939
Optimized - Annual Total Savings	**$251,572**
Optimized - 10-Year Total Savings	**$2,515,722**

Source: ODOT EMS data

As shown in **Table 2-8**, if ODOT were to implement the optimized replacement cycle for the passenger car fleet it would save **$252,000** annually, or approximately $**2.5 million** over a 10-year period, relative to its current state passenger car replacement practice.

Conclusion

ODOT's current replacement policy for its passenger car fleet is not optimized based on annual lifecycle cost. In addition, ODOT's practice is to routinely exceed the age and mileage criteria of the replacement policy which results in further inefficiency in the annual lifecycle cost. Establishing, implementing, and managing to an optimized cycling strategy would generate savings annual financial savings for ODOT while also resulting in a more reliable and well maintained fleet. In order to implement the optimal replacement cycle for its passenger vehicles ODOT will need to obtain a waiver from DAS.

Recommendation 2.2: ODOT should optimize the vehicle replacement policy and practice for its passenger car fleet to minimize the total lifecycle operating cost associated with acquisition, maintenance and repair, and fuel cost while maximizing residual vehicle value.

Financial Impact 2.2: ODOT could realize annual savings of **$252,000**, or approximately **$2.5 million** over 10 years, by setting the passenger car fleet replacement age and mileage at an optimized point that minimizes the overall lifecycle cost of each vehicle.

Additional Considerations

This analysis identifies an optimal replacement cycle based on ODOT's current and historical cost experience, fleet composition, vehicle and equipment maintenance and repair sourcing strategies (e.g., in-house, outsourced, etc.), and residual market values. A significant change to any one of these inputs could impact the optimal replacement mileage and age. For example, while the DAS replacement cycle is optimized to the DAS maintenance and repair sourcing strategy it does not appear to be optimized for application in an ODOT strategy. Furthermore, certain individual vehicles may have higher than acceptable operating cost due to ongoing maintenance and repair issues or general underperformance, these vehicles should be monitored, evaluated, and replaced where financially prudent, regardless of age or mileage. ODOT should routinely evaluate the cost effectiveness of optimal cycling strategies to ensure that the most cost effective strategy is employed.

Ohio Revised Code § 125.13 authorizes the Director of DAS to set policy on the disposal of excess and surplus supplies and assets. DAS Policy GSD-SFP-08 states that "Vehicles sold to state agencies and tax supported municipalities are sold at 60 percent of the current NADA retail pricing guide. Prices are strictly based on this formula and are non-negotiable." Although ODOT does not currently receive significant inquiries from these types of entities, the disposal of newer, lower mileage vehicles could draw an interest and the net result could be a diminished residual value. Diminished residual value would have an impact on the overall calculation of the optimal disposal point. ODOT should closely monitor the extent to which this required discounting affects the overall financial efficacy of the disposal strategy and adjust the strategy where applicable to maintain an optimal balance.

MAINTENANCE AND REPAIR LABOR OPTIMIZATION

Background

ODOT, operating under delegated fleet management authority from DAS, is responsible for maintenance and repair of its fleet of vehicles and equipment. The Office of Equipment Management (OEM) promulgates maintenance and repair activity types and a system of coding which provides a consistent, organized structure to the maintenance and repair data that is entered into the Equipment Management System (EMS). However, OEM does not oversee the day-to-day maintenance and repair activities of the districts or the garage locations. The day-to-day maintenance and repair activities are carried out by employees of the districts or the Central Office at garage locations across the State.[17]

ODOT employs personnel in maintenance and repair specific positions such as: Auto Mechanics; Auto Service Workers; and Auto Technicians. However, ODOT's maintenance and repair labor force is not limited to these specific classifications of employees. Rather, the labor force consists of a mix of hands-on employees and support staff. Within these groupings exists a wide variety of positions which allocate direct or indirect labor toward the vehicle and equipment maintenance and repair function.[18] For example, the hands-on employees include not only the maintenance and repair specific positions previously listed, but also other positions such as: Highway Technicians, Highway Maintenance Workers, and Welders.[19] Additionally, the support employees include positions such as: Account Clerks, Delivery Workers, and Storekeepers.

[17] ODOT currently staffs vehicle and equipment mechanics at 118 locations across the State.

[18] For example, direct labor is used to classify work performed directly on or for a specific vehicle or piece of equipment. In contrast, indirect labor is used to classify work that is not directly related to a specific vehicle or piece of equipment such as picking up and delivering parts, recording inventory, and paying vendors.

[19] For the last three fiscal years, FY 2010-11, FY 2011-12, and FYTD 2013 (as of May 14, 2013), ODOT has had a total of 3,388 individual employees allocate hours (either direct, indirect, or leave) to the vehicle and equipment maintenance and repair function; these employees represent 48 different position groupings.

Table 2-9 shows ODOT's total hands-on, support, and unknown labor by labor type (direct, indirect, and leave) over the last three fiscal years.[20]

Table 2-9: ODOT Three-Year Avg. Labor Hours

Three Year Avg.	All Staff Total	Hands-On	Support	Unknown [1]
Total Labor Hours	**870,577.7**	**731,242.3**	**130,982.8**	**8,352.5**
Direct Labor Hours	**485,840.8**	**482,134.6**	**665.4**	**3,040.9**
Percent Direct	55.8%	65.9%	0.5%	36.4%
Indirect Labor Hours	**260,992.8**	**148,213.5**	**108,723.3**	**4,056.0**
Percent Indirect	30.0%	20.3%	83.0%	48.6%
Leave Hours	**123,744.1**	**100,894.2**	**21,594.1**	**1,255.7**
Percent Leave	14.2%	13.8%	16.5%	15.0%

Total Labor Hours Percentage Breakdown	
Percentage Hands-On	**84.0%**
Percentage Support	**15.0%**
Percentage Unknown	**1.0%**

Labor Hours to Full Time Employees (FTEs)	
All Staff Total FTEs	**418.5**
Hands-On Total FTEs	**351.6**
Support Total FTEs	**63.0**
Unknown Total FTEs	**4.0**

Source: ODOT EMS vehicle and equipment maintenance and repair data
[1] Labor hours classified as unknown were largely associated with employees with no job title in ODOT's EMS data. However, given that the total labor hours allocated to unknown was, on average, equal to only 1.0 percent per year, these hours will be excluded from the further detailed analysis presented in this report.

As shown in **Table 2-9**, the majority of all maintenance and repair labor hours incurred over the last three years have been for hands-on, direct labor. In addition, hands-on employees are typically weighted more heavily toward direct labor while support employees are almost exclusively weighted toward indirect labor. Using an annual standard of 2,080 hours per FTE, **Table 2-9** shows that ODOT employs an average annual vehicle and equipment maintenance and repair labor force equivalent to 418.5 FTEs.

Methodology

ODOT provided Equipment Management System (EMS) data for all maintenance and repair activities by district.[21] In addition, ODOT provided all employee labor hours for vehicle and

[20] Fiscal Year to Date (FYTD) 2012-13 data was prorated and a projected total was calculated based on having progressed through 86.6 percent of the fiscal year at the date of data collection (i.e., May, 14, 2013).

equipment maintenance and repair activities. Both data sets were inclusive of the time period FY 2010-11 through FYTD 2012-13. This data was supplemented by a current inventory of all vehicles and equipment across ODOT.

Analysis was conducted to assess the extent to which meaningful labor supply and demand and maintenance and repair efficiency differences exist from district to district (including the Central Office) in the following areas:

- Hands on direct labor as a percent of total labor hours by district (see **Table 2-10**);
- Vehicle and equipment units per FTE (selected and hands-on) by district (see **Table 2-11** and **Table 2-12**);
- Aggregate labor differentials and FTE equivalent labor supply differential by district (see **Table 2-13** and **Table 2-14**);
- Annual labor demand based on current inventory of vehicles and equipment (see **Table 2-15**, **Table 2-16**, and **Table 2-17**); and
- FTEs per service location by district (see **Table 2-18**).

Although most comparisons are based on hands-on labor supply by District there are alternate assessment using a group of positions labeled as "selected". These selected positions include Auto Mechanics, Auto Service Workers, and Auto Technicians. These positions were selected in concert with OEM given that they are the positions which are most directly applicable to the vehicle and equipment maintenance and repair function.

Analysis

Table 2-10 shows average total labor; average total hands-on, direct labor; and hands-on, direct labor as a percent of total labor for all ODOT districts and ODOT-wide on average for the last three fiscal years.[22] **Table 2-10** has been ordered from highest to lowest percentage of hands-on, direct labor. Percent of hands-on, direct labor is important to understanding the overall mix of labor supply. A high percentage of hands-on, direct labor is desirable given that it is generally indicative of the potential for operating cost efficiencies in meeting a given labor demanded.

[21] ODOT is organized into 12 semi-autonomous districts and a Central Office. For the purpose of these analyses ODOT's Central Office is treated as equivalent to the districts given that it operates its own fully functional garage.
[22] FYTD 2012-13 data is prorated consistent with the data shown in **Table 2-9**.

Table 2-10: ODOT Three-Year Avg. Hands-On, Direct Labor Distribution

District	Avg. Total Labor	Avg. Hands-On, Direct Labor	% Hands-On, Direct Labor
District 6	83,840.7	51,219.7	61.1%
District 11	56,743.5	34,136.3	60.2%
District 12	96,046.3	56,559.7	58.9%
District 9	57,651.4	33,562.7	58.2%
District 10	75,574.8	43,922.2	58.1%
District 3	73,243.9	41,044.0	56.0%
District 1	75,107.2	42,022.4	55.9%
District 5	55,539.8	30,406.1	54.7%
District 7	72,209.8	39,327.7	54.5%
District 4	76,661.2	40,422.7	52.7%
District 2	55,360.7	28,554.2	51.6%
District 8	76,656.2	38,413.4	50.1%
Central Office	15,942.3	6,249.8	39.2%
ODOT Total	**870,577.7**	**485,840.8**	**55.8%**

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note: Unknown labor hours, an annual average of 1.0 percent of all labor hours, have been excluded from **Table 2-10**.

As shown in **Table 2-10**, District 6 had the highest overall average rate of hands-on, direct labor as a percentage of total labor (61.1 percent) while the Central Office had the lowest overall average rate (39.2 percent). The Central Office, given its large support function in managing the overall fleet of vehicles and equipment, is expectedly lower than other districts.

Table 2-11 shows current total vehicle and equipment units by district and ODOT total; three-year average calculated FTEs; and the resulting ratio of vehicle and equipment units per FTE. In this comparison average FTEs reflects total labor for all employees within the groups: Auto Mechanics, Auto Service Workers, and Auto Technicians for the last three fiscal years.[23] [24] The ratio of units per FTE is an important quantitative measure of labor supply within a specific location relative to labor demand.

[23] These groups of positions were identified by both district and Central Office staff as most directly applicable to the vehicle and equipment maintenance and repair function.
[24] FYTD 2012-13 data is prorated consistent with the data shown in **Table 2-9**.

Table 2-11: Vehicle and Equipment Units per Selected FTE Comparison

District	Total Units	Average Selected FTEs	Units per Selected FTE
District 1	1,569	21.2	73.9
District 2	1,524	20.4	74.6
District 3	1,508	19.5	77.3
District 4	1,591	26.0	61.3
District 5	1,199	17.9	66.9
District 6	1,767	27.3	64.8
District 7	1,441	22.9	62.9
District 8	1,352	20.3	66.8
District 9	1,053	17.8	59.0
District 10	1,322	23.9	55.3
District 11	1,098	18.3	60.0
District 12	943	26.3	35.8
Central Office	419	2.2	189.6
ODOT Total	**16,786**	**264.1**	**63.6**

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note: FTEs are calculated based on total hours divided by 2,080 hours (the standard hours worked by a full time employee).

As shown in **Table 2-11**, the Central Office is most efficient in terms of vehicle and equipment units per FTE. In contrast, District 12 is the least efficient. However, as previously noted, the labor supply is not constrained to the limited group of positions used to calculate FTEs in **Table 2-11**. Therefore, an additional comparison, including all hands-on employee labor, is necessary to fully understand the actual labor supply relative to the labor demand.

Table 2-12 shows current total vehicle and equipment units by district and ODOT total; three-year average calculated FTEs; and the resulting ratio of vehicle and equipment units per FTE. In this comparison average FTEs reflects total labor for all hands-on employees.

Table 2-12: Vehicle and Equipment Units per Hands-On FTE Comparison

District	Total Units	Average Hands-On FTEs	Units per Hands-On FTE
District 1	1,569	29.0	54.2
District 2	1,524	22.6	67.3
District 3	1,508	29.4	51.2
District 4	1,591	32.5	48.9
District 5	1,199	22.9	52.4
District 6	1,767	38.0	46.5
District 7	1,441	28.8	50.0
District 8	1,352	29.2	46.3
District 9	1,053	23.0	45.8
District 10	1,322	32.0	41.3
District 11	1,098	21.4	51.2
District 12	943	38.2	24.7
Central Office	419	4.3	97.2
ODOT Total	**16,786**	**351.6**	**47.7**

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note: FTEs are calculated based on total hours divided by 2,080 hours (the standard hours worked by a full time employee).

As shown in **Table 2-12**, the Central Office is still most efficient in terms of vehicle and equipment units per FTE. Similarly, District 12 is still the least efficient.

Table 2-13 shows net result of comparisons between each district's three-year average direct labor hours per equipment type and the ODOT-wide average direct labor hours per equipment type. Differentials shown in negatives are indicative of better than average performance over the last three years. For example, the ODOT average annual maintenance and repair direct labor hours for a passenger car is 15.2; each districts' individual three-year average is compared to this figure and the result is multiplied by the total number of vehicles and equipment by type by district.

Table 2-13: Equipment Type - Avg. Labor Differentials by District

District	Labor Hours Differential	Relative FTEs Surplus / (Deficit)
District 1	7,851.5	6.8
District 2	(28,505.5)	(24.6)
District 3	(2,242.1)	(1.9)
District 4	(20,543.4)	(17.7)
District 5	(13,182.9)	(11.4)
District 6	9,799.6	8.4
District 7	(4,793.9)	(4.1)
District 8	(6,308.0)	(5.4)
District 9	(1,686.5)	(1.5)
District 10	8,660.3	7.5
District 11	6,011.7	5.2
District 12	54,581.8	47.0
Central Office	(9,642.7)	(8.3)
ODOT Average Direct Labor Percentage		**55.8%**
ODOT Average Direct Labor Hours		**1,160.6**
ODOT Average Indirect and Leave Labor Hours		**919.4**

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note 1: Average labor surpluses / (deficits) are calculated based on direct labor only.
Note 2: Total FTEs calculated based on the ODOT average direct labor as a percent of total labor (see **Table 2-9**).

As shown in **Table 2-13**, based on the ODOT average labor hours for maintenance and repair of all vehicles and equipment District 2 is the most efficient district while District 12 is the least efficient district. As shown in **Table 2-11** and **Table 2-12**, one possible cause of this disparity is District 12's relatively low number of vehicle and equipment units and high number of employees. This condition results in more available employee time per unit and could be manifesting itself in the high labor differential shown in **Table 2-13**.

Table 2-14 shows net result of comparisons between each district's three-year average direct labor hours and cost per equipment type and the ODOT-wide average direct labor hours and cost per equipment type. Differentials shown in negatives are indicative of better than average performance. Vehicle and equipment types associated with snow and ice control are excluded from **Table 2-14** given the potentially significant differences in the operating environment across the State (e.g., snow belt, northwest and central Ohio, and southern Ohio).

Table 2-14: Equipment Type - Avg. Labor and Cost Differentials by District (Excluding Snow and Ice Control Vehicles and Equipment)

District	Labor Hours Differential	Relative FTEs Surplus / (Deficit)
District 1	1,886.6	1.6
District 2	(9,235.0)	(8.0)
District 3	(8,535.3)	(7.4)
District 4	(5,884.1)	(5.1)
District 5	(3,674.1)	(3.2)
District 6	3,787.0	3.3
District 7	(1,886.7)	(1.6)
District 8	(3,529.9)	(3.0)
District 9	3,262.3	2.8
District 10	1,468.4	1.3
District 11	5,223.1	4.5
District 12	20,240.4	17.4
Central Office	(3,122.9)	(2.7)
ODOT Average Direct Labor Percentage		**55.8%**
ODOT Average Direct Labor Hours		**1,160.6**
ODOT Average Indirect and Leave Labor Hours		**919.4**

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note 1: Average labor surpluses / (deficits) are calculated based on direct labor only.
Note 2: Total FTEs calculated based on the ODOT average direct labor as a percent of total labor (see **Table 2-9**).

As shown in **Table 2-14**, excluding vehicles and equipment associated with snow and ice control, based on the ODOT average labor hours for maintenance and repair of all vehicles and equipment District 2 is still the most efficient district while District 12 is still the least efficient district.

From the comparisons in **Table 2-13** to **Table 2-14** District 3 had the greatest gain in efficiency from (1.9) to (7.4); a 280.7 percent gain. This is indicative of District 3 being much more efficient at maintaining and repairing non snow and ice control vehicles and equipment. Conversely, District 9 had the greatest loss in efficiency from to (1.5) to 2.8; a 293.4 percent loss. This is indicative of District 9 being much more efficient at maintaining and repairing snow and ice control vehicles and equipment.

Table 2-15 shows calculated annual labor demand based on each district's current inventory of vehicles and equipment. For this calculation ODOT's average annual labor demand by individual vehicle or piece of equipment is multiplied by each district's vehicle and equipment units to calculate a total labor demand. The total labor demand is then compared to the total hands-on labor supply to identify instances where labor may be oversupplied; indicated as positive values.[25]

Table 2-15: Calculated Labor Demand – All Supplied Labor

District	Total Units	Total Labor Demand	FY 2012-13 Actual Labor	Labor Shift in Hours	Labor Shift in FTEs
District 1	1,569	62,047.4	74,449.6	12,402.2	6.0
District 2	1,524	63,333.4	60,047.0	(3,286.4)	(1.6)
District 3	1,508	66,195.5	68,669.0	2,473.5	1.2
District 4	1,591	74,619.5	68,927.0	(5,692.5)	(2.7)
District 5	1,199	55,527.5	52,562.3	(2,965.1)	(1.4)
District 6	1,767	79,687.4	72,367.6	(7,319.8)	(3.5)
District 7	1,441	60,759.5	72,500.3	11,740.8	5.6
District 8	1,352	64,864.2	71,618.0	6,753.8	3.2
District 9	1,053	49,667.4	59,871.0	10,203.6	4.9
District 10	1,322	59,458.6	74,975.2	15,516.6	7.5
District 11	1,098	49,875.7	54,490.3	4,614.6	2.2
District 12	943	54,671.0	92,621.1	37,950.1	18.2
Central Office	419	15,788.3	13,528.7	(2,259.7)	(1.1)

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note: Total labor demand is calculated based on ODOT's average direct labor hours by unit. ODOT's average total labor hours distribution including direct (58.6 percent), indirect (27.7 percent), and leave (13.7 percent) was applied to the direct labor hours to calculate a total labor demand by district.

As shown in **Table 2-15**, when taking into account total supplied labor, total vehicle and equipment units, and the average annual required labor hours to maintain those units, District 2, District 4, District 5, District 6, and the Central Office are all more efficient than the ODOT average. However, District 1, District 3, District 7, District 8, District 9, District 10, District 11, and District 12 all have a labor surplus of greater than 1.0 FTE. District 12 has the largest potential labor surplus at 18.2 FTEs more than if it were maintaining its inventory of vehicles and equipment at the ODOT average labor rate.

Table 2-16 shows a revised calculated annual labor demand based on each district's current inventory of vehicles and equipment. For this calculation ODOT's average annual labor demand by individual vehicle or piece of equipment is multiplied by each district's vehicle and equipment units to calculate a total labor demand. The total labor demand is then compared to the total hands-on labor supply to identify instances where labor may be oversupplied; indicated as positive values.

[25] Given the conservative nature of the underlying calculations (e.g., internal comparisons to ODOT averages rather than industry standards, hands on labor rather than all supplied labor, and performance expectations set at the ODOT average rather than at the high-performing level) districts shown with a staffing level lower than if they were performing at the ODOT average does not reflect a need to increase staffing.

Table 2-16: Calculated Labor Demand – Hands-On Positions Only

District	Total Units	Total Labor Demand	FY 2012-13 Actual Labor	Labor Shift in Hours	Labor Shift in FTEs
District 1	1,569	55,140.6	61,151.4	6,010.7	2.9
District 2	1,524	56,283.5	52,653.2	(3,630.3)	(1.7)
District 3	1,508	58,827.0	57,915.9	(911.1)	(0.4)
District 4	1,591	66,313.3	62,550.6	(3,762.7)	(1.8)
District 5	1,199	49,346.5	47,966.2	(1,380.3)	(0.7)
District 6	1,767	70,817.1	70,270.0	(547.1)	(0.3)
District 7	1,441	53,996.1	62,349.2	8,353.1	4.0
District 8	1,352	57,643.9	59,046.5	1,402.6	0.7
District 9	1,053	44,138.7	50,458.0	6,319.3	3.0
District 10	1,322	52,840.0	69,281.5	16,441.5	7.9
District 11	1,098	44,323.8	45,691.6	1,367.8	0.7
District 12	943	48,585.3	77,906.7	29,321.4	14.1
Central Office	419	14,030.9	8,730.5	(5,300.3)	(2.5)

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note: Total labor demand is calculated based on ODOT's average direct labor hours by unit. ODOT's average hands-on hours distribution including direct (65.9 percent), indirect (20.3 percent), and leave (13.8 percent) was applied to the direct labor hours to calculate a total labor demand by district.

As shown in **Table 2-16**, when taking into account total hands-on labor, vehicle and equipment units and the average annual required labor hours to maintain those units, District 2, District 3, District 4, District 5, District 6, and the Central Office are all more efficient than the ODOT average. However, District 1, District 7, District 9, District 10, and District 12 all have a labor surplus of greater than 1.0 FTE. District 12 has the largest potential labor surplus at 14.1 FTEs more than if it were maintaining its inventory of vehicles and equipment at the ODOT average labor rate.

When analyzing **Table 2-15** in relation to **Table 2-16** it is important to note that the labor demand calculation in **Table 2-15** is based on the ratio of direct, indirect, and leave hours for all employees while the labor demand calculation in **Table 2-16** is based on the ratio of direct, indirect, and leave hour for hands-on employees only. The hands-on employee direct labor ratio is more efficient than the all employees ratio, 65.9 percent versus 58.6 percent; therefore the calculation of the resulting labor surplus for each table is inherently different and should be interpreted as such.

Table 2-17 shows a final revised calculated annual labor demand based on each district's current inventory of vehicles and equipment. For this calculation ODOT's average annual labor demand by individual vehicle or piece of equipment is multiplied by each district's vehicle and equipment units to calculate a total labor demand. The total labor demand is then compared to the total selected labor supply to identify instances where labor may be oversupplied; indicated as positive values.[26]

Table 2-17: Calculated Labor Demand – Selected Positions Only

District	Total Units	Total Labor Demand	FY 2012-13 Actual Labor	Labor Shift in Hours	Labor Shift in FTEs
District 1	1,569	57,059.7	44,837.5	(12,222.2)	(5.9)
District 2	1,524	58,242.4	43,338.2	(14,904.2)	(7.2)
District 3	1,508	60,874.4	40,418.0	(20,456.3)	(9.8)
District 4	1,591	68,621.2	52,775.8	(15,845.5)	(7.6)
District 5	1,199	51,063.9	38,567.9	(12,496.0)	(6.0)
District 6	1,767	73,281.8	51,857.2	(21,424.6)	(10.3)
District 7	1,441	55,875.4	50,615.5	(5,259.9)	(2.5)
District 8	1,352	59,650.1	40,595.5	(19,054.6)	(9.2)
District 9	1,053	45,674.9	37,365.8	(8,309.1)	(4.0)
District 10	1,322	54,679.0	49,529.0	(5,150.0)	(2.5)
District 11	1,098	45,866.5	38,593.3	(7,273.2)	(3.5)
District 12	943	50,276.3	56,936.5	6,660.2	3.2
Central Office	419	14,519.2	4,133.4	(10,385.8)	(5.0)

Source: ODOT EMS vehicle and equipment maintenance and repair data
Note 1: Selected positions include Auto Mechanics, Auto Service Workers, and Auto Technicians.
Note 2: Total labor demand is calculated based on ODOT's average direct labor hours by unit. ODOT's average selected hours distribution including direct (63.7 percent), indirect (20.6 percent), and leave (15.7 percent) was applied to the direct labor hours to calculate a total labor demand by district.

As shown in **Table 2-17**, when taking into account only selected labor, District 12 is the only district that still exhibits a labor surplus. However, when compared to preceding analyses the identified surplus is a relatively conservative 3.2 FTEs. This shows that while other districts rely on labor supplied by staff outside of the selected positions group District 12 does not need to do so. Within District 12, the entire labor supply necessary to meet the labor demand of the District's fleet of vehicles and equipment could be provided by the District's current selected staff even with three fewer full time employees.

Table 2-18 shows the ratio of both hands-on and selected FTEs to currently staffed maintenance and repair locations by district. Given that not all maintenance and repair activities occur at a single location within each district there may be economies of scale afforded some districts due to their facilities organizations which are not available to other districts.

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[26] Similar to **Table2-16, Table 2-17** uses an even more conservative labor supply figure focused only on selected positions rather than all supplied labor.

Table 2-18: FY 2012-13 Staffing Coverage by Location

District	Selected FTEs	Hands-On FTEs	Staffed Locations	Selected FTEs per Location	Hands-On FTEs per Location
District 1	21.6	29.4	8	2.7	3.7
District 2	20.8	25.3	11	1.9	2.3
District 3	19.4	27.8	8	2.4	3.5
District 4	25.4	30.1	7	3.6	4.3
District 5	18.5	23.1	7	2.6	3.3
District 6	24.9	33.8	17	1.5	2.0
District 7	24.3	30.0	11	2.2	2.7
District 8	19.5	28.4	13	1.5	2.2
District 9	18.0	24.3	10	1.8	2.4
District 10	23.8	33.3	10	2.4	3.3
District 11	18.6	22.0	8	2.3	2.7
District 12	**27.4**	**37.5**	**7**	**3.9**	**5.4**
Central Office	2.0	4.2	1	2.0	4.2
ODOT Total	**264.2**	**349.0**	**118**	**2.2**	**3.0**

Source: ODOT EMS vehicle and equipment maintenance and repair data and ODOT Driver's Guide facility locations and services

As shown in **Table 2-18**, District 12 has a higher ratio of staff to locations, for both selected FTEs and hands-on FTEs, than any other district and the ODOT average. Even after a staffing reduction of 3.0 selected FTEs (a net result of 24.4 selected FTEs and 34.5 hands-on FTEs) District 12 would still have a ratio of 3.5 selected FTEs per location and 4.9 hands-on FTEs per location. Both ratios are higher than the ODOT average and all other districts but District 4. After the staffing reduction, District 4 would have a slightly higher ratio of selected FTEs per location (3.6) when compared to District 12 (3.5).

Overall, as shown in **Table 2-9**, ODOT has a vehicle and equipment maintenance and repair labor pool that is flexible to perform the necessary work on an as needed basis. When evaluating the efficiency of the organization of the labor pool there are meaningful distinctions to draw. For example, **Table 2-10** shows that as a percentage of total labor districts typically range from 50 to 60 percent direct, hands-on labor. Districts on the high end of this range appear to be more efficient given that every hour of direct, hands-on labor incurs fewer hours of indirect or support labor, and vice-versa. However, as shown in **Table 2-11** and **Table 2-12**, when taking into account the actual district-to-district inventory differences in vehicles and equipment there is wide variation in the ratio of units to FTEs. This leading indicator suggests that there may be a labor supply and demand imbalance across the districts. **Table 2-13** and **Table 2-14** further affirm that there are meaningful differences across the districts when evaluating the typical labor required to perform individual repairs, even when controlling for snow and ice control operations. **Table 2-15**, **Table 2-16**, and **Table 2-17** all highlight the labor supply and demand incongruity based on the current inventory of vehicles and equipment and the ODOT average annual labor demand per unit. Progressing from all supplied labor, to hands-on labor, to select position labor District 12 has the most substantial imbalance even at the most basic level of analysis. Finally, **Table 2-18** affirms the preceding conclusions by highlighting above average labor coverage within District 12. Although District 12 is highlighted in this analysis, there is also a potential labor supply and demand incongruity that exists in District 10, District 7, District 9, and District 1 (see **Table 2-16**) that should not be ignored; especially as ODOT evaluates the current and future state of its operations and necessary labor force.

Conclusion

ODOT's vehicle and equipment maintenance and repair labor supply is not optimized to meet labor demand. Districts vary widely in direct labor supply as a percentage of total labor, vehicle and equipment units per FTE, average annual direct labor hours by vehicle and equipment type, and FTEs per maintenance and repair location. Furthermore, vehicle and equipment unit inventories and demanded annual labor highlight potential labor oversupply across the Department. Finally, District 12, by all measures, has a labor surplus equal to at least 3.0

Recommendation 2.3: ODOT should analyze the extent to which labor supply variances from district to district are the result of actual labor demand. In doing so ODOT should evaluate the necessity of all supplied direct and indirect labor and should investigate strategies to maximize hands-on, direct productivity of staff while minimizing the need to incur indirect labor. Particular attention should be given to District 12 which appears to be overstaffed by a minimum of 3.0 FTEs. At minimum, ODOT should eliminate the 3.0 FTE position overage identified in District 12.

Financial Impact 2.3: If ODOT were to eliminate 3.0 FTE vehicle and equipment maintenance and repair positions in District 12 it could save **$171,000** annually based on a full annual hours expectation of 2,080, the average District 12 regular hourly rate of $19.38, and an applied benefits percentage of 41.3 percent.

3. FLEET MANAGEMENT - BLENDED BIODIESEL

***Savings:* $800,000**

Finding 3.1: Mandated use of blended biodiesel fuel has cost ODOT an additional $3.3 million over the last four years.

Recommendation 3.1: To meet reasonable standards of efficiency and cost-effectiveness, the General Assembly should revise the mandate that ODOT use blended biodiesel fuel in lieu of regular diesel fuel to make such use discretionary. If the General Assembly chooses to leave the mandate in place it should include a sunset provision for the mandate as well as a target price differential to achieve over that timeframe.

Finding 3.2: ODOT is solely responsible for approximately 85% of the entire statewide blended biodiesel mandate.

Recommendation 3.2: While the mandate remains in place, ODOT should stop its unnecessary practice of buying twice as much blended biodiesel as the mandated amount.

Financial Impact 3.1 & 3.2: Without the mandate to use blended biodiesel fuel, ODOT could realize recurrent savings of approximately **$800,000** per year, based on historical average fuel consumption trends and expenditures.

FUEL—BLENDED BIODIESEL

Fleet Management Blended Biodiesel: These recommendations were issued as part of the ODOT interim report dated May 15, 2012. No substantive changes have been made to the recommendations.

Background

Blended biodiesel fuel is available to consumers in three blends, including 2 percent biodiesel and 98 percent regular diesel, 5 percent biodiesel and 95 percent regular diesel, and 20 percent biodiesel and 80 percent regular diesel. The fuel blend most commonly used is 80 percent regular diesel and 20 percent biodiesel. In many cases, the biodiesel portion of the blend is derived from soybean oil. Due to the dilution of the fuel blend with lower energy content biofuel, the resulting energy composition per gallon is approximately 2 percent less than regular diesel fuel (126,379 BTUs per gallon for 20 percent blended biodiesel versus 128,700 BTUs per gallon for regular diesel). According to the US Department of Energy (DOE), fewer BTUs per gallon result in fewer miles per gallon in fuel economy. For relative price comparison purposes it is necessary to compare fuel sources on a per energy unit cost rather than by volume; accordingly, all baseline comparisons of DAS blended biodiesel and regular diesel prices per gallon in this report have been appropriately adjusted.[27]

Ohio Revised Code (ORC) § 125.834 mandates that State agencies, including ODOT, use blended biodiesel fuel. This mandate, which was codified in July 2006, states that:

> "Not later than ninety days after October 12, 2006, all motor vehicles owned or leased by the state that are capable of using an alternative fuel shall use an alternative fuel if the fuel is reasonably available at a reasonable price. Subject to division (D)[28] of this section, motor vehicles owned or leased by the state shall use… at least one million gallons of blended biodiesel per calendar year by January 1, 2007, with an increase of one hundred thousand gallons per calendar year each calendar year thereafter. The director of administrative services, under Chapter 119. of the Revised Code, shall adopt rules to implement the fuel use requirement of this division, and the directors and heads of all state departments and agencies shall issue a directive to all state employees who use state motor

[27] Comparisons based on ODOT's fuel inventory (gallons and total cost) are not able to be appropriately adjusted with any certitude given that they represent the full actual cost of the fuel (e.g., commodity cost plus taxes, transport cost, and supplier overhead) rather than just the fuel commodity itself.

[28] ORC § 125.834(D) states that "The director of administrative services shall adopt and may amend, under Chapter 119. of the Revised Code, rules that include both of the following:

> (1) Requirements for state agencies in the procurement of alternative fuels and motor vehicles capable of using alternative fuels, and cost limitations for the acquisition and operation of such vehicles;
>
> (2) Energy conservation and exhaust emissions criteria for motor vehicles capable of using alternative fuels."

> vehicles informing them of the fuel use requirement. The directive shall instruct state employees to purchase alternative fuels at retail fuel facilities whenever possible."

The Ohio Department of Administrative Services (DAS) promulgates the rules under which the blended biodiesel use mandate is disseminated (i.e., the annual usage expectations) and oversees the monitoring and reporting of the blended biodiesel use requirement. The primary method through which DAS reports this information to the public is the *Statewide Alternative Fuel Scorecard*. This report includes a monthly summary on actual reported blended biodiesel use, calendar year to date (CYTD) use, and calendar year (CY) mandated use. For CY 2011 ODOT was targeted to use 1,268,983 gallons of blended biodiesel, or approximately 84.6 percent of the total statewide use mandate of 1.5 million gallons of blended biodiesel. For CY 2012 ODOT was targeted to use 1,353,582 gallons of blended biodiesel, or approximately 84.6 percent of the total statewide use mandate of 1.6 million gallons of blended biodiesel.

Table 3-1 shows an overview of CY 2011 and CYTD 2012 blended biodiesel use compared to DAS utilization goals for all State agencies with a mandated use amount of greater than 1 percent of the total goal usage.[29]

[29] Other State agencies with mandated usage of between 0.5 percent and 1.0 percent of the total goal amount include: Department of Public Safety (DPS), Department of Developmental Disabilities (DDD), Department of Agriculture (AGR), and Department of Commerce (COM). Other State agencies with mandated usage of less than 0.5 percent of the total goal amount include: Bureau of Workers Compensation (BWC), Adjutant General (ADJ), Environmental Protection Agency (EPA), Lottery Commission (LOT), Expositions Commission (EXP), School for the Blind (OSB), Ohio Veterans Home (OVH), Library Board (LIB), Department of Youth Services (DYS), Department of Job and Family Services (JFS), Industrial Commission (OIC), School for the Deaf (OSD), and Department of Taxation (TAX).

Table 3-1: CY 2011 & CYTD 2012 Blended Biodiesel Use and Goal

CY 2011				
Agency	**Usage Goal**	**Goal As % of Total**	**Actual Usage**	**Use As % of Goal**
ODOT	1,268,983	84.6%	2,568,359	202.4%
DNR [1]	96,525	6.4%	14,518	15.0%
DRC [2]	64,350	4.3%	18,893	29.4%
DMH [3]	18,662	1.2%	22,606	121.1%
Other	51,486	3.5%	13,021	25.3%
Total	**1,500,006**	**100.0%**	**2,637,397**	**175.8%**
CYTD 2012 [4]				
Agency	**Usage Goal**	**Goal As % of Total**	**Actual Usage**	**Use As % of Goal**
ODOT	1,353,582	84.6%	617,090	45.6%
DNR [1]	102,960	6.4%	0	0.0%
DRC [2]	68,640	4.3%	0	0.0%
DMH [3]	19,906	1.2%	0	0.0%
Other	54,910	3.5%	705	1.3%
Total	**1,599,998**	**100.0%**	**617,795**	**38.6%**

Source: DAS *Statewide Alternative Fuel Scorecard* reports
Note: Totals in **Table 1** are unrounded and will vary from those reported on the DAS *Statewide Alternative Fuel Scorecard* due to its use of rounded totals.
[1] Department of Natural Resources (DNR)
[2] Department of Rehabilitation and Corrections (DRC)
[3] Department of Mental Health (DMH)
[4] CYTD 2012 information reflects data through the end of February 2012; the most up-to-date information available at the time of analysis.

As shown in **Table 3-1**, ODOT is not only responsible for most of the statewide blended biodiesel use goal, it is one of two State agencies that actually met the mandate for CY 2011 and is the only State agency that has put significant effort toward meeting the CY 2012 mandate thus far. Based on these mandated levels of blended biodiesel consumption ODOT is uniquely positioned as a major user to bear the majority of the cost burden or potential benefit associated with the blended biodiesel use mandate.

According to DOE, blended biodiesel "is a cleaner-burning alternative [to regular diesel fuel]. Using blended biodiesel in place of petroleum diesel significantly reduces emissions of toxic air pollutants." Proponents of blended biodiesel support its use not only for the environmental preference, relative to regular diesel fuel, but also due to the fact that "biodiesel is a domestically produced, renewable fuel that can be manufactured from new and used vegetable oils, animal fats, and recycled restaurant grease." It is important to note that ODOT currently operates all diesel vehicles to be in compliance with up-to-date emissions standards including the use of ultra-low sulfur premium diesel.

The Ohio mandate to use blended biodiesel is not unique. Government often intervenes in the marketplace to provide incentives or disincentives for engaging in certain activities. The general theory behind this type of intervention in the alternative energy development marketplace is to temporarily support the development of a market, which otherwise would not have developed as quickly, to the point that the intervention is no longer necessary for consumers to engage in the activity (i.e., the point at which the alternative energy fuel source is substantially price competitive to the regular fuel source). Ohio's mandate has been in place since July of 2006. Though no measures of success are defined in statute, to date blended biodiesel does not appear to have had as significant a market creation effect as intended; this is evidenced by blended biodiesel's price differential which remains largely financially uncompetitive with regular diesel fuel.

Methodology

OPT analyzed the relative energy content of blended biodiesel and regular diesel to ensure apples-to-apples energy content comparisons where possible. OPT then analyzed current and historical DAS contracts for blended biodiesel and regular diesel to determine the extent to which price differences exist and the trend over time. Finally, OPT analyzed ODOT's historical fuel purchase data to determine the extent to which the Department actually paid more for blended biodiesel relative to traditional diesel fuel.

Analysis

According to the DAS Office of Procurement Services, the Agency began offering blended biodiesel through its statewide purchasing contracts in December 2009. **Table 3-2** shows a historical overview of quarterly DAS blended biodiesel contract prices for CY 2010, CY 2011, and CYTD 2012; these prices are not reflective of the additional contractor cost for fuel delivery and overhead.[30]

Table 3-2: DAS Baseline Fuel Prices (CY 2010 to CYTD 2012)

Period	CYTD 2012 [1]	CY 2011	CY 2010 [2]
Quarter 1	$3.59	$3.41	$2.51
Quarter 2	$3.73	$3.69	$2.60
Quarter 3	N/A	$3.59	$2.59
Quarter 4	N/A	$3.48	$2.94
Annual Average	**$3.63**	**$3.54**	**$2.66**

Source: DAS blended biodiesel historical daily fuel price adjustment reports
Note: Applicable taxes are included in the price shown in **Table 2**.
[1] CYTD 2012 annual average is skewed slightly due to the inclusion of all data points in Q1 and only partial data points in Q2.
[2] CY 2010 Q1, Q2, and Q3 average prices are significantly impacted by the provision of a $0.20 per gallon federal tax credit for B20 blended biodiesel.

[30] The DAS blended biodiesel contract CSP904610 covered all blended biodiesel purchases from 12/01/09 to 07/30/11 but included only full amendments for contractor cost from January 2011 through July 2011. Therefore, fully burdened delivery cost for CY 2010 was unable to be accurately assessed in this analysis.

Table 3-3 shows a comparative overview of DAS blended biodiesel and regular diesel fuel prices by ODOT District for CY 2011 and CYTD 2012. The DAS bidding process solicits bids specifically by ODOT district. As a result each district has a unique price per gallon that is reflective of the baseline fuel cost plus the contractor differential, which is also unique to each district (the differential reflects the contractor's unique cost to operate by district). Finally, prices are delineated by delivery type: tank wagon delivery for 250 to 5,000 gallons and transport delivery for 5,001 or more gallons.

Table 3-3: DAS Total Cost Comparison (CY 2011 and CYTD 2012)

	CYTD 2012 Cost Comparison			CY 2011 Cost Comparison		
Tank Wagon Delivery [1]	**Blended Biodiesel**	**Regular Diesel**	**Difference**	**Blended Biodiesel**	**Regular Diesel**	**Difference**
District 1	$4.35	$3.64	$0.71	$3.93	$3.50	$0.43
District 2	$4.35	$3.66	$0.68	$3.93	$3.53	$0.40
District 3	$4.16	$3.61	$0.55	$3.84	$3.48	$0.36
District 4	$4.19	$3.60	$0.59	$3.89	$3.46	$0.42
District 5	$4.06	$3.61	$0.45	$3.76	$3.48	$0.29
District 6	$4.04	$3.57	$0.47	$3.76	$3.44	$0.32
District 7	$4.09	$3.65	$0.45	$3.81	$3.51	$0.30
District 8	$4.16	$3.66	$0.51	$3.85	$3.52	$0.33
District 9	$4.16	$3.67	$0.50	$3.85	$3.53	$0.32
District 10	$4.19	$3.69	$0.50	$3.92	$3.56	$0.36
District 11	$4.16	$3.65	$0.51	$3.86	$3.52	$0.34
District 12	$4.16	$3.59	$0.58	$3.86	$3.45	$0.41
Average Tank Wagon Cost Difference			**$0.54**			**$0.36**
Transport Delivery [2]	**Blended Biodiesel**	**Regular Diesel**	**Difference**	**Blended Biodiesel**	**Regular Diesel**	**Difference**
District 1	$3.96	$3.59	$0.37	$3.69	$3.45	$0.24
District 2	$3.95	$3.61	$0.35	$3.70	$3.47	$0.23
District 3	$3.99	$3.56	$0.43	$3.70	$3.43	$0.28
District 4	$4.04	$3.54	$0.49	$3.76	$3.41	$0.35
District 5	$4.04	$3.55	$0.48	$3.71	$3.42	$0.29
District 6	$3.94	$3.53	$0.41	$3.65	$3.40	$0.26
District 7	$3.98	$3.62	$0.36	$3.70	$3.49	$0.21
District 8	$3.99	$3.62	$0.38	$3.73	$3.48	$0.25
District 9	$3.98	$3.64	$0.35	$3.70	$3.50	$0.20
District 10	$4.04	$3.62	$0.42	$3.76	$3.49	$0.27
District 11	$4.01	$3.63	$0.38	$3.71	$3.50	$0.21
District 12	$3.99	$3.54	$0.46	$3.70	$3.40	$0.30
Average Transport Cost Difference			**$0.41**			**$0.26**

Source: DAS blended biodiesel and fuel contracts and daily price adjustments
Note: Applicable taxes are included in the price shown in **Table 3**.
[1] Tank wagon delivery applies to fuel orders of 250 to 5,000 gallons.
[2] "Transport delivery" applies to fuel orders of 5,001 or more gallon.

As shown in **Table 3-3**, in CY 2011 entities using the DAS contract, on average, paid $0.36 more per gallon for tank wagon blended biodiesel delivery than regular diesel and $0.26 more per gallon for transport blended biodiesel delivery than regular diesel. Furthermore, this difference has been further exacerbated in CYTD 2012 as entities have, on average, paid $0.54 more per gallon for tank wagon blended biodiesel delivery than regular diesel and $0.41 more per gallon for transport blended biodiesel delivery than regular diesel. CYTD 2012 price increases relative to CY 2011 are largely reflective of significant increases in contractor differential rates which increased effective January 6, 2012 and ranged in impact from as low as an additional $0.19 per gallon to as high as an additional $0.33 per gallon for tank wagon delivery and from as low as an additional $0.17 per gallon to as high as an additional $0.20 per gallon for transport delivery.

ODOT purchases fuel, both regular diesel and blended biodiesel, from DAS contractors and retail fuel facilities. In fact, ORC § 125.834 guides DAS to develop directives which "shall instruct state employees to purchase alternative fuels at retail fuel facilities whenever possible." To take into account the full range of possible fuel purchasing options OPT analyzed actual historical fuel purchase data from ODOT's Equipment Management System (EMS); this database contains records with key information such as district, type of fuel, quantity, and cost.[31]

Table 3-4 shows ODOT's last four full fiscal years of aggregate diesel and blended biodiesel consumption and cost data as well as the difference in average cost per gallon and net impact on the total fuel cost. Given that ODOT's EMS data tracks only the straight purchase price of the fuel, figures in **Table 3-4** are unable to be accurately adjusted for the 2 percent energy content deficiency associated with blended biodiesel relative to regular diesel. Therefore, the data in **Table 3-4** presents a more conservative cost per gallon difference and total cost difference than actually exists.

[31] ODOT's EMS data is categorized based on fiscal year rather than calendar year which is how DAS biofuel mandates and *Statewide Alternative Fuel Scorecard* reports are structured. The State fiscal year starts July 1 and ends June 30.

Table 3-4: ODOT Fuel Purchase Data (FY 2007-08 to FY 2010-11)

FY 2010-11							
Regular Diesel			**Blended Biodiesel**			**Difference**	
Total Cost	**Total Gallons**	**Avg. $ per Gallon**	**Total Cost**	**Total Gallons**	**Avg. $ per Gallon**	**$ Per Gallon**	**Total $**
$2,259,749	715,615	$3.16	$10,774,360	3,174,280	$3.39	$0.24	$750,713
FY 2009-10							
Regular Diesel			**Blended Biodiesel**			**Difference**	
Total Cost	**Total Gallons**	**Avg. $ per Gallon**	**Total Cost**	**Total Gallons**	**Avg. $ per Gallon**	**$ Per Gallon**	**Total $**
$2,781,562	1,119,133	$2.49	$7,192,186	2,676,716	$2.69	$0.20	$539,313
FY 2008-09							
Regular Diesel			**Blended Biodiesel**			**Difference**	
Total Cost	**Total Gallons**	**Avg. $ per Gallon**	**Total Cost**	**Total Gallons**	**Avg. $ per Gallon**	**$ Per Gallon**	**Total $**
$4,480,252	2,020,162	$2.22	$5,212,682	1,817,639	$2.87	$0.65	$1,181,581
FY 2007-08							
Regular Diesel			**Blended Biodiesel**			**Difference**	
Total Cost	**Total Gallons**	**Avg. $ per Gallon**	**Total Cost**	**Total Gallons**	**Avg. $ per Gallon**	**$ Per Gallon**	**Total $**
$7,049,957	2,197,654	$3.21	$6,484,354	1,769,598	$3.66	$0.46	$807,579

Source: ODOT EMS fuel purchase data for FY 2007-08, FY 2008-09, FY 2009-10, and FY 2010-11

As shown in **Table 3-4** ODOT experienced an additional $3.3 million in fuel cost over the last four fiscal years due to its use of blended biodiesel. Also, **Table 3-4** shows that on a fiscal year basis ODOT has continued to decrease its use of regular diesel over the last four years while at the same time increasing its use of blended biodiesel. Blended biodiesel as a proportion of total fuel consumption (regular diesel and blended biodiesel) has increased significantly from approximately 45 percent in FY 2007-08 to approximately 82 percent in FY 2010-11.

Conclusion

As shown in **Table 3-3** and **Table 3-4**, the economics and relative cost of blended biodiesel do not support a conclusion that the State's mandate has been effective in developing a sustainable, competitive alternative fuels market around ODOT as a key consumer. Any goal of promoting the development of a market that could change the economics of blended biodiesel has not been realized.

Taking into account the non-economic policy considerations associated with blended biodiesel as an alternative fuel choice, including the domestic production associated with the biofuel portion of blended biodiesel and the relatively lower emissions associated with blended biodiesel relative to regular diesel fuel, policy makers may choose to require the consumption of an otherwise uncompetitive fuel source. However, the significant cost for ODOT to engage in this activity is a measurable, direct cost to Ohio taxpayers that is not balanced by any reasonable documentation of benefits.

Recommendation 3.1: To meet reasonable standards of efficiency and cost-effectiveness, the General Assembly should revise the mandate that ODOT use blended biodiesel fuel in lieu of regular diesel fuel to make such use discretionary. If the General Assembly chooses to leave the mandate in place it should include a sunset provision for the mandate as well as a target price differential to achieve over that timeframe.

Recommendation 3.2: While the mandate remains in place, ODOT should stop its unnecessary practice of buying twice as much blended biodiesel as the mandated amount.

Financial Impact 3.1 & 3.2: Without the mandate to use blended biodiesel fuel, ODOT could realize recurrent savings of approximately **$800,000** per year, based on historical average fuel consumption trends and expenditures.

Other Considerations:

In addition to the higher direct cost associated with blended biodiesel, ancillary issues associated with its use could potentially add to overall operating cost. These ancillary issues include incorrect fuel mixtures, low temperature congealing, and increased engine wear and tear. Although ODOT was unable to provide data to quantify the financial impact of these issues, these potential costs, along with confirmation that they are still being experienced in the ODOT fleet, was independently corroborated by both the central office and district staff. Information from the DOE's Alternative Fuels Data Center also supports the assertion that low temperature congealing is possible, and that blended biodiesel's solvent effect may result in filter clogging. Although the DOE notes that these problems are generally able to be minimized by decreasing the proportional blend of biofuels, this solution runs counter to the goals of increasing biofuels use for its environmental and domestic production benefits.

4. FLEET MANAGEMENT - COMPRESSED NATURAL GAS

Savings: N/A

Finding 4.1: In the current market, CNG vehicles do not provide a cost savings opportunity for ODOT

Recommendation 4.1: Based on current market prices for fuel, conversion cost and the cost benefit analysis ODOT should not proceed with implementation of CNG conversion at this time. However, if traditional fuel prices increase or conversion costs decrease to certain tipping points CNG could become a financially viable fuel for an ODOT application. Policymakers could decide to move forward with implementing CNG vehicles in an ODOT application based on a broader policy analysis that includes all statewide vehicles.

Financial Impact 4.1: N/A

FUEL—COMPRESSED NATURAL GAS

Fleet Management Compressed Natural Gas: This recommendation was issued as part of the ODOT interim report dated April 25, 2013. No substantive changes have been made to the recommendation.

Background

Compressed natural gas (CNG) is a viable, proven alternative vehicle fuel that offers many policy advantages to traditional gasoline and diesel fuels. These policy advantages include that CNG:

- Offers a significant economic growth opportunity for Ohio;
- Can be produced domestically, including in Ohio;
- Is an environmentally preferable fuel source, based on relative vehicle emissions;[32] and
- Provides opportunity for mutually beneficial public-private partnerships with potential to defer cost and risk to Ohio.

In addition to its distinct policy advantages relative to traditional fuels, CNG also offers a significant price advantage on a comparative gallon basis relative to both traditional fuels and other alternative fuels. However, CNG also has a significant per vehicle conversion cost which is dependent on the type of vehicle being converted and the desired operational range of the converted vehicle.[33] With a CNG conversion, tanks represent the bulk of the cost, so larger tank size vehicles can significantly increase the total cost of a conversion. Passenger cars, vans, and pickup trucks can be converted in the range of $9,000 to $13,000 per vehicle, while large single or tandem axle dump trucks can be converted in the range of $30,000 to $50,000 per vehicle. In addition to the per vehicle conversion cost is the costs associated with providing the fueling infrastructure for CNG vehicles. Fueling infrastructure can be provided through partnerships with private sector firms or other public sector fueling stations. These entities would then recoup the cost through higher CNG prices at the pump and negatively impact ROI. Conversely, fueling infrastructure could be developed and operated by ODOT, although the increased capital cost, which is dependent on the specific location and application, would significantly increase and also diminish potential ROI.

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[32] According to recent studies published by the National Energy Policy Institute and the National Petroleum Council CNG is estimated to hold a greenhouse gas emissions advantage of 10 to 25 percent relative to traditional gasoline and diesel fuels.

[33] During the course of the audit the only commercially available, direct from the original equipment manufacturer (OEM), vehicle was the Honda Civic Natural Gas. In this analysis "converted" and "conversion" are used broadly and would apply to any natural gas vehicles (NGVs) available directly from an OEM or through a combination OEM and third-party up-fitter. In all cases conversion cost represents the incremental cost of one vehicle and represents the higher initial cost incurred at the time of purchase or up-fitting.

Methodology and Analysis

OPT developed a current state financial analysis based on current fuel and CNG conversion costs. In addition, US Department of Energy transportation sector energy price projections were used to establish a baseline fuel cost projection. The baseline cost analysis and projected increases were then applied to several representative types of vehicles within the ODOT fleet to study the potential based on optimized annual mileage, expected useful life, and annual fuel consumption. Additional levels of sensitivity analysis were conducted based on current state fuel cost and decreased conversion cost (see **Table 4-2**) as well as increased fuel cost and current state conversion cost (see **Table 4-3**). These additional levels of sensitivity analysis identified trigger points at which cost components would transition into a financially viable position for ODOT converting its fleet.

Table 4-1 shows the payback periods for the current state analysis.

Table 4-1: Current State Analysis Outcomes

Vehicle Type	Conversion Cost	Annual Mileage	Payback Period	Useful Vehicle Life
Passenger Car	$9,000	20,000	7 Years	6 Years
1/2 Ton Pickup	$13,000	15,000	10 Years	8 Years
3/4 Ton Pickup	$13,000	15,000	8 Years	8 Years
1 Ton Pickup	$13,000	15,000	8 Years	8 Years
Light Dump Truck	$13,000	15,000	7 Years	8 Years
Heavy Dump Truck	$30,000 - $50,000	12,000	10 - 15 Years	10 Years
Current Price	**Gasoline Equivalent**		**Diesel Equivalent**	
CNG	$1.91		$2.13	

Source: ODOT Equipment Management System, DAS State fuel contracts, US Department of Energy Alternative Fuel Data Center, and current market conversion cost estimates

Note: Expected annual mileage has been increased to account for conservative increases in per-vehicle utilization resulting from implementation of recommendations to right-size the fleet. In addition, ODOT would likely target and pilot a NGV program toward vehicles with higher than average mileage. Actual average annual mileage for FY 2010-11 ranged from as low as 9,376 miles for heavy dump trucks to 12,340 miles for ¾ ton pickup trucks. Passenger cars, which have the highest expectation of increased utilization, had an average of 10,588 miles; 20,000 miles represents an 89 percent increase in utilization expectation beyond ODOT's current state of operations.

As shown in **Table 4-1**, with current fuel prices and incremental conversion costs, CNG implementation for ODOT would not likely result in a positive financial ROI. Under current conditions, individual vehicle conversion cost payback periods are extended beyond projected vehicle useful age and mileage parameters.

Table 4-2 shows resulting payback periods for a 60 percent reduced conversion cost scenario.

Table 4-2: Conversion Cost Analysis Outcomes

Vehicle Type	Current	60% Cost Reduction		Useful Vehicle Life
	Conversion Cost	Conversion Cost	Payback Period	
Passenger Car	$9,000	$3,600	3 Years	6 Years
1/2 Ton Pickup	$13,000	$5,200	5 Years	8 Years
3/4 Ton Pickup	$13,000	$5,200	4 Years	8 Years
1 Ton Pickup	$13,000	$5,200	4 Years	8 Years
Light Dump Truck	$13,000	$5,200	4 Years	8 Years
Heavy Dump Truck	$50,000	$20,000	7 Years	10 Years

Source: ODOT Equipment Management System, DAS State fuel contracts, US Department of Energy Alternative Fuel Data Center, and current market conversion cost estimates
Note: CNG, gasoline, and diesel fuel cost is held constant at the baseline presented in **Table 1**.

Table 4-3 shows resulting payback periods for 30 percent increased fuel price scenario.

Table 4-3: Fuel Cost Analysis Outcomes

Vehicle Type	Current	30% Price Increase [1]		Useful Vehicle Life
	Per Gal. Gas/Diesel	Per Gal. Gas/Diesel	Payback Period	
Passenger Car	$3.26/$3.46	$4.56/$4.68	4 Years	6 Years
1/2 Ton Pickup	$3.26/$3.46	$4.56/$4.68	6 Years	8 Years
3/4 Ton Pickup	$3.26/$3.46	$4.56/$4.68	5 Years	8 Years
1 Ton Pickup	$3.26/$3.46	$4.56/$4.68	5 Years	8 Years
Light Dump Truck	$3.26/$3.46	$4.56/$4.68	4 Years	8 Years
Heavy Dump Truck	$3.26/$3.46	$4.56/$4.68	9 Years	10 Years
Current Price	**Gasoline Equivalent**		**Diesel Equivalent**	
CNG	$1.91		$2.13	

Source: ODOT Equipment Management System, DAS State fuel contracts, US Department of Energy Alternative Fuel Data Center, and current market conversion cost estimates
Note: Conversion cost is held constant at the baseline presented in **Table 1**.
[1] 30 percent fuel price increase represents the five year average fuel baseline increased by 30 percent.

As shown in **Table 4-2** and **Table 4-3**, if traditional fuel prices increase by 30 percent or more than current prices, or if incremental conversion cost decreases by 60 percent or more than current prices, then CNG fleet conversion could offer ROI potential within a reasonable timeframe for ODOT.

Conclusion

With current fuel prices, incremental conversion costs, and usage patterns CNG vehicle implementation for ODOT would not likely result in a positive financial ROI.

Recommendation 4.1: Based on current market prices for fuel, conversion cost and the cost benefit analysis ODOT should not proceed with implementation of CNG conversion at this time. However, if traditional fuel prices increase or conversion costs decrease to certain tipping points CNG could become a financially viable fuel for an ODOT application. Policymakers could decide to move forward with implementing CNG vehicles in an ODOT application based on a broader policy analysis that includes all statewide vehicles.

Additional Considerations

Although it was out of scope for this audit, the Ohio Performance Team feels there is merit in further exploring the benefits of a multi-state CNG cooperative. A natural result of a cooperative such as this is the creation of jobs across multiple industries. Similar to public-private partnerships, a multi-state cooperative could force the creation of a new market yielding additional savings in infrastructure, equipment, and ongoing operational costs for Ohio. If negotiated properly, it is conceivable that the initial infrastructure and conversion costs could be paid for entirely by the private sector.

During the course of the audit the Governor joined with 14 other state governors in signing a memorandum of understanding (MOU) "to attract automobile makers in the U.S. to develop a functional and affordable original equipment manufacturer (OEM) fleet natural gas vehicle (NGV) that will also meet public demand." The MOU also notes that the signatories anticipate soliciting a joint-RFP that "shall require that the ultimate cost of an OEM NGV should be comparably priced to an equivalent gasoline powered model."

The Oklahoma Department of Central Services is administering the RFP and bidder selection process representing 28 total states, including all 15 MOU participants. The bid solicitation was closed in September 2012 with an initial contract period of October 5, 2012 through October 4, 2013. Although the MOU indicated that the RFP should require price parity for CNG vehicles relative to traditional fuel vehicles, the initial results of the bidding indicate that this has not yet been achieved. Ohio-specific bids for the types of vehicles included in this analysis, still result in a per-vehicle price differential of between $10,000 and $13,000.

If the final result of the MOU is sufficient to achieve the conversion cost reductions outlined in **Table 4-2** ODOT could reasonably move forward with a pilot program of CNG vehicles. However, to ensure that the potential for ROI is maximized, ODOT should strategically place pilot vehicles so that it can partner with other entities to gain access to existing fueling stations and maintenance facilities rather than invest in infrastructure. Finally, any ODOT pilot program should be carefully managed to ensure not only that ROI is actually achieved but that sufficient, accurate data is collected to ensure that any future expansion of the pilot is based on data-driven analysis.

5. COST / BENEFIT – REST AREAS

***Savings:* $7.2 million**

Finding 5.1: There are 21 rest areas located near alternative stopping opportunities. The alternatives provide adequate service for the safety and comfort of travelers in Ohio and offer ODOT the opportunity to optimize its rest area inventory.

Recommendation 5.1: ODOT should close the 21 rest areas identified as having alternative stopping opportunities nearby.

Financial Impact 5.1: Closing the 21 rest areas located an acceptable distance from alternative stopping opportunities will save approximately **$7.2 million** annually.

Savings: N/A

Finding 5.2: ODOT does not have a system to monitor, measure, and evaluate rest area utilization. A performance management plan could provide ODOT with information for further rest area optimization such as the number and type of vehicles that enter the parking area, the number of visitors, and seasonal variation in usage patterns.

Recommendation 5.2: ODOT should implement a sustainable, ongoing plan to optimize the level of services offered at Ohio's rest areas. ODOT should select rest areas identified in this report as well as a statistically valid random sampling of additional areas to study utilization including the number and type of vehicles that stop at each area and the number of visitors that use the facilities. The study should try to identify seasonal variations such as increased usage during the summer or near major holidays. The study should also include continuous tracking of rest area expenditures including the costs of labor, supplies, custodial contracts, capital expenditures, service, and any other major expenses.

Financial Impact 5.2: N/A

COST/BENEFIT – REST AREAS

Cost/Benefit – Rest Areas: Recommendation 5.1 was issued as part of the interim report dated April 23, 2012.

The scope of the interim report was limited to rest areas located in District 5, but has been expanded upon to cover all rest areas in the final report.

Background

The Ohio Department of Transportation (ODOT) maintains 92 rest areas throughout the State of Ohio on interstate and non- interstate roadways. As shown in **Table 5-1** below, the majority of Ohio’s rest areas are along interstate highways or U.S. routes. The purpose of rest areas is to provide the traveling public a safe place to pull over to rest or use the facilities during long drives. ODOT maintains three types of rest areas; modern, primitive and truck only. The 80 modern rest areas throughout Ohio feature amenities including rest rooms, drinking fountains, vending machines, and parking for cars and large commercial trucks. ODOT also maintains 10 primitive rest areas which usually include drinking water, primitive restroom facilities, and parking lots that are smaller than those at modern areas. The two truck parking only rest areas feature no facilities and are designed to give long distance commercial drivers a place to pull over and rest. As of 2013 the median age of the rest area inventory is 27 years. ODOT expends approximately $28.2 million on all aspects of rest area operations and maintenance annually.

Table 5-1 shows rest areas along each type of roadway and the FY 2010-11 through FY 2012-13 average expenditures.[34]

Table 5-1: Rest Areas in Brief

Type	Number of Areas	Operating Expenditures[1]	Service Expenditures[2]
Interstates	**45**	**$11,002,630**	**$7,864,577**
I-70	10	$2,641,528	$1,043,207
I-71	12	$2,851,792	$2,851,792
I-75	10	$2,643,408	$2,643,408
I-76	2	$397,149	$175,127
I-77	5	$1,106,896	$654,039
I-80	1	$249,197	$222,177
I-90	3	$750,102	$174,709
I-271	2	$362,557	$100,119
US Routes	**32**	**$6,161,630**	**$699,750**
US-22	1	$71,692	$106,198
US-23	6	$1,311,160	$135,852
US-30	8	$1,705,363	$254,589
US-33	10	$1,969,141	$186,630
US-35	3	$573,374	$2,743
US-50	2	$378,720	$0
US-52	1	$135,312	$13,739
US 250	1	$16,868	$0
State Routes	**15**	**$1,774,616**	**$768,390**
SR 2	3	$636,441	$304,397
SR 7	4	$426,999	$579
SR 11	1	$113,886	$236,708
SR 13	1	$82,486	$118,932
SR 32	2	$145,992	$238
SR 39	1	$7,048	$0
SR 60	1	$84,087	$6,318
SR 78	1	$127,217	$0
SR 550	1	$150,459	$101,218
Total	**92**	**$18,938,876**	**$9,332,717**

Source: ODOT rest area information

[1] Operating expenses include utilities, labor, maintenance, county and district overhead from FY 2010-11, and FY 2010-11 through FY 2012-13 average janitorial contracts.

[2] Service expenditures are from FY 2010-11 and include work performed on the rest area grounds, but not on the structure itself.

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[34] Due to the decentralized nature of expenses tracking at the district level, FY 2010-11 operating expenses were the most up to date financial data available for all rest areas.

Overview

In 2012 ODOT engaged the Ohio Performance Team (OPT) to assist with developing a long term strategy to optimize rest area inventory. For several years ODOT has been investigating possible strategies for reducing annual rest area expenditures. To date, ODOT has taken the following action to right-size the current inventory of rest areas:

- In 2011, two rest areas in Tuscarawas County were closed after ODOT was able to determine that there were a number of viable alternative stopping opportunities nearby.[35]
- Two primitive rest areas along state route 62, and two primitive areas along US 50 in Highland County have been closed.
- As of May of 2013, ODOT is planning to close all the primitive rest areas in District 10 which includes areas in Hocking, Gallia, Athens, Meigs, Morgan, Washington, and Monroe Counties.
- ODOT is in the process of seeking a private sector partner that is willing to operate rest areas along U.S. and state routes.[36]

On average, $11,200,000 (60 percent) of the annual operating cost of rest areas is derived from the custodial contract. As of 2013, ODOT has contracts with 31 different custodial vendors. Vendors are associated with the Community Rehabilitation Program (CRP), which provides employment and job training for persons with disabilities.

Table 5-2 shows the average square footage, annual custodial costs and average costs per square foot for each type of rest area.

Table 5-2: Custodial Contracts

Type of Area	Average Sq. Footage	Custodial Expenditures[1]	Costs per Square Foot
Interstate	2,926	$156,436.04	$68.84
US Route	1,022	$92,514.02	$102.60
State Route	653	$50,480.41	$71.48

Source: ODOT rest area custodial contract information
[1]Based on the average cost from FY 2010-11 through FY 2012-13.

As shown in **Table 5-2**, the average custodial contracts range in price from approximately $156,000 for interstate rest areas to approximately $50,000 for areas located along state routes. The lower cost at rest areas located along state routes reflects the fact that most primitive rest areas with smaller, less labor intensive facilities are located along state routes, whereas most of

[35] The decision to close these areas was based on the distance to alternative stopping opportunities without considering utilization.
[36] Opportunities for privatizing areas along interstate highways are limited by federal law.

the areas located on U.S. routes and all interstate rest areas are modern. Standard vendor contracts are for either one or two fiscal years.

ODOT also has a long standing relationship with the Business Enterprise Program (BEP). BEP provides blind persons with employment operating vending machines in government owned buildings. The 1936 Randolph-Shepard Act is a federal law that makes BEP the preferred operator for vending machines located on federal land. Approximately 26 percent of vending machines operated by BEP in Ohio are located at interstate rest areas (i.e., federal land). BEP operates 329 vending machines in 31 interstate rest areas across the state of Ohio. ODOT must take existing agreements with both the CRP and BEP into account before moving forward with any future changes in rest area operations.

Methodology and Analysis

Rest area optimization is a common cost-saving measure for state departments of transportation. In the last few years, states including Arizona, California, Connecticut, Kentucky, Maine, Missouri, Michigan, Texas and Virginia have looked at rest area closures as a cost saving measure. States that have looked into rest area closure have reached various conclusions. For example, Michigan concluded that it was not necessary to close any rest areas whereas Connecticut decided that the private sector offered enough alternatives to allow for the closure of all rest areas. Most states that research rest areas focus on similar criteria, such as distance between alternative stopping opportunities and the utilization of existing areas.

Rest area inventory must also be considered in light of federal guidelines. For example, the United States Department of Transportation (USDOT) has non-regulatory guidelines that states are encouraged to consider when evaluating rest areas inventory. NS 23 CFR 752[37] advises that states should only consider closing rest areas if they can show "…spacing of an hour's drive time or less…" between stopping alternatives. In Federal Register Volume 71, Issue 201 (2006), the Federal Highway Administration (FHWA) suggests that private sector alternatives to public rest areas should offer 24 hour service including rest room facilities as well as parking for both cars and heavy trucks.

OPT's assessment of Ohio's inventory of rest areas was conducted in cooperation with ODOT and after OPT consulted with a representative from USDOT. OPT began the process by collecting an up-to-date inventory of rest areas in Ohio. Along with the latitude and longitude coordinates, OPT requested data on the age, square footage, acreage, and recent expenditures for utilities, maintenance, and capital improvements. The information provided was uploaded into mapping software using latitude and longitude coordinates.

[37] Federal Aid Policy Guide, October 5th, 1992, Transmittal 6

To assess whether or not rest areas were located near commercial alternatives, data was gathered on the location of major-chain commercial truck stops in Ohio. In order to remain consistent with the recommendations of FHWA, only commercial truck stops were considered as viable commercial alternatives. Limiting commercial alternatives to only truck stops assures that the alternative stopping opportunities offer 24-hour service, restrooms, fuel, refreshments, and truck parking. Latitude and longitude coordinates for Flying J's, Loves, Petro, Pilot, and Travel America stores were downloaded from the corporate website for each store. The coordinates of each store were added to the mapping software to compare the location of ODOT's rest areas to the commercial alternatives.

Once the location of rest areas and commercial alternatives were mapped out, rest areas were grouped in clusters of stops going the same direction along the same roadway. Within each cluster the distance between rest areas was measured using mapping software. Consideration was given to the future distance between rest areas along a roadway if one or more existing rest areas were removed. To keep consistent with NS 23 CFR 752, the goal of this analysis was to locate clusters where one of more areas could be removed while maintaining a distance between remaining areas of about one hour's drive time.

There were several criteria that were considered in addition to distance between existing rest areas. The most prominent was the stopping opportunities provided by commercial alternatives. Distances between commercial truck stops were compared with distances between existing rest areas. There was also a comparison of parking capacity. The goal was to find commercial alternatives to existing rest areas with parking capacity that matched or exceeded the existing rest areas and that would not increase a traveler's time between stopping opportunities to over one hour. If there were multiple, adjacent rest areas that met the above criteria, the areas with a higher cost of operations were selected for closure.

Table 5-3 lists 21 rest areas where an alternative stopping opportunity was identified. This table shows the time and distance from and to an alternative stopping opportunity in the current state.

Table 5-3: Rest Area Distances Compared

Current				
Rest Area	**Miles from Previous Stopping Opportunity**	**Minutes from Previous Stopping Opportunity**	**Miles To Next Stopping Opportunity**	**Minutes to Next Stopping Opportunity**
US-30 EB in Allen	33.4	31	50.3	47
US-23 SB in Wyandot	N/A[1]	N/A	31.4	31
I-70 EB in Madison	67.8	62	60.1	58
I-80 WB in Trumbull	1.4	6	N/A[2]	N/A
I-75 NB in Auglaize	33.6	32	39	36
I-75 SB in Auglaize	39.1	37	33.3	31
I-70 EB in Guernsey	29.3	27	20.7	22
I-71 NB in Fayette	33.8	32	59.7	55
I-71 SB in Fayette	60.6	55	33.4	32
I-70 WB in Muskingum	50.5	51	33.1	35
US-30 EB in Van Wert	33.4	31	20.1	21
US-30 WB in Van Wert	21.8	23	33.4	31
I-71 NB in Delaware	59.7	55	24.6	31
I-71 NB in Wayne	48.7	50	28.3	28
I-71 SB in Wayne	27.2	27	49.1	50
US-30 WB in Wyandot	42.4	41	50	47
US-30 EB in Wyandot	50.3	47	42.2	41
I-75 NB in Butler	29.3	28	53.2	50
I-70 EB in Licking	33.1	35	59.9	56
I-70 WB in Licking	60.1	58	59.4	55
I-70 EB in Preble	10.8	12	67.8	62

Source: ODOT rest area information

[1] There is no previous stopping opportunity on the US 23 because this is near where the road begins.

[2] There is no next stopping opportunity on I-80 because this is where the road ends.

Table 5-4 shows future state travel distances if the 21 rest areas identified in **Table 5-3** are removed. It should be noted that there will be only one area where travel times between stopping opportunities will slightly exceed one hour.

Table 5-4: Distances between Stops with Rest Areas Removed[1]

Future State				
Rest Area	**Miles from Previous Stopping Opportunity**	**Minutes from Previous Stopping Opportunity**	**Miles To Next Stopping Opportunity**	**Minutes to Next Stopping Opportunity**
US-30 EB in Allen	50.8	43	41.9	37
US-23 SB in Wyandot	N/A[2]	N/A	25.2	23
I-70 EB in Madison	70	59	44.4	44.4
I-80 WB in Trumbull	4.4	12	9.5	10
I-75 NB in Auglaize	72.6	68	26.3	26
I-75 SB in Auglaize	72.4	68	44.1	40
I-70 EB in Guernsey	50	45	15.2	16
I-71 NB in Fayette	35.5	32	61.4	52
I-71 SB in Fayette	64.2	59	31.4	29
I-70 WB in Muskingum	52.9	51	35.5	34
US-30 EB in Van Wert	60	53	N/A[3]	N/A
US-30 WB in Van Wert	60	53	41.9	37
I-71 NB in Delaware	61	52	21.6	26
I-71 NB in Wayne	65.3	56	21.2	21
I-71 SB in Wayne	20.3	19	64.9	55
US-30 WB in Wyandot	47.6	43	41.1	35
US-30 EB in Wyandot	41.9	37	47.7	43
I-75 NB in Butler	37.1	35	43.7	39
I-70 EB in Licking	35.5	34	55.8	49
I-70 WB in Licking	44.4	38	38.5	34
I-70 EB in Preble	18.1	16	70.6	60

Source: ODOT rest area information

[1] Alternative stopping opportunity for the rest areas in Auglaize along I-75 northbound and southbound is the rest areas in Hancock and Miami, respectively. All other alternative stopping opportunities are commercial facilities.

[2] There is no previous stopping opportunity on the US 23 because this is near where the road begins.

[3] There is no next stopping opportunity on I-80 because this is where the road ends.

Rest areas listed in **Table 5-3** have been identified as having an acceptable alternative stopping location nearby. The alternative location has been shown to have a number of parking spaces that meets or exceeds the current rest area. **Table 5-4** shows the distances and travel times between available alternatives. Drivers in Ohio will have ample stopping opportunities along major highways without the rest areas identified in **Table 5-3**. It should be noted that even if the current level of rest area services were reduced, there will be few places where drivers have a full hour's drive between alternatives. For example, on I-75, where the removal of two rest areas in Auglaize is estimated to require one hour and eight minutes between stops, a driver will pass through both Lima and Wapakoneta on the way to the next rest area. This means that in addition to the alternative stopping opportunities identified in **Table 5-4**, a driver will find safe parking, restroom facilities, and refreshments along the route.

Peer states have often relied on utilization data to help guide decision-making on rest area optimization. For example, studies in Connecticut, Michigan and Texas each took utilization data as one factor in considering whether to expand or reduce the overall rest area inventory. Peer states usually measure both traffic flow on the roadway as well as traffic pulling into the rest area to develop a "capture rate" – or a ratio of cars pulling into the rest area as a percentage of all cars driving by. For example, in Michigan a motion activated camera was also placed at rest areas to take pictures of automobiles parking at the facilities. This allowed researchers to analyze the type of vehicle (e.g., passenger car, truck, RV, etc.) as well as the length of stay. The goal of these types of studies is to collect enough data to match supply and demand for rest area parking spaces. This data can assist in long term capital planning and rest area inventory optimization. ODOT does not collect utilization data for rest areas in Ohio.[38]

Table 5-5 compares the existing parking spaces at rest areas to the parking available at the suggested alternatives. Without more detailed utilization data, this comparison acts as a check on parking capacity.

[38] ODOT has historically collected data on the number of visitors at 10 travel information centers (TIC) throughout Ohio but this data was not a statistically valid representation of visitors at all rest areas and the TIC program has been discontinued.

Table 5-5: Parking at Rest Areas and Alternatives

Rest Area	Rest Area	Alternative	Difference	Percent Difference
30 EB Allen	56	150	94	167.9%
23 SB Wyandot	56	70	14	25.0%
70 EB Madison	50	125	75	150.0%
80 WB Trumbull	103	240	137	133.0%
75 NB Auglaize	86	113	27	31.4%
75 SB Auglaize	85	107	22	25.9%
70 EB Guernsey	51	48	(3)	(5.9%)
71 NB Fayette	43	148	105	244.2%
71 SB Fayette	39	100	61	156.4%
70 WB Muskingum	63	100	37	58.7%
30 EB Van Wert	56	255	199	355.4%
30 WB Van Wert	56	82	26	46.4%
71 NB Delaware	40	115	75	187.5%
71 NB Wayne	43	185	142	330.2%
71 SB Wayne	58	185	127	219.0%
30 WB Wyandot	39	70	31	79.5%
30 EB Wyandot	39	70	31	79.5%
75 NB Butler	75	200	125	166.7%
70 EB Licking	39	90	51	130.8%
70 WB Licking	43	152	109	253.5%
70 EB Preble	44	50	6	13.6%

Source: ODOT rest area information

As shown in **Table 5-5**, for each rest area identified as having a viable alternative nearby, the alternative offers an equal or greater number of overall parking spaces. In one example, the eastbound rest area on I-70 in Guernsey County, the alternative offers three fewer car parking spaces, but an equal number of truck parking spaces. Also, the alternative rest area is located approximately fifteen minutes from Wheeling, West Virginia, which will offer ample stopping opportunities for passenger vehicles.

In addition to the rest areas identified in **Table 5-3** as having viable alternatives located nearby, OPT also identified five rest areas where the level of parking at identified alternatives was either below the existing rest areas or where the analysis was inconclusive.

Table 5-6 shows two rest areas where the identified alternative had significantly fewer parking spaces than the existing rest area.

Table 5-6: Study for Commercial Capacity

Rest Areas	Annual Expenditures[1]	Age	Number of Parking Spaces	Spaces at Alternative	Differences
70 WB Preble	$238,536	28	103	50	(53)
77 NB Washington	$231,988	27	62	50	(12)

Source: ODOT rest area information
[1]Includes FY 2010-11 utilities, labor, maintenance, county and district overhead and services expenses as well as FY 2010-11 through FY 2012-13 average janitorial contracts.

As shown in **Table 5-6,** there are two rest areas where the number of parking spaces at the identified alternative is significantly lower than the number of spaces at the existing rest area. It is recommended that ODOT conduct a utilization study to determine how many of the parking spaces at the areas identified in **Table 5-6** are used, how often and by what types of vehicles.

Table 5-7 shows three rest areas where an estimated upper bound of parking utilization suggests the need for a deeper utilization study.

Table 5-7: Study for Data Reliability

Rest Area	Annual Expenditures[1]	Distance From Alternative	Distance to Alternative	Distance w/area removed[2]	Upper Bound of Utilization
SR 7 NB in Gallia	$203,960	19.90	20.50	40.40	128.9%
US-33 EB in Logan	$297,517	34.80	32.90	67.70	151.9%
US-33 WB in Logan	$315,123	34.60	32.90	67.50	151.9%

Source: ODOT rest area information
[1]Includes FY 2010-11 utilities, labor, maintenance, county and district overhead and services expenses as well as FY 2010-11 through FY 2012-13 average janitorial contracts.
[2]This is a calculation of the distance between alternative stopping opportunities if the rest area is removed.

Visitor data from the 10 TICs was used to calculate an estimate of the lower and upper bound of utilization – expressed as a percentage of parking spaces used per hour – at each rest area. The three rest areas listed in **Table 5-7** were the areas that had both acceptable alternatives nearby and had the highest estimated utilization rate. While the TIC data does not represent a statistically valid sample of rest area utilization, the abnormal estimated utilization rates suggest a more in depth study of the actual utilization of the rest areas listed in **Table 5-7** should be conducted.

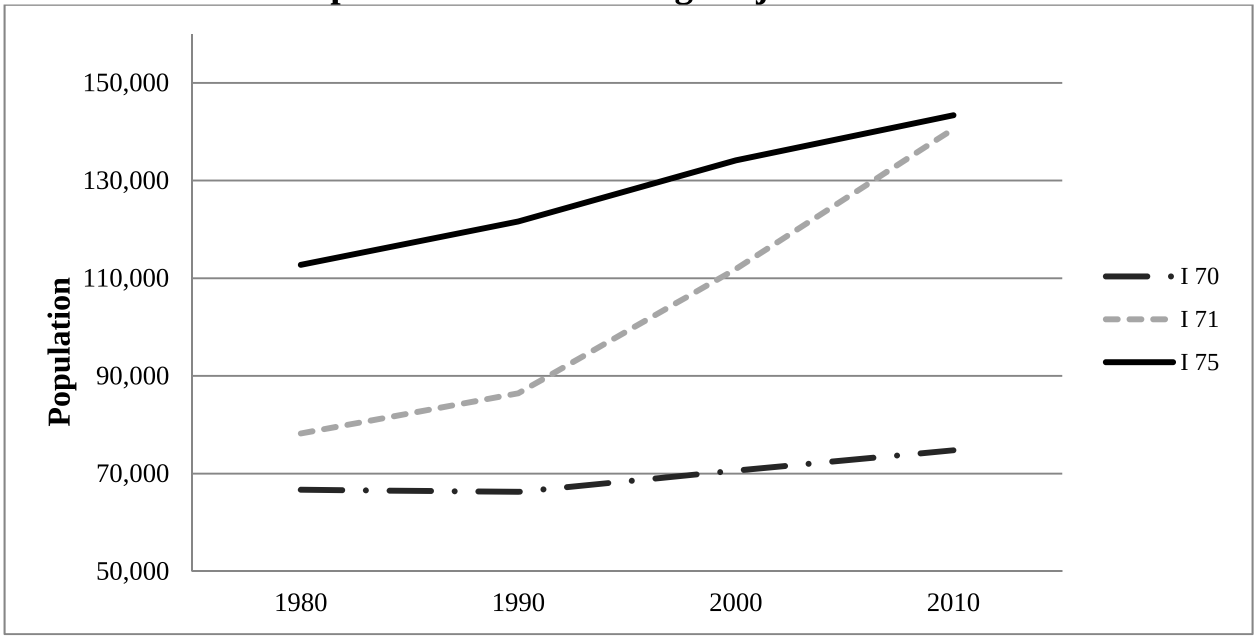
In addition to the areas identified in **Tables 5-6** and **5-7**, there are at least three other areas which present opportunities for additional analysis. The two rest areas on I-71 in Medina County and the eastbound rest area on I-70 in Belmont County were each carefully examined during the course of this analysis. All three rest areas are located along corridors where populations are increasing and where there were other rest areas and commercial alternatives. For the two rest areas in Medina County, it was concluded that the areas in Wayne County, just south of the areas in Medina County, offer a better opportunity for service reduction from an economic perspective due to higher cost of operations at the Wayne County areas. A similar conclusion was reached for the eastbound rest area on I-70 in Belmont when comparisons were made to the rest area on

I-70 East in nearby Guernsey County. The areas in Medina and Belmont should be studied continuously as both rest area demand and potential alternatives change.

The above analysis represents an assessment of Ohio's rest areas based on the most up-to-date data available. ODOT should consider that as the population of Ohio's cities continues to grow it is reasonable to expect that additional alternative stopping opportunities will be developed above and beyond the alternative opportunities identified in **Table 5-4**. The chart below demonstrates population growth along Ohio's major interstate corridors. This population growth will continue to drive changes in the demand for rest area services as well as increased alternative stopping opportunities.

Chart 5-1 shows the population growth in counties with rest areas located along the I-70, 71 and 75 corridors from 1980 through 2010.

Chart 5-1: Population Growth along Major Corridors 1980-2010



Source: Ohio Department of Development

As shown in **Chart 5-1**, counties with rest areas located along the I-70, 71, and 75 corridors have experienced average population growth of 9.4 percent per decade between 1980 and 2010. 12 of the 19 rest areas identified in **Table 5-3** as having a commercial alternative nearby are located along the 70, 71 and 75 corridors, suggesting that commercial alternatives have developed as population has increased. A performance management plan can help ODOT gather data on changing utilization rates as well as alternative stopping opportunities so that ODOT can continue to right-size the rest area inventory.

Table 5-8 shows the 21 rest areas with acceptable stopping opportunities nearby. The areas are ranked by annual operating costs.

Table 5-8: Areas near Alternative Opportunities

District	County	Route	Direction	Annual Expenditures[1]	Age
3	Wayne	I-71	SB	$583,505	11
5	Guernsey	I-70	EB	$528,869	28
3	Wayne	I-71	NB	$486,829	11
4	Trumbull	I-80	WB	$471,374	30
5	Licking	I-70	WB	$468,757	7
5	Licking	I-70	EB	$466,202	7
6	Delaware	I-71	NB	$427,699	26
5	Muskingum	I-70	WB	$427,213	27
8	Preble	I-70	EB	$417,021	28
6	Fayette	I-71	NB	$390,676	28
8	Butler	I-75	NB	$368,419	9
6	Madison	I-70	EB	$366,852	32
6	Fayette	I-71	SB	$361,770	28
1	Wyandot	US 30	WB	$226,653	11
7	Auglaize	I-75	SB	$204,038	32
7	Auglaize	I-75	NB	$196,110	32
1	Wyandot	US 23	SB	$183,299	41
1	Van Wert	US 30	EB	$176,724	27
1	Van Wert	US 30	WB	$174,973	27
1	Wyandot	US 30	EB	$153,342	11
1	Allen	US 30	EB	$153,342	41
Total				**$7,233,666**	

Source: ODOT rest areas

[1]Includes FY 2010-11 utilities, labor, maintenance, county and district overhead and services expenses as well as FY 2010-11 through FY 2012-13 average janitorial contracts.

As shown in **Table 5-8,** there are 21 rest areas located an acceptable distance from alternative stopping opportunities. Areas identified have annual expenditures between $583,505 and $153,342. If ODOT discontinues all operations at the areas listed, the total savings will be approximately **$7.2 million** annually. Factors including the age of rest areas, contracts with BEP and CRP and the amount of federal monies invested may require ODOT to phase certain areas out of operation instead of closing immediately. A phased approach may reduce total savings but can allow ODOT to meet existing contractual obligations while realizing some savings.

Conclusion

There are 21 rest areas located near alternative stopping opportunities. The alternatives provide adequate service for the safety and comfort of travelers in Ohio and offer ODOT the opportunity to optimize its rest area inventory. Furthermore, ODOT does not have a system to monitor measure and evaluate rest area utilization. A performance management plan could provide ODOT with information such as the number and type of vehicles that enter the parking area, the number of visitors and seasonal variation in usage patterns. ODOT can use data collected through a performance management plan to continuously optimize rest area expenditures. An optimized rest area inventory will help ODOT provide for the safety and comfort of travelers in Ohio while also offering a good value to the taxpayers.

Recommendation 5.1: Close rest areas located near viable alternatives
ODOT should close the 21 rest areas identified in **Table 5-8** as having alternative stopping opportunities nearby.

Financial Impact 5.1: Closing the 21 rest areas located an acceptable distance from alternative stopping opportunities will save approximately **$7.2 million** annually.

Other Considerations

Permanently closing rest areas is one possible option for realizing savings. Reducing service levels without completely discontinuing operations will decrease the total savings but may be appropriate in some circumstances. ODOT should consider the following options as part of any long term plan to optimize rest are service delivery.

Reduced Service Options

- **Truck Parking** - Both ODOT and USDOT mentioned the rest areas located along I-71 in Morrow County as a good example of a truck parking only facility. Truck parking will significantly reduce the costs of operations while allowing the facilities to be deemed “in use” by USDOT. Peer states have experienced objections from the trucking industry when rest areas are suggested for closure, and truck parking may help alleviate those concerns.
- **Seasonal Service** – ODOT should investigate the possibility of reducing rest area services during the off season. ODOT could shut down facilities at select areas during the fall and winter if it can be determined that certain areas are primarily used between Memorial and Labor Days. During the off season, ODOT could leave the parking lots open for emergency or overnight truck parking. There will be an expense associated with shuttering each area annually, but ODOT could save through reduced custodial services several months of the year.

Alternative Service Delivery

- **Private Sector –** ODOT has taken a leading role in discussing the possibility of a private sector operator taking over one or more rest areas in the state. If ODOT can find an acceptable private sector partner, privatization of rest area operations should be included as part of a long term rest area optimization plan.

- **Public Sector –** In addition to privatization, ODOT should explore cooperation with local governments for assistance in operating rest areas along rural roads. For example, there is a rest area located along US 52 in Clermont County that has become a de facto local park. ODOT could seek local government partners to share the burdens of rest area operations.

Recommendation 5.2: Develop a performance management plan to optimize service levels
ODOT should implement a sustainable, ongoing plan to optimize the level of services offered at Ohio's rest areas. ODOT should select rest areas identified in this report as well as a statistically valid random sampling of additional areas to study utilization including the number and type of vehicles that stop at each area and the number of visitors that use the facilities. The study should try to identify seasonal variations such as increased usage during the summer or near major holidays. The study should also include continuous tracking of rest area expenditures including the costs of labor, supplies, custodial contracts, capital expenditures, service and any other major expenses.

A performance management plan can also help ODOT optimize future expenditures. ODOT's current plans call for modernizing several existing primitive rest areas. A utilization study can help ODOT determine whether or not there is actually demand for modernization. For example, if a study found that an existing primitive rest area was utilized less than rest areas in more populated regions, ODOT might decide not to invest in modernization and instead leave the existing primitive area as-is. Additionally, if a utilization study conducted over time shows rest area usage changing along any roadway, ODOT may be able to adjust capital expenditures to match demand. Finally, as Ohio's metropolitan areas continue to expand, a utilization study will help ODOT continuously update the list of rest areas where alternative stopping opportunities have changed the level of rest area services needed for safety.

6. COST / BENEFIT - VEGETATION MANAGEMENT

Savings: **$4.4 Million**

Finding 6.1a: ODOT mowing policy provides a higher level of mowing service than similar state departments of transportation. Bringing mowing service levels in line with similar states would allow for ODOT to refocus scarce resources on center-line activities that return higher value for the taxpayer.

Finding 6.1b: Balanced integrated vegetation management (IVM) strategy is a cost-effective alternative to traditional mechanical mowing. Expansion of this program offers the ability to achieve an acceptable level of service at a lower cost to the taxpayer.

Recommendation 6.1: ODOT should modify its policy and practice to reduce mowing to a maximum of three cycles per year consistent with practices employed by other similar states. Furthermore, ODOT should employ additional strategies to reduce its mowing cycles to two cycles wherever possible while maintaining an acceptable level of roadway safety. To achieve two cycles ODOT should consider employing a mix of the following strategies:

- Evaluate the current transitional and undisturbed zones to identify areas where no mow strategies can be expanded;
- Expand the use of plant growth regulator and herbicidal spraying where cost-effective relative to mechanical mowing; and
- Reduce the "mowback" to a level that provides for safety and zone recovery consistent with practices employed by leading similar states.

Financial Impact 6.1: Mowing at a standard of 3 cycles or less the Department could save approximately **$4.4 million** per year. Additional mowing strategies enabling a reduction of mowing to 2 cycles the Department could save up to a cumulative total of approximately **$7.4 million** per year.

VEGETATION MANAGEMENT

Cost/Benefit –Vegetation Management: This recommendation was issued as part of the ODOT interim report dated April 25, 2013. No substantive changes have been made to the recommendation.

Background

Ohio Revised Code (ORC) § 5541.02 allows that "The director of transportation shall have supervision and control of all trees and shrubs within the limits of a state highway." Furthermore, "The director [of transportation] may cut, trim, or remove any grass, shrubs, trees, or weeds growing or being within the limits of a state highway. The powers conferred by this section upon the director shall be exercised only when made necessary by the construction or maintenance of the highway or for the safety of the traveling public."

ODOT's *Maintenance Administration Manual* (the *Manual*)[39] notes that the safety of the traveling public is ensured by "providing clear sight distance at intersections and curves, unobstructed road signs, and clear guardrails. Obstructed road signs and sight distance issues are more than a nuisance to the driver, they are safety hazards. Vegetation management efforts are therefore a key aspect of the ODOT maintenance program." Furthermore, the *Manual* notes that integrated vegetation management (IVM), including a mix of mechanical mowing, brush and tree removal, and herbicidal spraying, is employed by ODOT to develop a "management plan" that provides the optimal result. Finally, the *Manual* emphasizes that "a good plan will save labor, time, and money" and "also provides the motorist with a uniform and attractive roadside."

Although IVM is the generally accepted and practiced approach within ODOT this mix of vegetation management practices has not always been employed in a balanced fashion. For example, policy directives from ODOT administration have emphasized or deemphasized certain aspects of IVM such as the use of plant growth regulators (PGR) and herbicidal sprays. One aspect of ODOT's vegetation management operation that appears to have remained constant from administration to administration is mechanical mowing. This includes the mowing of roadside grasses and broad leaf weeds as well as the annual removal of brush and small trees. ODOT refers to the full right-of-way removal of brush and small trees as "mowback".[40]

[39] Chapter 400: Vegetation Management, revised June 1, 2010

[40] Mowback typically applies to the entire right-of-way with some exceptions. The *Manual* divides the roadway into four areas for the purpose of vegetation management activities. The first zone is the "vegetation free zone" and encompasses the shoulder area of the road. The second zone is the "operational zone" and typically encompasses a 30 foot swath on each side of an interstate or divided highway. The third zone is the "transitional zone" and encompasses the area far enough from the roadway that tree falls will not directly impact safety. The fourth and final zone is the "undisturbed zone" and encompasses the area that is typically not required to be managed unless dictated by the nature of the surrounding property use. For example, undisturbed zones adjacent to farmland should be managed such that the vegetation is not detrimental to that farmland.

ODOT's policy is to begin performing mechanical mowing on all roadsides when the grass has reached 12 inches in height.[41] "Rights of way are typically mowed before each major traveling holiday: Memorial Day, the Fourth of July, and Labor Day. A final mowing can occur in late September or October to remove any unwanted vegetation and prepare the right-of-way for winter. Additional cuttings in the operational zone may be required if excess rainfall makes the cool season grasses grow above and beyond normal." ODOT's policy and practice is generally to perform four mowing cycles annually.

Methodology

ODOT's vegetation management activities were first analyzed to determine the extent to which the current state of operations was consistent with stated policy.[42] ODOT's vegetation management activities were then analyzed in relation to identified similar states to determine if opportunities for efficiencies were attainable through changes to policies and practices and implementation of leading practices (see **Table 6-1** for similar state data and selection methodology). Finally, analysis of both ODOT's internal data and information from similar leading practice states was used to evaluate the potential effectiveness of broader application of chemical management strategies as an alternative to mechanical mowing.

[41] ODOT's *Roadside Safety Landscaping Guidelines* (January 20, 2006) allows for the planting of low-growing groundcovers with a mature height of less than 18 inches to be planted in the clear zone graded section within 30 feet of the roadway. According to the guidelines, the parameters, including the 18 inch height guideline, were selected because they allow for adequate sight distance. However, field conditions and geography are to be evaluated on a case-by-case basis.

[42] ODOT records all vegetation management data in the Department's Transportation Management System (TMS) on a daily basis. These daily records include comprehensive data on the employee performing the work, the type of work performed (mowing, weed eating, spraying, and arm mowing), the specific equipment used to perform the work, the location of the work performed (district, county, route number, and mile markers), and the total cost to accomplish the work. Data for ODOT's entire mowing program was analyzed for the last five complete years (CY 2007 through CY 2011) and detailed analysis, the primary basis of this recommendation, was performed for ODOT's CY 2010 and CY 2011 vegetation management activities.

Service-Level Analysis

ODOT has official center-line mileage records for each interstate, US route, and state route roadway. According to these records, ODOT has vegetation management jurisdiction over roadways with a total center-line distance of approximately 16,057 miles. Analysis of the total linear miles of work performed, aggregated for both crew and contract work,[43] for CY 2010 and CY 2011 identified that ODOT actually performs slightly more than 4 complete mowing cycles per year.[44] Analysis indicates that ODOT performed a weighted average of 4.16 cycles per route in CY 2010 and 4.26 cycles per route in CY 2011. These measurements are for two-lane and four-lane mowing only as other forms of IVM (spraying, weed eating, and arm mowing) were not taken into account in these specific calculations.

To assess the appropriateness of the number of mowing cycles and the appropriateness of the extent to which annual mowback is performed by ODOT, 10 similar states were selected and studied. This selection of similar states was based on United States Department of Agriculture (USDA) plant hardiness zones and estimation of representative zone by state; location relative to Ohio (i.e., adjacent or not); and average annual rainfall and daily mean temperature as reported by the National Oceanic and Atmospheric Administration (NOAA). **Table 6-1** shows information on these measures for Ohio and identified similar states as well as the number of annual mowing cycles and mowback.

[43] ODOT's crew mowing accomplishments are generally measured in terms of swath miles; a five foot swath that is one linear mile long. ODOT's contract mowing accomplishments are typically measured in terms of either linear miles and/or acres. However, all contract plan documents include detailed linear mileage data for the contract work regardless of the basis of measurement used for contract fulfillment and payment.

[44] Though detailed analysis was only performed for CY 2010 and CY 2011 the total linear miles of work accomplishment was generally consistent for all five years of data collected. Total linear miles ranged from a low of approximately 63,300 in CY 2008 to a high of 74,300 in CY 2011; on average, over the last five years there were approximately 70,000 total linear miles per year.

Table 6-1 shows Ohio and similar state data used to develop the similar state average.

Table 6-1: Ohio and Similar State Overview

Similarity to Ohio						Annual Mowing [1]	
State	**USDA Zones**	**Rep. Zone**	**Adjacent**	**Avg. Annual Rainfall**	**Daily Mean Temp.**	**Cycles**	**Mowback**
Ohio	**5b - 6b**	**6a**	**N/A**	**38.30**	**50.03**	**4.00**	**1.00**
Connecticut	5b - 7a	6a or 6b	No	47.22	51.15	3.00	1.00
Illinois	5a - 7a	5b	No	38.82	50.14	2.00	1.00
Indiana	5b - 6b	5b or 6a	Yes	40.64	51.98	3.00	N/A
Kansas	5b - 7a	6a	No	27.84	54.02	N/A	0.25
Kentucky	6a - 7a	6b	Yes	48.41	55.80	3.00	1.00
Michigan	4a - 6b	5a or 5b	Yes	32.25	44.71	N/A	0.50
Missouri	5b - 7b	6a	No	41.17	55.18	3.00	1.00
New York	3b - 7b	5a or 5b	No	40.20	50.20	3.00	1.00
Pennsylvania[2]	5a - 7b	6a	Yes	41.38	51.64	2.75	0.75
West Virginia	5a - 7a	6a	Yes	43.79	52.73	4.00	1.00
Similar State Average Annual Cycles and Mowback [3]						**2.97**	**0.83**

Source: ODOT policy; USDA plant hardiness zone data; NOAA average annual rainfall and daily mean temperature; *Integrated Roadside Vegetation Management* (National Cooperative Highway Research Program (NCHRP), 2005); and similar state policies, reports, and interviews
Note: Cycles is inclusive of mowback for all data shown in **Table 1**.
[1] NCHRP survey data is used as a baseline for all annual mowing data. However, where updated policies or information on service levels was able to be obtained the information in **Table 1** was updated to reflect the most current information available.
[2] Pennsylvania Department of Transportation targets 50 percent annual mowback but allows for 100 percent mowback based on local conditions; 75 percent annual mowback was used to take into account both factors.
[3] Similar State Average represents the average of only those states for which information was available.

As shown in **Table 6-1,** six of eight states for which annual cycle information was available reported three annual mowing cycles while Illinois reported two and West Virginia reported four.[45] Based on comparison to similar states it is reasonable to determine that ODOT could generally reduce its mowing to a three-cycle standard while maintaining an acceptable roadway condition. In contrast, six of nine states for which mowback information was available reported providing a level of service consistent with ODOT's once annual mowback. However, Kansas, Michigan, and Pennsylvania all target less than a full annual mowback by rotating the mowback area so that a portion of the roadway receives a full mowback in any given year but ideally never the full roadway. Based on comparison to these similar states, it is reasonable to determine that

[45] Pennsylvania has been included with states that have three annual mowing cycles given that local conditions could dictate use of a full mowback cycle which would bring the total number of mowing cycles to three annually.

ODOT could seek to pilot a biennial mowback strategy where 50 percent of the roadway receives a full mowback each year.

Balanced Integrated Vegetation Management (IVM) Analysis

In addition to the tactical reduction of traditional mechanical mowing, ODOT could also seek to employ a more balanced IVM approach which has already been piloted in some ODOT districts as well as in other states.

Purdue University, in conjunction with the Indiana Department of Transportation has identified the opportunity for cost savings associated with the targeted use of plant growth regulator (PGR) in lieu of mechanical mowing. For example, a study titled *Integrated Vegetation Management for Indiana Roadsides* (Lowe, Herold, and Kraushar, 2011) was presented at the 2011 Purdue Road School conference. The case study found that the use of PGR, in combination with seed head suppressant herbicides, was safer, faster, and cheaper than mechanical mowing and could be a replacement for some mowing cycles. The case study identified the application of PGR and selective herbicide to be approximately 43 percent less expensive than traditional mechanical mowing; PGR and selective herbicides were identified as costing nearly $28 less per mile which calculates to nearly $23 less per acre.[46]

Furthermore, the Missouri Department of Transportation identified a reduction of two mechanical mowing cycles annually when employing PGR. In this analysis, PGR was identified as approximately 63 percent less expensive, nearly $26 less on a cost per acre basis.[47]

ODOT District 5 has employed PGR in lieu of some mowing activities and was identified by central office management as the most advanced district in performing these activities. **Table 6-2** shows ODOT's District 5 PGR spraying cost per acre for the last five complete years as compared to the District 5 and ODOT-wide crew mowing cost per acre, also for the last five complete years.

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[46] The study calculated the per mile mowing cost to be $64.32 per mile versus a PGR / selective herbicide cost of $36.67 per mile. Based on the study area, a mowing cost was calculated at $53.07 per acre versus a PGR selective herbicide cost of $30.26 per acre.

[47] MODOT data, used in a 2007 study by ODOT, identified a mowing cost of $40.62 per acre and a spraying cost of $14.83 per acre. Total cost savings were identified at approximately $2.2 million for a reduction of approximately 66,400 acres of mowing.

Table 6-2: District 5 PGR Cost Comparison (CY 2007 – CY 2011)

District 5 Comparison		ODOT-Wide Comparison	
Crew Mowing Cost per Acre	**$65.28**	**Crew Mowing Cost per Acre**	**$47.19**
PGR Cost per Acre [1]	**$34.65**	**PGR Cost per Acre** [1]	**$34.65**
Difference	**($30.64)**	**Difference**	**($12.55)**
% Difference	**(46.9%)**	**% Difference**	**(26.6%)**

Source: ODOT Transportation Management System (TMS)
Note: PGR acres were calculated based on 20 gallons of mixed herbicidal spray per acre; an amount used by ODOT in a previous PGR analysis.
[1] PGR cost per acre is inclusive of all labor, equipment, and PGR and herbicidal spray associated with each work accomplishment for District 5 that included the use of PGR.

As shown in **Table 6-2**, District 5 PGR spraying cost per acre has been about 47 percent less than mowing cost per acre over the last five years. **Table 6-2** also shows that although the District 5 PGR spraying cost per acre has been closer to the cost of ODOT-wide mowing, it is still about 27 percent less than the cost of mowing. This analysis of District 5 PGR cost illustrates the potential for cost savings associated with the increased adoption of the use of PGR and herbicidal spraying.

Though cost-effective, there are training needs, equipment needs, and practical application constraints associated with the widespread use of PGR. For example, the ODOT analysis identified equipment needs costing approximately $4,000 per vehicle (the equipment is attached to an existing ODOT dump truck platform). Based on the most conservative savings identified in **Table 6-2** ODOT would need to spray approximately 320 acres per up-fitted vehicle to recover the cost of the equipment upgrades. Over the last five years, ODOT crews have mown an average of approximately 290,000 acres per year. PGR spraying also requires ODOT employees to be trained and licensed in the application of these herbicides. Although there are examples of District 5 providing trainings to other ODOT districts, there would need to be a concerted effort to fully train all appropriate district personnel which could delay implementation of this technique. Finally, PGR is best suited for application to established grasses so any new construction areas would need to be given up to five years to fully establish growth prior to full PGR treatment. In addition, treatment areas may also need to be rotated annually to ensure that the seed head suppression effects of PGR do not cause lasting damage to the regenerating ability of desirable roadside grasses. Due to the combination of the initial startup cost, training needs, and the need to target and rotate spraying activities on established grasses, the gradual implementation of this strategy is likely best suited for overall efficiency and effectiveness.

Conclusion

ODOT should reduce its base expectation of annual mechanical mowing commensurate with service levels provided by similar states (i.e., three annual mowing cycles). Furthermore, ODOT should employ leading practice strategies such as plant growth regulator (PGR) and herbicidal spraying that allows for reduced mowing need and cost but provides a level of vegetation management sufficient to ensure roadway safety. In addition to a more balanced integrated vegetation management (IVM) strategy, ODOT could also pilot a reduced mowback strategy already employed by some similar states. This combination of displacing mechanical mowing through targeted spraying and strategic reduction in intensity of service provision could result in an additional full mowing cycle reduction.[48]

Recommendation 6.1: ODOT should modify its policy and practice to reduce mowing to a maximum of three cycles per year consistent with practices employed by other similar states. Furthermore, ODOT should employ additional strategies to reduce its mowing cycles to two cycles wherever possible while maintaining an acceptable level of roadway safety. To achieve two cycles ODOT should consider employing a mix of the following strategies:

- **Evaluate the current transitional and undisturbed zones to identify areas where no mow strategies can be expanded;**
- **Expand the use of plant growth regulator and herbicidal spraying where cost-effective relative to mechanical mowing; and**
- **Reduce the "mowback" to a level that provides for safety and zone recovery consistent with practices employed by leading similar states.**

Financial Impact: 6.1 If ODOT were to reduce mowing to a standard of 3 cycles or less the Department could save approximately **$4.4 million** per year. If ODOT were to implement additional mowing strategies enabling a reduction of mowing to 2 cycles the Department could save up to a cumulative total of approximately **$7.4 million** per year (see **Table 6-3** for full estimates of financial impact).[49]

Table 6-3 shows the estimated financial impact associated with the reduction of one and two mowing cycles from the current service delivery baseline.

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[48] Although some studies and analysis identify the potential for a reduction of up to two mowing cycles through the implementation of PGR and herbicidal spray the full potential will need to be assessed by ODOT taking into account local conditions. Therefore, for the purpose of this analysis, PGR and herbicidal spraying will be assumed to be a one-to-one offset with traditional mechanical mowing.

[49] Savings by transitioning to two mowing cycles per year are contingent upon the extent to which ODOT can strategically lessen the intensity of the current mowing program versus the extent to which PGR is used to offset the need for traditional mechanical mowing.

Table 6-3: Cycle Reduction Financial Implication

Reduction to 3 Cycles for all Crew Two and Four-Lane Mowing			
	2011	**2010**	**Two-Year Average**
Total Annual Financial Impact	**$4,552,403.49**	**$4,197,809.11**	**$4,375,106.30**
Equipment & Materials Impact	$1,243,929.42	$1,093,564.40	$1,168,746.91
Percent Equipment & Materials	27.3%	26.1%	26.7%
Labor Impact	$3,308,474.07	$3,104,244.72	$3,206,359.39
Percent Labor	72.7%	73.9%	73.3%
Reduction to 2 Cycles for all Crew Two and Four-Lane Mowing [1]			
	2011	**2010**	**Two-Year Average**
Total Annual Financial Impact	**$7,600,348.90**	**$7,196,318.61**	**$7,398,333.76**
Equipment & Materials Impact	$2,077,686.33	$1,880,095.05	$1,978,890.69
Percent Equipment & Materials	27.3%	26.1%	26.7%
Labor Impact	$5,522,662.58	$5,316,223.55	$5,419,443.06
Percent Labor	72.7%	73.9%	73.3%

Source: ODOT TMS data
Note: Although labor savings associated with a reduction in mowing effort would be realized primarily through the reallocation of labor to center-line activities, additional savings could be achieved through the reduction of overtime. ODOT has spent an average of approximately $41,000 on overtime for crew two-lane and four-lane mowing over the last two years. ODOT should structure service delivery reductions such that they eliminate the need for all mechanical mowing overtime.
[1] Savings is shown as cumulative so the portion associated with a reduction to three cycles is included in the savings associated with a further reduction to two cycles.

As shown in **Table 6-3**, ODOT could save approximately **$4.4 million** annually by reducing the standard mowing approach to a maximum three cycle service delivery model. Further savings of up to a cumulative total of approximately **$7.4 million** could be achieved by further reducing mowing to a maximum two cycle service delivery model.[50]

[50] Based on historical cost and work accomplishments (see **Table 3**) it is estimated that ODOT could implement a spraying program that is approximately 27 percent less costly than traditional mechanical mowing. A straight reduction from three to two mowing cycles would yield savings of $3,023,277; 27 percent, or the baseline with full offsetting of PGR and herbicidal spraying for mechanical mowing, is equal to $816,271. As previously noted, full annual offsetting is not likely to be the case given the need to rotate PGR and herbicidal spray application; this factor essentially doubles the offsetting baseline to approximately $1.6 million annually.

7. COST/BENEFIT – EXTERNAL AUDIT

Savings: N/A

Finding 7.1: ODOT lacks formal interpretation of federal guidelines regarding compliance audits of federal programs.

Recommendation 7.1: ODOT management should collaborate with the Office of External Audits (OEA) to document a formal interpretation of Federal Highway Administration (FHWA) guidelines.

Financial Impact 7.1: N/A

Savings: N/A

Finding 7.2: ODOT does not have an overall risk assessment strategy to allow it to optimize resource allocation across all audit areas.

Recommendation 7.2: OEA should expand the current risk assessment evaluation to be comprehensive across all audit areas to optimize the allocation of resources based on total demand.

Financial Impact 7.2: N/A

Savings: N/A

Finding 7.3: ODOT lacks sufficient management reporting to relays key metrics of the OEA Audit Plan.

Recommendation 7.3: OEA should provide management monthly reports that are clear, concise and relevant to managing the operations of the department.

Financial Impact 7.3: N/A

COST/BENEFIT - EXTERNAL AUDIT

Background

The Office of External Audits (OEA) is charged with reviewing and auditing work performed by external contractors as well as conducting compliance reviews and oversight of federal funds. These tasks are done pursuant to federal laws and regulations relating to the administration of federal highway funding. Such laws and regulations include:

- U.S. Code § 106(g) relating to program oversight including sub-recipients.
- 23 CFR § 172 – relating to administration of engineering and design related contracts.
- 49 CFR § 18.37 relating to sub grants and § 18.40 relating to monitoring and reporting.
- Part 31 of the Federal Acquisition Regulations (FAR) relating to federal contract cost principles and procedures.
- OMB Circulars A-87 relating to cost principles and A-133 relating to responsibilities of pass-through entities.

The individual areas of risk that OEA conducts reviews or audits include the following:

- **Local Public Agencies (LPAs) –**This risk area focuses on county engineers and municipal public service organizations that administer project funds on behalf of ODOT. OEA expends 24 percent of their efforts on this task. In state fiscal year (FY) 2010-2011 and FY 2011-2012 recoveries of $4.7 million were found by OEA in this area.
- **Transit Authorities –**This risk area focuses on local public transit authorities, primary buses system, auditing them for compliance with federal regulations. OEA expends 22.5 percent of their efforts on this task. In FY's 2010-2012 no significant financial findings were discovered by OEA in this area.
- **Metropolitan Planning Organizations (MPOs) –**This risk area focuses on quasi-governmental planning agencies that coordinate projects between regional governmental entities. OEA expends 22.5 percent of their efforts on this task. In FY's 2010-2012 findings of $144,000 were found in this area.
- **Architectural and Engineering consultants (A/E) –**This risk area focuses on overhead and direct labor effort of architecture and engineering (A/E) firms and subcontractors. OEA expends 24 percent of their efforts on this task. There have been no significant findings in this area due to the proactive nature of OEA's audits.
- **Railroads –**This risk area focuses on ODOT projects that affect a railroad right-of-way. OEA expends 7 percent of their efforts on this task. In FY's 2010-2012 cost recoveries of $32,000 were found in this area.
- **Utilities –** This risk area focuses on ODOT projects on, or affecting the right-of-way. In 2013 there have been no OEA efforts expended on this task. In FY's 2010-2012, $34,000 in cost recoveries was made by OEA in this area.

Methodology and Analysis

Members of OPT, ODOT and OEA met on several occasions to develop the scope and objectives of this engagement. Through these collaborative sessions, the following audit objectives were identified:

- Is there a clear method of determining the workload demand of OEA?
- Does OEA execute an effective risk analysis that prioritizes areas relative to risk and allows for proper resourcing?
- Are performance measurements communicated effectively to ODOT management?

As part of this analysis, OPT interviewed FHWA management, peer state audit executives, and ODOT executives regarding what efforts are required to be compliant with relevant laws and regulations. Interviews with ODOT management indicate that they expect OEA to focus on functions that are legally required and provide compliance in an efficient manner.

Is there a clear method of determining the workload demand of OEA?

OEA's auditing work is done as a result of the Stewardship and Oversight Agreement (SOA) between the FHWA and ODOT. The SOA requires ODOT to utilize a balanced approach to ensure federal-aid funds are used efficiently and effectively in Ohio. This approach includes the FHWA Financial Integrity Review and Evaluation (FIRE) program to minimize fraud waste and abuse. ODOT conducts financial audits and limited scope reviews of external agencies receiving federal-aid funds to ensure the proper use of these funds are used properly and that federal and state requirements are met.

In interviews with peers and with leadership, OPT found variance in staffing, audit approaches, and overall interpretation of meaning of "oversight." This lack of clarity presents challenges to defining and quantifying workload levels or workload demand.

Does OEA execute an effective risk analysis that prioritizes areas relative to risk and allows for proper sourcing?

As required by federal law and regulation, ODOT is responsible for supervising, monitoring and providing oversight of federal funding in the areas previously mentioned. The oversight portion of this responsibility is accomplished by audits and reviews completed by OEA. No overall federal standards exist for a comprehensive risk analysis across the universe of work required by federal funding. The FHWA has published proposed rules[51] but had not finalized them yet. The proposed rules allow ODOT to use risk assessments in the allocation of audit resources for architecture and engineering consultant costs only. The remaining areas for which ODOT is

[51] Federal Register Vol.77, No.171, September 4, 2012 p.53813-53814

responsible for providing oversight are subject to interpretation based on the perception of risk and for which FHWA fails to provide specific guidance. FHWA has deferred guidance to AASHTO, an organization of state transportation officials that advocates transportation-related policies and provides technical support to states in the execution of administrative and oversight efforts. OEA has been considered a leader in AASHTO efforts.

OPT interviewed audit leadership in the peer states of Wisconsin, Idaho, Michigan, Iowa and Missouri. Wisconsin, Michigan and Missouri reported that, similar to Ohio, their audit selection process is based on subjective data. Two states, Idaho and Michigan report that they use threshold limits and risk ranking processes to select projects and consultants for audits. These varying degrees of risk assessment among peers and the FHWA's proposed risk assessment guidelines demonstrates that there is no clear standard from which to create a comprehensive risk assessment plan.

Historically, OEA has not operated under a formal risk-assessment plan. OEA has recently completed risk assessments within the six individual oversight areas. This plan, however, does not prioritize resources amongst the risk areas. This plan also cannot offer insight as to whether current resources are sufficient to cover annual workload.

Are performance measurements communicated effectively to ODOT management?

OPT interviewed audit leadership at the peer states of Wisconsin, Idaho, Michigan, Iowa and Missouri regarding monthly reporting of results. Leadership in three states, Iowa, Texas and Missouri, stated that they do not prepare monthly reports on external audit activities, although Iowa is considering reinstating a monthly reporting process. The remaining peers indicated varying degrees of regularly scheduled results measurement.

OPT reviewed the existing monthly report package sent by OEA to ODOT management. Analysis indicates that the report falls short with respect to readability and providing useful and actionable information on the part of management. Best practice in the audit profession indicates that an organization's Chief Audit Executive (CAE) should regularly report on the department's performance relative to an annual plan[52]. The OEA monthly reporting process does not meet the needs of ODOT management with respect to the quality of information provided. Specifically, ODOT management has indicated that it prefers qualitative information regarding priorities, results and bottom line effects of reviews and audits performed by OEA.

[52] Institute of Internal Auditors – International Standards for the Professional Practice of Internal Auditing – Performance Standard 2060 – Reporting to Senior Management.

Conclusion

OPT interviewed OEA associates and reviewed internal documentation that indicated that the current universe of potential audit projects are not systematically reviewed and ranked by overall risk to ODOT. In part, this is due to lack of leadership on the part of FHWA which forces individual states, including Ohio, to make varying interpretations with regard to priorities. ODOT does not have a systematic method to measure demand for OEA services.

The process, by which OEA selects projects, though comparable to some peer states and in compliance with subjective federal risk assessment guidelines, is not consistently governed by risk-based criteria. Consequently, OEA does not utilize a formal risk assessment for all audit areas. Projects are selected based on ODOT management's perception of risk by individual areas or risk silos. Thresholds for establishing projects priorities, as they relate to all areas of OEA, have not been set.

The existing reporting process falls short of ODOT management's stated needs. The monthly reporting of clear, concise and conclusive results is a standard in the audit industry and allows management to monitor and adapt as organizational needs arise.

Recommendation 7.1: ODOT management should collaborate with OEA to document a formalized interpretation of FHWA guidelines.

Recommendation 7.2: OEA should expand the current risk assessment evaluation to be comprehensive across all audit areas to optimize the allocation of resources based on total demand.

Recommendation 7.3: OEA should provide management monthly reports that are clear, concise and relevant to managing the operations of the department. An example of such an improvement is included in Exhibit B.

Additional Considerations

Once OEA has established a framework for comprehensive risk assessment and resource prioritization, ODOT should assess the extent to which resources are adequate to cover the identified high-demand, high-value workload. ODOT should determine if increased or decreased external audit coverage is needed. If an increase in coverage is needed and able to be supported in a data-driven manner, ODOT should weigh cost-effectiveness of internal resources vs. outsourced alternatives.

Although it appears that ODOT's internal resources are cost-competitive with outsourced alternatives, sufficient data does not exist to support a full determination of the cost benefit profile of in-house versus outsourced service delivery. While analysis of peer external audit functions has shown that there is little experience in actually contracting out this work, there should be a full ODOT-specific analysis based on the work performed, resource constraints, and desired quality of the final product.

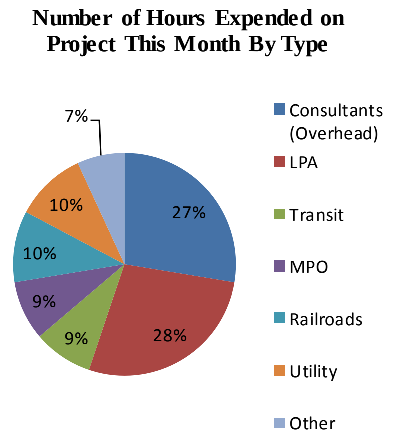
Appendix B

Exhibit B-1 is an example of a monthly dashboard. This demonstration is for illustrative purposes.

Exhbit B-1: Office of External Audits (OEA) Sample Dash Board Month, 2013

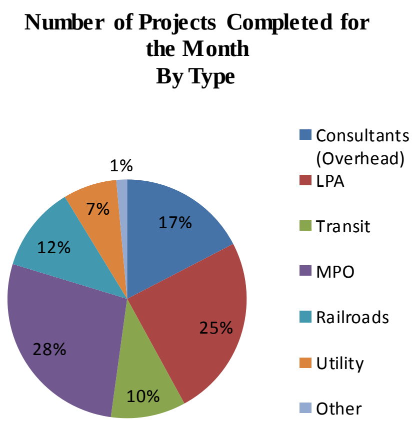
Current Month

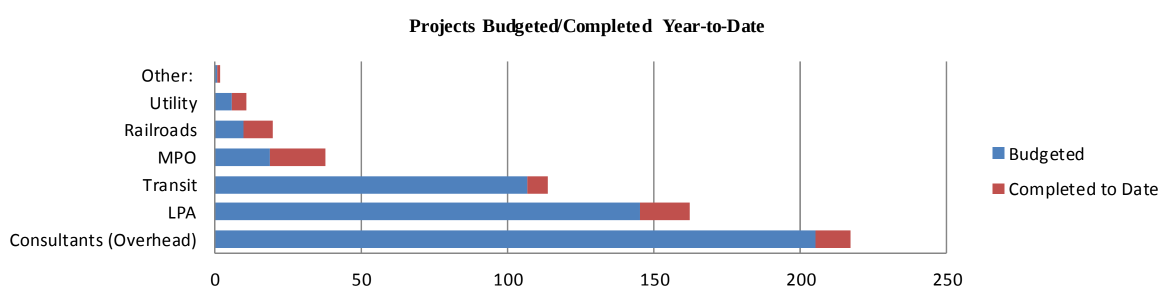
Project	Hours Expended this Month	Reviews Completed	Operations Narrative
Consultants (Overhead)	160	12	12 Consultants were reviewed this month, the average overhead reduction was X%
LPA	160	17	9 Consultants reviewed were Tier 1, 3 remaining were Tier 2
Transit	50	7	1 Transit audit found under reported income of $106K
MPO	50	19	1 Rail audit revealed $17.4K was overbilled to ODOT
Railroads	60	8	No findings this month on MPO's
Utility	60	5	
Other	40	1	
Total	**580**	**69**	



Year to Date

Project	Reviews Budgeted	Reviews Completed to Date	Administrative Notes
Consultants (Overhead)	205	12	Marc attended AASHTO training this month
LPA	145	17	Summer intern hired
Transit	107	7	
MPO	19	19	
Railroads	10	10	
Utility	6	5	
Other:	1	1	
Total	**493**	**71**	





8. REGIONS REVIEW - AERIAL ENGINEERING

***Savings:* $334,000**

Finding 8.1: The office of aerial engineering performs photogrammetric and LIDAR collections at a lower cost than the private sector consultants.

Recommendation 8.1: Establish and enforce an ODOT policy that all photogrammetric and LIDAR work must be coordinated through the Office of Aerial Engineering.

Financial Impact 8.1: By combining work currently done in-house with work currently sent to outside contractors, we estimate that ODOT could save approximately **$334,000** on an annual basis.

Finding 8.2: The cost for individual projects incurred by the Office of Aerial Engineering is not adequately tracked. Management lacks sufficient information about projects, potentially leading to inefficient use of resources.

Recommendation 8.2: ODOT Management should require the Office of Aerial Engineering to implement a robust time reporting process for all associates by project to assist in accurate reporting of time and costs. Such time recording would provide a complete and accurate cost of each project and assist in evaluating appropriate sourcing.

Financial Impact 8.2: N/A

Finding 8.3: After implementation of Recommendations 1 and 2, determine whether this function is cost-effective with outside vendors.

Recommendation 8.3: Upon completion of Recommendations 1 and 2, ODOT Management will have sufficient, reliable information to compare the cost of providing services with the Cessna Caravan with that of outside consultants. If the data collection process with the Cessna Caravan is not cost-effective as compared to outside consultants, ODOT should consider the sale of the plane.

Financial Impact 8.3: N/A

AERIAL ENGINEERING

Regions Review – Aerial Engineering: These recommendations were issued as part of the ODOT interim report dated September 19, 2012. Minor revisions were made since the interim was released in order to reflect updated information and analysis.

Background

The Ohio Performance Team (OPT) is tasked with evaluating the operations of the Ohio Department of Transportation (ODOT) Office of Aerial Engineering against industry standards and leading practices. ODOT owns and operates a Cessna Caravan acquired in FY 2004 at a cost of $1.7 million, of which $1.4 million was funded through federal sources. Subsequent modifications to the plane included LIDAR[53] and digital photography capabilities, acquired at a cost of $869,000 and $1.3 million respectively, increasing total investment in the plane to $3.9 million.[54]

Under current practice, ODOT districts have the option, but are not required, to consult with or use the services of the Office of Aerial Engineering to prepare base maps, orthophotography (photogrammetric) or digital terrain models (LIDAR) based upon data acquired with the equipment installed on the Cessna Caravan. Alternatively, ODOT Districts may use outside consultants to complete this work. ODOT Districts that use outside consultants for this work must pay for services using their own budget centers; in contrast, Districts are not charged for work performed by the Office of Aerial Engineering, which is paid from the central ODOT budget.

Under Federal Law (23 U.S.C. 306), the US Secretary of Transportation is empowered to "whenever practicable, authorize the use of photogrammetric methods in mapping and the utilization of commercial enterprise for such services." The National Highway System Designation Act amended Section 306 to require the Secretary to "issue guidance to encourage States to utilize, to the maximum extent practicable, private sector sources for all or part of surveying and mapping services for projects under this title." Neither the original or amended Section 306, nor any other Federal law or regulation, mandates the use of private sector for surveying and mapping. Guidance issued by U.S. Department of Transportation states that there is significant potential and capacity within the surveying and mapping private sector that can help State and local governments meet their needs in those areas. The guidance indicates that

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[53] **LIDAR** (**Light Detection and Ranging**) is an optical remote sensing technology that can measure the distance to, or other properties of a target by illuminating the target with light using pulses from a laser.

[54] The plane was grounded in mid-2009 for installation of digital photography capability and because of Federal Aviation Administration compliance issues. The plane reentered service during January 2011 and is now fully functional.

some states elect to wholly outsource such functions, while the remaining states either co-source or complete the function in-house.

Methodology/Analysis

Cessna Caravan Utilization Analysis

Excluding downtime for an FAA compliance issue, the Cessna Caravan has operated on average 244 hours per year since acquisition. Based on a standard work year of 2,000 hours[55], the historic actual utilization rate of the plane is 12.2 percent. The threshold criteria for non-military aircraft range from 200 to 350[56] operating hours per year. The Cessna Caravan historical average of 244 hours of operation is within this range.

Process Analysis

Discussions with industry officials from both the public and private sector indicated that use of aircraft for projects less than 85 acres in size may not be an appropriate use of technology in all instances. For example, a van-based or tripod-based LIDAR may be a more cost-effective alternative solution for smaller acreage projects. Analysis of the 2012 schedule using outside vendor rates indicates that projects of less than 85 acres in size make up 1.4 percent of the schedule, but could comprise up to 26.2 percent of total costs. Flexibility in using alternative technology such as van or tripod-based LIDAR could reduce overall cost to acquire data.

The current process for districts to request photogrammetric and LIDAR within ODOT lacks effective control and consistency. Despite the availability of the underutilized Cessna Caravan, ODOT districts are, according to department management, free to contract with outside vendors for this work. The districts pay directly for such services, while the state plane is costed through the central ODOT budget. During FY 2012 ODOT has indicated that individual districts spent $408,046 on outside contract work that could have been accomplished in-house by the Office of Aerial Engineering utilizing the Cessna Caravan asset.

Beyond direct savings available to ODOT by increasing use of the Cessna, there is additional value in using relatively higher expertise in the Office of Aerial Engineering. Staff in the ODOT regions who make decisions about using outside contractors for aerial engineering work will, in

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[55] For data comparability purposes, OPT uses the convention of 2,000 hours annual use in equipment analysis. Actual hours used varies by equipment type and other factors. In the case of commercial aviation, actual hours used annually could exceed 4,000, taking into account maintenance time. In the case of aircraft operating under VFR (visual flight rules), such as the Cessna, actual available hours could be as low as 1,000 hours annually. In practical terms, this means a likely maximum utilization rate for the Cessna, using a 2,000 hour baseline, is 50 percent. Maximum utilization of commercial aircraft under the same baseline could be 200 percent to 300 percent.

[56] North Carolina uses a 200 hour threshold for ownership, while the GAO reports that non-military federal government average is 350 hours per year.

general, have significantly less experience in both market conditions and technical capabilities. Centralizing decisions about aerial engineering services will increase the effectiveness and efficiency of mapping and related services. According to department management, this available expertise within the Office of Aerial Engineering, in the effective and efficient use of consultants and technology, is not being utilized consistently or effectively by ODOT districts. The value of the increased expertise is not readily quantifiable within the scope of the audit.

Comparison with Other States

OPT confirmed the following in communications and interviews with nearby states:

- The Indiana Department of Transportation (INDOT) indicated that aerial photography is completed with a leased plane. Furthermore, INDOT does not utilize LIDAR in their processes.[57] However, INDOT is attempting to acquire a plane, partner with another neighboring state, or hire outside vendors for such services.
- The Wisconsin Department of Transportation (WisDOT) owns their aircraft, but uses it only for photogrammetric work. WisDOT does not regularly use LIDAR and uses outside consultants when it does.
- The Kentucky Transportation Cabinet (KYTC) confirmed that they outsource LIDAR and photogrammetric work to three on-call vendors. KYTC utilizes a program manager to assign and supervise the rotation of selected vendors, quality control and deliverables.
- The Michigan Department of Transportation (MDOT) also uses outside vendors on an as needed basis and similar to KYTC uses a program manager to source and provide requested deliverables to district engineers. MDOT uses their website to bid out such projects to multiple pre-qualified vendors as needed.

Office of Aerial Engineering Budget Analysis

Discussions with ODOT management indicated that the in-house project and Transportation Management System (TMS) used to track costs on a project-by-project basis is not producing data adequate to the needs of management in making decisions about cost control and effectiveness. The Office of Aerial Engineering has not robustly required the recording of employee time by specific project in TMS. As a result, actual time data has not been available to OPT, forcing the use of estimates of time to complete projects. Our analysis of such in-house estimates indicates that the information is incomplete. Since actual costs cannot be determined, given the lack of accurate time reporting information, this analysis instead uses historical rate

[57] INDOT officials believe that LIDAR may be excessive, although it may be appropriate for large projects.

information to estimate the cost of providing the 2012 projects scheduled to be flown by Office of Aerial Engineering.

During the period of time that the Cessna was unavailable to the Office of Aerial Engineering during 2009, 2010, and early 2011, the Department contracted with outside vendors to provide digital photography and LIDAR information. The outside vendors produced photographic images and LIDAR data for the Office of Aerial Engineering to prepare base maps, digital terrain models or orthophotographs. Based on information provided to OPT by the Office of Aerial Engineering, the cost of such work ranged from $6.77 per acre for a 1,593 acre project to $322.24 per acre for a 64 acre project. OPT interviews indicated frequent lack of bidding with outside vendors or emphasis on negotiating terms, suggesting that the reported costs do not represent actual market conditions and may be inflated.

Based upon information provided to OPT by ODOT, the cost to acquire LIDAR and digital photographic information including both in-house and outsourced work utilizing the Cessna platform would have been $597,000 in FY 2012. The cost to acquire this same information based upon historical rates from outside vendors and applied to the 2012 flight schedule is estimated to be $523,516,[58] plus an additional $408,046 contracted by Districts independent of the Office of Aerial Engineering with outside vendors.[59]

Conclusions

The cost of operating the Office of Aerial Engineering through the data collection stage (i.e., flying the Cessna Caravan to capture photogrammetric and LIDAR data) is $597,000 annually. An estimate prepared by OPT of the cost to do this same work in 2012 by outside consultants based upon information provided by ODOT Office of Aerial Engineering is $523,516, plus an additional $408,046 spent on outside contractors for work that could have been accomplished in-house. The examples of Kentucky and Michigan to centralize this specialized service with a subject matter expert controlling and monitoring usage statewide leads us to conclude that significant savings could be realized by requiring ODOT districts to submit all requests for photogrammetric and LIDAR work to the Office of Aerial Engineering for sourcing. This would prevent the use of outside consultants for work that could be accomplished in-house at an incremental cost and increase the utilization rate of the Cessna Caravan asset.

[58] The cost of having all FY 2012 work done by the Office of Aerial Engineering would have been approximately 12 percent lower if it had been contracted out (the difference between $597,000 and $523,000). However, because the marginal cost of having additional work done in-house is much lower than the outside vendor contract cost, having all work done by ODOT would have resulted in a total savings of $334,000. ($523,000 + $408,000 - $597,000).

[59] OPT cannot opine as to whether all projects provided are in fact an appropriate use of the Cessna Caravan and the on-board technology, nor whether competitive bidding of a full year flight schedule would have resulted in lower rates.

During the course of our review it became apparent that cost for individual projects incurred by the Office of Aerial Engineering are not adequately tracked by the TMS system. Management of the department does not have comprehensive and accurate costs associated with completion of specific tasks or projects. This may lead to inefficient use of resources due to the reliance by management on inaccurate underlying data.

After ODOT Management has consolidated all photogrammetric and LIDAR work completed in Ohio in-house and accomplished the installation of a robust time and cost reporting system, ODOT will have sufficient data to determine whether this function is cost-effective versus outside vendors. At present, the historic Cessna Caravan utilization rate of 12.2 percent (13.8 percent utilization scheduled for 2012) is at the lower end of efficiency thresholds.[60] As a comparison, INDOT owned its Cessna, but now contracts for its aerial needs with outside vendors. Research of peer states and the federal government indicate that ownership of aircraft operating fewer than 200 to 350 hours per year may not be cost-effective.

Recommendation 8.1: Establish and enforce an ODOT policy that all photogrammetric and LIDAR work must be coordinated through the Office of Aerial Engineering. A savings of $334,562 based on FY 2012 experience is indicated by keeping this work in-house.

Recommendation 8.2: ODOT Management should require the Office of Aerial Engineering to implement a robust time reporting process for all associates by project to assist in accurate reporting of time and costs. Such time recording would provide a complete and accurate cost of each project and assist in evaluating appropriate sourcing.

Recommendation 8.3: Upon completion of Recommendations 1 and 2, ODOT Management will have sufficient, reliable information to compare the cost of providing services with the Cessna Caravan with that of outside consultants. If the data collection process with the Cessna Caravan is not cost-effective as compared to outside consultants, ODOT should consider the sale of the plane.

Financial Impact 8.1: By combining work currently done in-house with work currently sent to outside contractors, we estimate that ODOT could save **$334,562** on an annual basis.

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[60] The break-even point between contracting for outside vendor service and owning and using the Cessna Caravan varies each year according to the project mix. For example, a 100-acre mapping project could have the same cost as a 4,500-acre mapping project.

9. REGIONS REVIEW - GEOTECHNICAL ENGINEERING

***Savings:* $233,000**

Finding 9.1: The Office of Geotechnical Engineering (OGE) completes geotechnical engineering work at a lower cost than comparable work by outside consultants.

Recommendation 9.1: ODOT should consider additional resources for both the drilling and laboratory areas of OGE to reduce less cost-effective use of outside consultants. The balance between in-house resources and the use of outside consultants should be driven by the future needs of ODOT.

Financial Impact 9.1: By combining work currently done in-house with work currently sent to outside contractors, we estimate that ODOT could save approximately **$233,000** on an annual basis.

Savings: N/A

Finding 9.2: Districts hire outside consultants to complete geotechnical work, paying the cost from district budgets. The budgetary process builds such costs into the next budget cycle.

Recommendation 9.2: All work, both outside consultant completed and that executed by OGE, should be billed to the appropriate district to reflect, at the district level the actual cost of resources devoted to the specific task. This places OGE on even footing with outside consultants and modifies the behavior of districts to use the most cost-effective resource to complete a task.

Financial Impact 9.2: N/A

Savings: N/A

Finding 9.3: ODOT has no centralized process for hiring outside consultants which results in variation and inconsistency between districts as to when and why services are outsourced.

Recommendation 9.3: ODOT should consolidate the responsibility for completing in-house and district task ordered (non-consultant designed) projects that require geotechnical engineering into OGE. This will allow ODOT to track the overall cost of providing geotechnical services throughout the state and potentially allow for more cost-effective statewide or regionalized contracted services. Consultant-designed projects, both District Preservation Funds (DPF) and Central Office Funds (COF), are not affected by this recommendation since such projects already have geotechnical services built into the complete design price.

Financial Impact 9.3: N/A

Savings: N/A

Finding 9.4: OGE does not track certain tasks in a manner that would allow comparison to work completed by outside consultants, which undermines the ability to compare costs.

Recommendation 9.4:
OGE should organize the cost accounting functions to mirror that of the private sector and to track comparable tasks completed internally by the department. Tasks not completed by outside consultants such as research, quality assurance review, data management, standards and procedures administration, etc., should be segregated from costs to complete deliverable tasks.

Financial Impact: N/A

GEOTECHNICAL ENGINEERING

Regions Review – Geotechnical Engineering: These recommendations were issued as part of the ODOT interim report dated April 25, 2013. No substantive changes have been made to the recommendations.

Background

OGE is made up of three distinct areas, Geology and Exploration (Drilling), Laboratory, and Design (Engineering) sections. OGE operates with two drilling crews, a budget of $2.35 million during 2011 and 21 authorized positions, including 3 vacancies.

Funding for ODOT related geotechnical projects come from a number of different sources which include DPFs and COFs. DPFs are annual appropriations used to maintain roadways and bridges within a specific ODOT district. COFs include major funds such as new bridges, safety, geological site management, etc. If an ODOT project is designated to be designed by a consultant and geotechnical engineering services are part of the contract, then the consulting firm will usually employ a sub-consultant to execute the geotechnical engineering. This method makes up the bulk of ODOT project design and occurs on primarily large projects. Depending on the type of project, funds to perform this work will either come from DPF or COF.

Most ODOT districts have pre-arranged terms called task order contracts, with outside consultants to execute geotechnical work within their districts. Districts not wanting to spend their DPF allotment on task orders with a geotechnical consulting firm, will contact the OGE to execute the needed service via a task order. Task orders completed in-house by the OGE are not billed back to the individual district. Examples of such task orders include culvert replacements, minor bridge replacements, minor roadway projects, and emergency geohazard projects. On occasion OGE will work on larger projects with emergency or accelerated timelines.

Districts are not required to consult with OGE prior to outsourcing the work to consultants. During 2011, districts spent approximately $2.1 million on task orders with outside consultants. At various points throughout the year, geotechnical engineering work that could have been completed in-house was sent to consultants in 2011 due to lack of coordination with OGE. Task orders that cannot be completed by the OGE due to time or resource constraints are completed by consultant(s) and billed back to the appropriate district and fund.

The process used by the OGE is similar to that used by the ODOT Office of Aerial Engineering in that districts can either use the services of the department or not. Districts that use the services of OGE are not charged for the work performed while those that elect to place geotechnical work with outside consultants pay for such services directly from their budget center. In general, district budgets at ODOT are developed as a function of what was spent in previous years, which may lead to the decision by the district to outsource work to maintain budget levels for succeeding years. The unintended end result may lead to districts losing future budget allocations, or not use OGE and allow internal resources to be underutilized. Additionally, similar to the Aerial Engineering function, the cost accounting function at present does not provide sufficient flexibility to account for project specific tasks versus management tasks, making internal decision making on in-source versus out-source problematic.

Methodology

The Ohio Performance Team (OPT) has been tasked with evaluating the Office of Geotechnical Engineering (OGE) which is part of the Division of Engineering within the Ohio Department of Transportation (ODOT). OPT has evaluated the OGE practices against industry standards, as well as peer state and leading practices.

Peer State Analysis

OPT confirmed the following in communications and interviews with nearby states:

- The Michigan Department of Transportation (MDOT) has one drilling crew and associated equipment operated from a central office. Two other MDOT drilling crews are operated from regions across the state. MDOT's regions are organizationally the same as ODOT's districts. A central testing facility is located in Lansing and it is equipped to do most tests. Satellite testing facilities are located in the regions, but are less comprehensive than the Lansing facility. According to MDOT representatives, about 50 percent of geotechnical services are completed by outside vendors due to in-house capacity limitations. The process to bid a project out is similar to their process for photogrammetric services. MDOT has pre-qualified vendors and bid specifications are hung off of the MDOT website for bidding by these vendors. Low bids are generally awarded the contract.

- The geotechnical area in the Kentucky Transportation Cabinet (KYTC) is part of the Structural Design Department. This section has 30 employees. According to representatives of the KYTC, about 75 to 80 percent of geotechnical work is done in-house. Although Kentucky has three drilling crews and their own laboratory, on occasion the demand may be such that they have to go outside to get the drilling work done on a timely basis. This is typically due to an emergency situation. When Kentucky does find it necessary to go outside they have statewide contracts awarded on a two-year basis with four different contractors that are utilized on a rotating basis. Kentucky has stated to OPT that based upon their analysis, KYTC believes that the cost of performing this task in-house is significantly less than outside consultants.

- The Indiana Department of Transportation (INDOT) geotechnical area has 21 employees and has 3 divisions similar to Ohio: Field Work, Laboratory, and Engineering. INDOT bases the decision to outsource on resources and expertise constraints. Currently, INDOT has four rigs, but can operate only one due to staff shortage. When the decision is made to outsource a project, it is done as a package with all stages done by the consultant. Currently, 65 to 75 percent of state projects and 100 percent of local projects are outsourced. Consultants are hired for a period of two years from a list of pre-certified contractors with an upper dollar limit on the amount of the contract via a fixed amount purchase order. Projects are then assigned to the contractor based on individual project needs, contractor strengths and estimated cost versus remaining contract balance. INDOT has indicated to OPT that they believe the cost to complete this task in-house is less than using outside consultants.

INDOT has found that in emergency situations, completing the work in-house is a better option to avoid time lag due to contract preparation delays but it depends on the resource availability.

Budget Analysis

OPT reviewed all three areas of OGE, which includes drilling, laboratory and engineering. OGE provided OPT with 2011 production statistics for the drilling and laboratory work that was comparable to that completed by outside consultants. As part of our analysis, we excluded OGE time spent on standard setting, review of consultant work and other tasks not associated with actual drilling and laboratory deliverables. OGE was not able to provide comparable work statistics for the engineering area. A summary of this information is provided in the **Table 9-1** below.

Table 9-1: OGE vs. Outside Consultant Cost Analysis

Drilling:	**Cost**
OGE 2011 Actual Performance using Outside Consultant Rates	$755,637.75
2011 OGE Actual Cost	$629,777.47
Savings over Outside Consultants	**$125,860.28**
Laboratory:	
Total OGE 2011 Actual Performance using Outside Consultant Rates	$280,019.00
2011 OGE Actual Cost	$172,852.62
Savings over Outside Consultants	**$107,166.38**
Combined Drilling & Laboratory @ Outside Consultant Rates	$1,035,656.75
Combined In-House OGE Costs	$802,630.09
Combined Savings Over Outside Consultants - Drilling and Laboratory	**$233,026.66**
Percentage Savings	**22.5%**

Source: OGE and consultant financial information

OPT compared the work completed by the drilling and laboratory areas of OGE in 2011 and priced such work at the average rate charged by outside consultants. OPT then compared the cost of completing this same work in-house at actual OGE labor costs plus benefits and operating costs. As shown in **Table 9-1**, had the work completed by OGE during 2011 been completed by outside consultants, ODOT would have paid $1,035,657. The actual cost to complete these tasks by OGE was $802,630 including direct benefit and operating costs. Based upon this analysis, OPT concludes that in-house work completed by OGE is competitive with outside consultants. This is supported by peer state analysis completed internally by INDOT and KYTC of their cost of operations versus outside consultants.

Conclusion

Based upon our analysis, OGE completes tasks at 22.5 percent less than outside consultants. This is generally in line with similar analysis made by INDOT and KYTC of their respective operations. Similar to Aerial Engineering, the conclusion is that ODOT should consolidate the process of sourcing in-house and district ordered tasks into OGE to complete such work in the most cost-effective manner. Based upon future needs, ODOT should consider additional resources for both the drilling and laboratory areas to reduce the use of less cost-effective outside resources. Additionally, ODOT should organize the cost accounting functions to mirror that of the private sector thereby giving ODOT management cost information that is comparable to private sector bids.

Recommendation 9.1: ODOT should consider additional resources for both the drilling and laboratory areas of OGE to reduce less cost-effective use of outside consultants.

Financial Impact: OPT analysis indicates that the cost of completing comparable work by outside consultants is greater than completing the same work in-house by OGE. In 2011 ODOT districts spent $2,107,872 on task orders with outside consultants. OGE management has indicated that this work could not be completed in-house due to lack of drilling and laboratory resources. OGE completes this work at 22.5 percent less than the average 2011 consultant price. Had sufficient OGE resources been on hand in 2011 for drilling and laboratory work alone, ODOT would have spent approximately **$233,000** less (see **Table 9-1**) to accomplish this work in-house ODOT needs to consider the scope of future projects as part of the overall staffing considerations.

Recommendation 9.2: ODOT should ensure that all work, both outside consultant completed and that executed by OGE, be billed to the appropriate district to reflect, at the district level, the actual cost of resources devoted to the specific task. This places OGE on even footing with outside consultants and modifies the behavior of districts to use the most cost-effective resource to complete a task.

Financial Impact: Similar to the Office of Aerial Engineering, OPT discovered that individual districts can hire outside consultants to complete geotechnical work. The process is such that the use of outside consultants will result in the district paying for the work out of their own budget, but if OGE is used, the resource is free to the district. Additionally, districts that have traditionally used outside consultants are rewarded through the budgetary process by such costs being built into the next budget cycle reinforcing the “use it or lose it” practice. By implementing an appropriate pricing mechanism districts will be more disciplined in the use of currently “free” resources and less inclined to use outside consultants to preserve budget dollars.

Recommendation 9.3: ODOT should consolidate the responsibility for completing in-house and district task ordered (non-consultant designed) projects that require geotechnical engineering into OGE. This will allow ODOT to track the overall cost of providing geotechnical services throughout the state and potentially allow for more cost-effective statewide or regionalized contracted services. Consultant designed projects, both DPF and COF, are not affected by this recommendation since such projects already have geotechnical services built into the complete design price.

Financial Impact: Districts are not required to contact OGE before the hiring of outside consultants and are free to make individual arrangements with respect to rates with these vendors. Expertise with regard to geotechnical engineering resides within OGE as well as knowledge with respect to expected costs. The OGE resource should be utilized by districts to source the most cost-effective combination of geotechnical services for district specific projects.

Recommendation 9.4: OGE should organize the cost accounting functions to mirror that of the private sector and to track comparable tasks completed internally by the Office. Tasks not completed by outside consultants such as research, quality assurance review, data management, standards and procedures administration, etc., should be segregated from costs to complete deliverable tasks. Our recommendation is that the resulting product should give ODOT management an apples-to-apples comparison of completing a task in-house versus the cost of employing outside consultants to complete the same work.

Financial Impact: During the course of our work, OPT determined that OGE tracks only certain tasks in a manner that is comparable to work completed by outside consultants. This makes the process of comparing in-house versus outside consultant costs difficult to accomplish and may result in inefficient use of resources, particularly if work is accomplished by one set of resources more effectively.

10. REGIONS REVIEW - STRUCTURAL ENGINEERING

Savings: N/A

Finding 10.1: ODOT policy does not require districts to utilize snooper trucks in a consistent manner, opening the possibility for some bridge inventory to be either over-served or under-served.

Recommendation 10.1: Create criteria and standards for bridges requiring snooper use and an inventory of the bridges meeting these criteria, and optimize the scheduling of snooper trucks with modern logistical software. Defer any capital decisions (including the sale or rebuild) regarding a third snooper truck until the routing optimization analysis is completed.

Financial Impact 10.1: N/A

Savings: N/A

Finding 10.2: Ohio bridge inspection regulations are more restrictive than federal regulations, imposing an additional constraint on ODOT. Only a small minority of other states have codified similarly restrictive standards. Conforming Ohio standards to federal standards should not impair the safety of Ohio's bridges and, by providing Ohio's bridge inspectors with more flexibility, should actually improve inspection quality.

Recommendation 10.2: Revise Ohio law to bring Ohio's bridge inspection time-table in line with the less restrictive Federal standards, establishing a 24-month basis for bridge inspection and allowing ODOT to seek waivers to conduct 48-month inspections for qualifying bridges.

Financial Impact 10.2: N/A

STRUCTURAL ENGINEERING

Regions Review – Structural Engineering: These recommendations were issued as part of the ODOT interim report dated April 25, 2013. No substantive changes have been made to the recommendations.

Background

"Our mission is to provide ODOT districts with standards, policy, procedures, training, design resources, data and research to allow them to continually monitor and improve the quality of ODOT's bridge inventory. This support will enable them to provide safe, cost-effective, durable and smooth riding bridges for the public, along with providing bridges that meet the needs of Ohio's growing economy."

-- Structural Engineering Mission Statement

Bridge Inspections

The ODOT Administrator of the Office of Structural Engineering has responsibility "for developing and maintaining procedures and practices that provide for and promote the professional inspection of bridges including but not limited to: prepare, maintain and update a Manual of Bridge Inspection, develop and furnish inspection forms, initiate, collect, retain and report Structure Inventory and Appraisal (SI&A) data to Federal Highway Administration (FHWA) and make SI&A data available to internal and external offices and agencies."[61]

Though the Office of Structural Engineering is ultimately responsible for quality assurance for all bridges in Ohio, the responsibility for performing the inspection varies according to the highway jurisdiction of the bridge route. Much like road maintenance in Ohio, the physical inspection of bridges is handled by the 12 ODOT districts, the 88 County Engineers, or the roughly 220 municipalities. In some cases the Turnpike Authority, railroads and private owners assume inspection responsibility.

Snooper Truck Operation

The majority of bridge inspections in Ohio are accomplished without the use of heavy equipment. For a subset of bridges with access limitations, ODOT uses a specialized boom truck called a snooper to aid in inspections.

Snooper trucks feature a crane-like arm that extends under the bridge and holds a platform where inspection personnel can stand. The snooper trucks are typically utilized when the bottom of the bridge deck is inaccessible from the ground, either because of a bridge's height or span over

[61] 23 CFR 650.C

impassable terrain. Snoopers are also frequently deployed for use on "fracture critical" bridges, which are bridges without redundant supporting elements and thus require closer scrutiny from inspectors. Over the last several years, the Office of Structural Engineering has inspected 400-500 bridges per year with snooper trucks. These 400-500 bridges represent about 3 percent of the total bridges inspected by ODOT.

Current State

ODOT's Office of Structural Engineering currently owns three snooper trucks and operates them out of the central office in Franklin County. The districts are responsible for identifying bridges that require under-deck access via snooper, and central office then schedules a window of time for the trucks to visit individual districts.

Historically ODOT has owned and operated 2 snoopers, but in the wake of the 2007 collapse of the I-35W Bridge in Minneapolis the US Department of Transportation mandated a series of one-off inspections to be completed nationwide. ODOT purchased a 3rd snooper and assigned a 3rd crew to comply with this mandate. These one-time inspections are now complete, and ODOT has returned to its historical standard of a two-crew operation. With one of the snooper trucks due for an expensive overhaul in 2013, a major question for ODOT going forward is what to do with the third truck: whether to retain the truck and staff a full-time crew for it, keep the truck as a backup, or sell the truck.

Methodology

Ohio Performance Team conducted interviews with ODOT leadership, administrators of Ohio's bridge inspection program, FHWA administrators and the leadership of the peer states' bridge departments. These interviews, as well a study of state and federal regulations and practices were used to determine the current state of Ohio's bridge program and to identify potential operational improvements.

Analysis

During the course of the engagement, the Ohio Performance Team worked with ODOT's Office of Structural Engineering to identify several opportunities for improving the efficiency of their operation.

The first such opportunity pertains to ODOT's utilization and method of scheduling the snooper trucks. As mentioned previously, each of the 12 ODOT districts is responsible for identifying bridges in their territory that they would like to inspect with a snooper truck. The district then coordinates with central office to schedule a snooper truck and 2-member central office inspection crew. Central office typically completes all snooper inspections within a district before moving on to the next district.

An issue that arises under this arrangement is that the districts may apply differing judgment in choosing the bridges to be inspected via snooper, since the choice of bridges is at the district's discretion. As a result, the potential exists for some districts to over-utilize the snooper inspection program. At the same time, other districts may be left without sufficient time scheduled with the snooper truck when their bridge inventory warrants the equipment's use.

A clear, centrally established set of criteria for usage of snooper trucks could remedy the utilization conflict. From this set of standards, ODOT could compile a statewide inventory of 'snooper-bridges'[62] and generally reduce the inter-district inconsistency. The snooper truck operation would then be managed based on needs, rather than equipment availability.

The creation of a statewide snooper bridge inventory would also allow ODOT to take advantage of new routing and scheduling methods. Currently, all bridges within a district are completed before the snooper moves on to perform inspections in the next district, and the actual routing is done by hand. The creation of a static, statewide inventory of snooper-bridges would allow for two advantages in snooper-routing:

- An opportunity to route the equipment in a holistic way across the state, rather than the suboptimal situation where districts are scheduled in isolation.
- With a consistent inventory of snooper-bridges, ODOT could employ a piece of modern logistical software to optimize routing. Several options currently exist in the market place.

The ODOT Office of Structural Engineering must comply with 2 independent sets of regulations pertaining to bridge inspections—state law (Ohio Revised Code) and federal law (Code of Federal Regulations.)

> ORC § 5501.47 stipulates that "…inspection shall be made **annually** by a professional engineer or other qualified person under the supervision of a professional engineer, or more frequently if required by the director, in accordance with the manual of bridge inspection described in division (B) of this section." Emphasis added.
>
> Code of Federal Regulations 650.311(a) mandates a less restrictive standard: "Inspect each bridge at regular intervals not to exceed **twenty-four months**." Emphasis added.

State law requires yearly inspections while federal code requires an inspection at least once per 24 months. Since the state regulation is the more restrictive threshold for compliance, ODOT's bridge inspection program completes a yearly inspection on every bridge in their jurisdiction,[63] approximately 14,500 bridges.

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[62] The inventory of snooper-bridges would include only those bridges meeting the pre-defined criteria for usage of snooper trucks.

[63] ODOT generally inspects all bridges on highways not falling within both the boundaries and jurisdiction of counties, municipalities, and other organizations. The local agencies generally conduct inspections not carried out by ODOT.

The additional inspection burden Ohio imposes on top of Federal regulations is fairly unique among states. Nationwide only a handful of states dictate an inspection timeframe less than the national standards. Among a group of peer states identified by OPT on the basis of similar bridge counts and similar square mileage, Ohio was the only state that codified into law more restrictive inspection standards than the federal requirement. Ohio's code has been in effect since September 28, 1973.

Nationally, the trend among states has actually been toward inspections less frequent than the federally mandated 24 months. The FHWA offers a waiver to extend the interval for bridge inspections up to 48 months for bridges that meet certain criteria. See **Exhibit C-1 in Appendix C** for a full description of the eligibility criteria for a waiver. Currently 17 states are taking advantage of the 48-month waivers (see **Table C-2 in Appendix C**).

Based on the experience of other states and expertise at the FHWA, relaxing Ohio's annual inspection mandate to come in line with the federal 24 month requirement will not impair the safety of Ohio's bridges. Providing Ohio's bridge inspectors with more flexibility should actually improve inspection quality. By removing the artificial constraint of one year, Ohio bridge inspectors will be able to deploy their resources in a more tailored approach, allocating more time to the bridges that could benefit from additional scrutiny.

Conclusion

By implementing the two recommendations of this report, ODOT Office of Structural Engineering will be able to manage their operations in a more strategic manner. Establishing an inventory of bridges requiring snooper truck use will allow ODOT to allocate snooper equipment and crews based on Ohio's statewide needs, rather than serving individual districts' requests. Revising Ohio's bridge inspection law to move in line with FHWA standards will allow ODOT to better allocate bridge inspection resources based on the characteristics of individual bridges.

Recommendation 10.1: Create a list of criteria and standards for bridges requiring snooper use, create an inventory of the bridges meeting these criteria, and optimize the scheduling of snooper trucks with modern logistical software.

Establish Criteria. Incorporating input from the individual districts, ODOT's Administrator of the Office of Structural Engineering should establish a set of criteria for bridges requiring the use of snooper trucks.

After discussing this new strategy for the management of the snooper truck operation, the Administrator of Structural Engineering produced a draft of criteria (See **Exhibit C-2**, in **Appendix C)**

The Administrator of Structural Engineering would solicit input from the 12 districts before finalizing this policy update in the "ODOT Manual of Bridge Inspection."

Create Inventory. From this list of criteria, identify and create an inventory of all Ohio bridges requiring the use of a snooper truck. This completed snooper-bridge inventory will form the basis of a new centralized management plan for the snooper operation. Instead of their current role of scheduling the trucks based on districts' requests, the Administrator of Structural

Engineering will dictate the schedule of the snooper truck operations, an improvement over the current ad-hoc system of fulfilling district requests.

Optimize Routing. Using the inventory, deadlines for inspection, and other logistical inputs, an optimized statewide schedule and routing plan that minimizes the costs of snooper truck operation could be implemented

Sub-recommendation**: Because the requisite data for a logistical and routing analysis is not yet in place, the Office of Structural Engineering should defer any capital decisions (including the sale or rebuild) regarding the third snooper truck until the routing optimization analysis is completed in phase two of OPT's engagement with ODOT**.

Recommendation 10.2: Revise the language of the Ohio Revised Code section 5501 to bring Ohio's bridge inspection time-table in line with the less restrictive Federal standards. The legal requirement for bridge inspection frequency would move from an annual basis to a 24-month basis.

Updating this regulation will bring Ohio in line with its peer states and will remove an artificial constraint on ODOT's bridge inspection operations. Bridge inspectors at ODOT will then be able to more efficiently allocate their resources to bridges requiring more scrutiny, and they will also have the ability to reduce operational costs. Additionally, revising ORC will give ODOT's administration the option of seeking a federal waiver, where appropriate, to allow them to conduct 48-month inspections for qualifying bridges.

Appendix C

Table C-1 compares the bridge inventory in Ohio to the bridge inventory of peer states.

Table C-1: Bridge Inventory of Ohio and Peers

State	Bridge Count	Area of State (Square Miles)	State Law Mandates more frequent inspections than Fed Code?	DOT Policy Identifies certain inspections more frequently than Fed Code?	48 Month Waivers in Place
Ohio	27,403	44,825	Yes	Yes	No
Illinois	26,436	57,914	No	Yes	Yes
Iowa	24,537	56,271	No	Yes	No
Missouri	24,286	69,704	No	Yes	No
Oklahoma	23,730	69,899	No	Yes	Yes
Pennsylvania	22,320	46,056	No	Yes	No
Virginia	13,523	42,774	No	Yes	No

Source: FHWA National Bridge Inventory; Conversations with state DOT bridge administrators

Exhibit C-1 – National Bridge Inspection Standards (NBIS) Technical Advisory 5140.21

1. Varying the Frequency of Routine Inspection. The intent of this NBIS revision is to maintain a 2-year interval as the normal inspection frequency for routine inspection. However, the revised rule includes provisions for adjusting the frequency of routine inspection for certain types or groups of bridges to better conform with their inspection needs. States must identify bridges which require monitoring at intervals less than 2 years and increase the inspection frequency for these bridges as needed to assure adequate monitoring. States have the option either to continue inspecting the remaining bridges at least once every 2 years or to develop an alternative inspection program which specifies bridges that may be inspected at intervals longer than 2 years. While the NBIS does not specify a maximum interval between routine inspections, intervals should not exceed 4 years. Criteria used for selecting bridges that will have inspection intervals exceeding 2 years must be approved by the FHWA.

    (1) The following list is intended as a guide for identifying classes of bridges that, in general, would not be considered for routine inspection at intervals longer than 2 years. This list is also appropriate for identifying bridges that are candidates for routine inspection at intervals more frequent than every 2 years.

    - (a) Bridges with any condition rating of 5 or less.
    - (b) Bridges that have inventory ratings less than the State's legal load.
    - (c) Structures with spans greater than 100' in length.
    - (d) Structures without load path redundancy.
    - (e) Structures that are very susceptible to vehicular damage, e.g., structures with vertical over or under-clearances less than 14'-0", narrow thru or pony trusses.
    - (f) Uncommon or unusual designs or designs where there is little performance history, such as segmental, cable stayed, etc.

    (2) A new or newly rehabilitated bridge should not be considered for inspection intervals longer than 2 years until it has received an inventory inspection and an in-depth

inspection 1 or 2 years later. No bridge should be considered for inspection intervals longer than 2 years unless the bridge has received an in-depth inspection and this inspection revealed no major deficiencies.

(3) The interval established for routine inspections should be evaluated and, if necessary, adjusted after each inspection.

(4) Regardless of the frequency selected for routine inspection, individual bridge members may require differing types and frequency of inspection (e.g., fracture critical members, distressed members and underwater members). The requirements for these special inspections are discussed under paragraph 5b. In addition, any structure that has been subjected to an earthquake, a major flood, or any other potentially damaging event should immediately receive a damage inspection.

(5) Proposed inspection programs that call for routine inspection at intervals longer than 2 years must be approved by the FHWA Regional Administrator in consultation with the Washington Headquarters office. The State's criteria for determining frequency of inspection exceeding 2 years must envelop the criteria of all jurisdictions within the State, i.e., the FHWA will not separately approve a jurisdiction's criteria that allows longer intervals between inspections than the State's criteria allows.

(6) Local governments within the State that want to increase the 2-year inspection interval must submit their programs for FHWA approval through the State. This requirement is necessary since the State is responsible for maintaining and ensuring the adequacy of NBI data on all bridges within its borders that are subject to the NBIS. Federal agencies should submit their proposals for increasing the 2-year inspection interval through the States to the FHWA Washington Headquarters. The FHWA will send approvals of acceptable Federal agency proposals directly to the Federal agencies and copies will be distributed through normal FHWA channels to affected States.

(7) Submissions to the FHWA for increased inspection intervals must contain the following information as a minimum.

(a) The criteria used in establishing the interval between inspections. The criteria developed for establishing the interval between inspections, if greater than 2 years, shall include the following:

1 Structure type and description.
2 Structure age.
3 Structure load rating.
4 Structure condition and appraisal ratings.
5Volume of traffic carried.
6 ADTT.
7 Major maintenance or structural repairs performed within the last 2 years.
8 An assessment of the frequency and degree of overload that is anticipated on the structure.

(b) A discussion of failure experience, maintenance history, and latest inspection findings for the group of structures identified.

(c) The proposed inspection interval.

Table C-2 shows the date of approval for states with a 48-month waiver in place.

Table C-2: States with waivers to inspect bridges at a 48-month frequency

State	Waiver Approval Date
South Dakota	May 6, 1994
Montana	March 8, 1994
New Mexico	April 14, 1994
Arkansas	July 8, 1994
North Dakota	February 6, 1995
Arizona	July 24, 1995
Texas	August 7, 1995
Illinois	August 31, 1995
Mississippi	March 20, 1997
Colorado	June 30, 1997
Oklahoma	March 24, 1998
Washington State	April 22, 1998
Connecticut	June 19, 1998
West Virginia	June 15, 1999
Kentucky	May 1, 2001
FHWA Federal Lands	March 5, 2003
Connecticut (update)	May 10, 2005
California	January 31, 2006
Kentucky (rescinded)	February 28, 2008
Minnesota	September 13, 2010
Mississippi (update)	October 26, 2010

Source: FHWA "Four Year Bridge Inspection Approval List"

Exhibit C-2 – Administrator of Structural Engineering's draft of criteria:

Criteria:

- Bridges with span lengths greater than 200 not having permanent inspection access
- Fracture critical member
- Fatigue related details (E and E') with high ADTT and without access from below
- Curved bridges subject to out-of plane bending
- Structures in a General Appraisal less than 5, poor condition, with no access from a bucket truck or ladder
- Bridges with unusual or complex features (pin and hangers)
- Complex bridges (suspension, cable stay)
- Concrete segmental box bridge
- Steel box bridges
- Bridges greater than 35 feet in height with no access from below
- Bridges greater than 10 feet in height over water

VII. AUDIT OBJECTIVES OVERVIEW

AOS and ODOT signed a letter of engagement effective September 26, 2011. This letter of engagement included three scope areas which are outlined below. Based on these initial scope areas AOS engaged in supplemental planning activities to develop detailed audit objectives for comprehensive analysis. These detailed audit objectives are listed below as are references to recommendations associated with the objectives.

Scope Area A: Regions Review - Evaluate ODOT's regional and headquarters operations to identify opportunities to improve operational effectiveness and efficiency across the regions. This review will include, but not be limited to, a review of opportunities for overhead reduction.

- **Objective 1: Engineering (See R8.1 through R8.3, R9.1 through R9.4, and R10.1 and R10.2)**
  - Is ODOT's aerial engineering function cost competitive with private industry standards? What opportunities for greater economy and efficiency exist within the current operating model?
  - Is ODOT's geotechnical engineering function cost competitive with private industry standards? What opportunities for greater economy and efficiency exist within the current operating model?
  - Is ODOT's structural engineering function cost competitive with private industry standards? What opportunities for greater economy and efficiency exist within the current operating model?

In addition, AOS included a management comment in **Section IV**: **Comment on Organizational Realignment** with regard to thematic issues identified across the scope areas and objectives performed related to the Central Office and district structure.

Scope Area B: Fleet Management - Evaluate fleet management practices against industry standards and leading practices. One specific area for analysis will be reviewing the applicability of alternative fuel strategies.

- **Objective 1: Fleet Utilization (See R1.1 through R1.12)**
  - Is ODOT's vehicle and equipment utilization efficient? If not, what are the causes and what opportunities does ODOT have to gain greater operational efficiency and management effectiveness in this area?

- **Objective 2: How operationally efficient and cost-effective are ODOT's fleet operation and management functions?** (**R2.1 through R2.3**)
  - Is current vehicle maintenance staffing appropriate for the number of vehicles being maintained and the types of maintenance activities performed? (**R2.3**)
  - Are there alternatives to ODOT's vehicle maintenance and operating model that provide opportunities for greater operational economy, efficiency and effectiveness?
  - Are there alternatives to ODOT's pool car operating model that provide opportunities for greater operational economy, efficiency and effectiveness?

- **Objective 3: Biodiesel Cost Analysis (See R3.1 and R3.2)**
  - Is ODOT's use of blended biodiesel in lieu of traditional diesel financially cost-effective? If not, what financial opportunity does elimination of the use of blended biodiesel afford ODOT?

- **Objective 4: Compressed Natural Gas Alternative Fuel Vehicles Financial Analysis (See R4.1)**
  - Do alternative fuels provide opportunities for cost savings relative to the use of traditional fuels?
  - What opportunities does ODOT have to utilize alternative fuels in its current operational state; do these opportunities provide operational efficiencies or cost savings?

Scope Area C: Business Area Cost/Benefit Analysis - Analyze key ODOT business areas to determine if the services provided are required and, if so, that they are delivered in the most cost-effective manner. Photogrammetry is one example of a key business area for review.

- **Objective 1: Rest Areas (See R5.1-5 & 5.2)**
  - Are there reasonable alternative service providers for rest areas in Ohio? If so what opportunities for increased operational efficiency do these alternative service providers offer ODOT
- **Objective 2: Vegetation Management (See R6.1)**
  - How does ODOT's in-house vegetation management work performed compare to ODOT's policy and the policies and practices of other similar states or industry standards? What efficiency opportunity does balanced integrated vegetation management offer ODOT relative to the current state?
- **Objective 3: External Audit (See R7.1-7.3)**
  - Is there a clear method of determining the workload demand of OEA?
  - Does OEA execute an effective risk analysis that prioritizes areas relative to risk and allows for proper resourcing?
  - Are performance measurements communicated effectively to ODOT management?
- **Objective 3: Dump Truck Procurement (Issued as a verbal recommendation)**
  - Is ODOT dump truck procurement model efficient and effective in meeting the needs of the organization to carry out the core service of snow and ice control? What opportunities for improvement to efficiency exist in the current dump truck procurement process?

VIII. ACRONYMS

AF – Automotive Fleet
AOS – Auditor of State
BEP – Business Enterprise Program
BLS – Bureau of Labor and Statistics
CFR – Code of Federal Regulations
CNG – Compressed Natural Gas
COF – Central Office Funds
CPM – Cost per Mile
CRP – Community Rehabilitation Program
CY – Calendar Year
CYTD – Calendar Year to Date
DAS – Department of Administrative Services
DOE – Department of Energy
DPF – District Preservation Funds
FHWA – Federal Highway Administration
FTE – Full Time Employee
FY – Fiscal Year
GAGAS – Generally Accepted Government Auditing Standards
IVM – Integrated Vegetation Management
KYTC – Kentucky Transportation Cabinet
LIDAR – Light Detection and Ranging
MDOT – Michigan Department of Transportation
MOU – Memorandum of Understanding
NADA – National Auto Dealers Association
NBIS – National Bridge Inspection Standards
NCHRP – National Cooperate Highway Research Program
NGV – Natural Gas Vehicle
NOAA – National Oceanic and Atmospheric Administration
OAC – Ohio Administrative Code
ODOT – Ohio Department of Transportation
OEA – Office of External Audit
OEM – Office of Equipment Management
OEM – Original Equipment Manufacturer
OGE – Office of Geotechnical Engineering
OPT – Ohio Performance Team
ORC – Ohio Revised Code
P&E – Planning and Engineering Division
PGR – Plant Growth Regulator
PID – Project ID
SI&A – Structure Inventory and Appraisal
SFY – State Fiscal Year
TMS – Transportation Management System
USDA – United States Department of Agriculture

IX. CLIENT 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

June 26, 2013

David Yost
Auditor of State
88 East Broad Street, 5th Floor
Columbus, Ohio 43215

Dear Auditor Yost:

With the recent completion of your performance report of our agency, the Ohio Department of Transportation (ODOT) would like to thank you and your staff for your efforts and recommendations for improving our operations.

ODOT is actively examining its processes at all levels of activity. The department is currently looking at its fleet management for constructive ways to reduce inventory and maintenance costs while still providing top quality service to our customers. ODOT welcomes any and all input we receive for making the department the best and most efficient organization it can be.

Again, your time and diligence on behalf of the state has been most appreciated.

Respectfully,

Jerry Wray
Director

JW:rp

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
JUNE 27, 2013

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