



A REPORT
TO THE
ARIZONA LEGISLATURE

Performance Audit Division

Performance Audit

Arizona Department of Transportation—

Highway Maintenance

JUNE • 2007
REPORT NO. 07-03



Debra K. Davenport
Auditor General

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Audit Staff

Melanie M. Chesney, Director

Shan Hays, Manager and Contact Person

Brent Nelson, Team Leader

Brian Miele

Jay Rasband

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DEBRA K. DAVENPORT, CPA
AUDITOR GENERAL

STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

WILLIAM THOMSON
DEPUTY AUDITOR GENERAL

June 5, 2007

Members of the Arizona Legislature

The Honorable Janet Napolitano, Governor

Victor Mendez, Director
Arizona Department of Transportation

Transmitted herewith is a report of the Auditor General, A Performance Audit of the Arizona Department of Transportation—Highway Maintenance. This report is in response to a May 22, 2006, resolution of the Joint Legislative Audit Committee. The performance audit was conducted as part of the sunset review process prescribed in Arizona Revised Statutes §41-2951 et seq. I am also transmitting with this report a copy of the Report Highlights for this audit to provide a quick summary for your convenience.

As outlined in its response, the Arizona Department of Transportation agrees with all of the findings and plans to implement all of the recommendations.

My staff and I will be pleased to discuss or clarify items in the report.

This report will be released to the public on June 6, 2007.

Sincerely,

Debbie Davenport
Auditor General

Enclosure

SUMMARY

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Transportation (ADOT) pursuant to a May 22, 2006, resolution of the Joint Legislative Audit Committee. This is the second in a series of three reports and was conducted as part of the sunset review process prescribed in Arizona Revised Statutes (A.R.S.) §41-2951 et seq. This audit focuses on the Intermodal Transportation Division's (Division) highway maintenance activities including how maintenance monies are spent, the overall highway pavement conditions, and how needed maintenance work is identified and planned. The first audit focused on the use of consultants to design and manage construction projects, the process for inspecting projects under construction, and audits conducted on consultant and construction contracts. The final audit report will address the 12 statutory sunset factors.

ADOT was established in 1974 to plan, develop, design, construct, maintain, and operate the State's highway transportation infrastructure for moving people and goods by surface and air throughout Arizona. The State's transportation infrastructure value exceeded \$9 billion as of June 30, 2006, and the Division had 922 employee positions assigned to highway maintenance activities. ADOT has nine districts that provide highway maintenance services within their assigned geographic areas and four groups with state-wide maintenance duties. In addition, eight employees in the Materials Group measure pavement conditions and administer pavement preservation projects done by contractors. As of December 31, 2005, Arizona's highway system included 18,503 travel lane miles, which measure roadway capacity, or more than 27,000 maintenance lane miles including ramps, passing lanes, and shoulders. For fiscal year 2007, ADOT has a total of \$124.3 million in funding for highway maintenance, and plans to spend \$103.3 million for pavement preservation.

Maintenance monies support numerous activities (see pages 11 through 17)

The Division provides various road-related and pavement maintenance. Legislative appropriations for maintenance—approximately \$118.6 million in fiscal year 2007—represent approximately 10 percent of ADOT's total highway monies, and almost 9

of 10 of these dollars are spent on nonpavement features and other costs such as employee leave, supervision, and utilities. Nonpavement features are extensive including roadside items such as highway shoulders, drainage structures, guardrails, and fences; traffic control features such as signs, signals, and pavement markings; landscaping and vegetation; and rest areas. Although the Division's maintenance crews perform most maintenance activities, division expenditures for contractor-provided maintenance have increased. Specifically, the Division spent \$17.5 million on contractor-provided maintenance in fiscal year 2006, compared to \$4.1 million in fiscal year 1997.

Expenditures for pavement preservation projects come primarily from federal and state monies made available through ADOT's *Five-Year Transportation Facilities Construction Program*. Contractors perform these projects, which usually involve replacing 1 to 3 inches of pavement or overlaying existing pavement with 1 to 3 inches of asphalt. These projects are intended to extend the life of pavement before more costly reconstruction is needed. In fiscal year 2006, ADOT estimates it spent \$77.3 million on 25 pavement preservation projects for an estimated 399 lane miles and plans to spend \$103.3 million for pavement preservation, which includes \$5.5 million for preventive maintenance, in fiscal year 2007.

ADOT also receives monies that are earmarked for highway maintenance in Maricopa County. In November 2004, Maricopa County voters approved Proposition 400, which extended the County's half-cent transportation excise tax, of which a portion is allocated to ADOT for regional landscape maintenance and litter pickup. The Division received \$5.7 million each year in fiscal years 2006 and 2007 and used these monies for landscape maintenance, litter control, and pavement sweeping.

Most Arizona pavement rated satisfactory (see pages 19 through 24)

Most road pavement in Arizona's state highway system has received satisfactory ratings, and overall ratings were higher in 2005 than in 1995.¹ Well-maintained pavement provides several benefits, including increased safety, fewer auto repair expenses, improved quality of the overall road network, and higher user comfort.² The Division evaluates pavement quality using various measures including the International Roughness Index (IRI), a nationally accepted measure of road smoothness. Arizona's roads compared favorably with contiguous states', and ratings generally showed improvement in 2005 compared to 1995. Interstate roads, which often have the highest traffic volume, received better ratings than state routes and U.S. highway roads, which have a lower percentage of high traffic volume

¹ The Division's road condition measurement focuses on pavement condition and does not address nonpavement features such as guardrails, shoulders, and drainage systems.

² Kreis, Doug, Lenahan O'Connell, and Brian Howell. *Long-Term Maintenance Needs Planning*. Lexington, KY: Kentucky Transportation Center, College of Engineering, University of Kentucky, September 2005.

segments. Finally, a consumer satisfaction survey showed that Arizona residents are generally satisfied with highway maintenance efforts, but still want improvements in all maintenance areas.

Division should improve method to determine maintenance needs and allocate maintenance dollars (see pages 25 through 35)

The Division should improve how it identifies annual maintenance needs and allocates maintenance monies to maximize the state highway system's life expectancy, operational efficiency, appearance, and safety. ADOT has received increased funding for maintenance, but because of increased associated costs and maintenance demands, the Division reported that it has reduced its ability to provide adequate highway system maintenance, such as pavement preventive maintenance activities. Highway maintenance expenditures increased 56.6 percent between fiscal years 1997 and 2006, averaging a 5.1 percent annual increase. At the same time, asphalt costs increased 171 percent, traffic volume increased by 59 percent, and travel lane miles increased by 8 percent. Division officials said the majority of the new miles were in urban areas and are therefore more costly to maintain because of heavy traffic volume and landscaping, median barriers, lighting, and other features. In addition, some maintenance crews are affected by an increased number of emergency incidents that reduce time and money available for planned maintenance because the crews must respond to the incidents and repair damaged features, such as guardrails and fences, in a timely manner.

The Division does not have integrated, systematic, state-wide processes to identify maintenance needs. The districts plan annual work based on their historical activity and current budget, not on an analysis and prioritization of everything that needs to be done. In addition, the Division has not established adequate criteria such as maintenance and inspection frequency guidelines to help districts plan needed maintenance. Further, lacking an adequate process for identifying and prioritizing state-wide needs, ADOT generally allocates maintenance funding on a historical basis rather than by documented needs. This could result in one district's inability to complete higher-priority work while another district completes lower-priority work. Further, this method does not consider roadway miles, traffic volume, population, and other factors that may affect district maintenance workload.

The Division is developing four computerized systems to help measure its maintenance needs, but these systems will not identify all needed maintenance. The Division should implement a more systematic approach for addressing maintenance needs by establishing frequency schedules, when applicable, for maintenance activities; identifying all needed maintenance state-wide; estimating monies and

resources required to perform the needed maintenance; providing a prioritization method to ensure that the most important and cost-effective maintenance is performed within resource constraints; and providing a systematic method for allocating resources to meet maintenance needs.

Other pertinent information (see pages 37 through 39)

The Division uses a combination of paid contractors, the Adopt-a-Highway program, prison labor, and in-house maintenance crews to provide litter control along the state highway system. In the greater Phoenix area, where a Maricopa County excise tax provides monies for landscape maintenance and litter pickup, the Division plans litter pickup for each roadway once a week. Most of this work is done by private contractors paid with the excise tax monies, augmented by the Adopt-a-Highway sponsor program. The Tucson and Flagstaff districts also use the Adopt-a-Highway sponsor program, but on a much smaller scale than the Phoenix area. In other districts, ADOT's maintenance crews do only spot litter pickup on a public complaint basis or when they observe debris on roadways that may pose safety hazards. The Adopt-a-Highway volunteer program supplements maintenance crew litter pickup in the rural districts.

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INTRODUCTION & BACKGROUND

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Transportation (ADOT) pursuant to a May 22, 2006, resolution of the Joint Legislative Audit Committee. This is the second in a series of three reports and was conducted as part of the sunset review process prescribed in Arizona Revised Statutes (A.R.S.) §41-2951 et seq. This audit focuses on ADOT highway maintenance activities, including how maintenance monies are spent, the overall condition of highway pavement, and how needed maintenance work is identified and planned. The first audit focused on using consultants to design and manage construction projects, the process for inspecting projects under construction, and audits conducted on consultant and construction contracts. The final audit report will address the 12 statutory sunset factors.

ADOT responsible for maintaining transportation infrastructure

ADOT was established in 1974 and is responsible for planning, developing, designing, constructing, maintaining, and operating the State's highway transportation infrastructure for moving people and goods by surface and air throughout Arizona. The State's transportation infrastructure value exceeds \$9 billion as of June 30, 2006, and ADOT's Strategic Plan notes that protecting this substantial investment for Arizona's taxpayers is of paramount importance.

The Intermodal Transportation Division (Division), one of ADOT's six divisions, is responsible for ADOT's highways program. As such, the Division provides comprehensive highway management activities, including highway design, construction, and maintenance. The Division's maintenance mission is "to maximize the life expectancy, operational efficiency, safety and appearance of the state highway system." In addition to pavement maintenance, the Division maintains other roadway features such as guardrails, shoulders, and drainage systems (see textbox). The Division's maintenance activities also include snow and ice removal, weed and litter control, and responding to accidents and other emergencies. Finally, the Division operates a traffic

The State's transportation infrastructure value exceeds \$9 billion.

Examples of roadway features ADOT maintains:

- Cattle guards
- Drainage systems
- Guardrails
- Landscaping
- Lighting
- Median barriers
- Rest areas
- Right-of-way fencing
- Shoulders
- Signage
- Striping
- Traffic signals

Table 1: Summary of Centerline Miles, Travel Lane Miles, and Maintenance Lane Miles
December 31, 1996 through December 31, 2005

<u>December 31</u>	<u>Centerline Miles</u>	<u>Travel Lane Miles</u>	<u>Maintenance Lane Miles¹</u>
1996	6,596	17,130	Not reported
1997	6,605	17,160	Not reported
1998	6,608	17,363	Not reported
1999	6,608	17,381	Not reported
2000	6,611	17,407	24,958
2001	6,651	17,554	25,423
2002	6,785	18,067	25,851
2003	6,786	18,184	26,095
2004	6,816	18,449	27,000
2005	6,800	18,503	27,568
Net increase over period reported	204	1,373	2,610
Percentage increase over period reported	3.1%	8.0%	10.5%

¹ Includes unpaved roads, which totaled 180 lane miles as of December 31, 2005.

Source: Auditor General staff analysis of information in *FHWA Highway Statistics* reports, ADOT's Highway Performance Management System, and *Annual State Highway System Logs*. Maintenance lane miles were not reported until 2000.

operations center that is intended to help maintain public safety and reduce urban congestion by monitoring roadways, providing public information, and managing traffic-related incidents state-wide.

The Division maintains an expanding state-wide road system that includes interstate highways, which have uniform design standards and cross state lines; U.S. routes, which cross state lines and whose design standards are not uniform; and state routes, which are unique to Arizona. This system comprises nearly 7,000 centerline miles, a measure that disregards the number of lanes, or more than 18,000 travel lane miles, a measure of roadway capacity. When ramps, passing lanes, and shoulders are included, the Division is responsible for maintaining more than 27,000 maintenance lane miles. All three measures have increased in the past 10 years, as shown in Table 1. Most highway growth added capacity through more lanes, rather than new highways. Thus, travel lane miles increased more than centerline miles. Maintenance miles exceed travel lane miles because they include paved shoulders, ramps, and auxiliary and passing lane miles.

Organization, staffing, and maintenance activities

The Division's maintenance responsibilities are divided among several organizational units. Altogether, 922 of the Division's 2,223 FTE positions are assigned to highway maintenance. These employees are assigned to 4 groups with state-wide responsibilities and 9 districts responsible for defined geographical areas. In addition, a section in the Materials Group with 8 employees not funded by maintenance has responsibilities that include administering pavement preservation projects. Specifically:

- The state-wide **Maintenance Group** (6 FTE funded by maintenance appropriation), headed by the State Maintenance Engineer, provides support services to groups and districts that do maintenance work. This group allocates maintenance appropriations to the other groups and districts that have maintenance-funded employees. The group also operates and maintains ADOT's maintenance management system (PeCoS) that ADOT uses to plan

and report completed maintenance work, as well as preparing and maintaining performance guidelines that describe highway roadway maintenance work activities. In addition, the group assists districts with contracts for roadway maintenance services and materials. Finally, the group administers outdoor advertising permits and encroachment permits on highway right-of-ways.

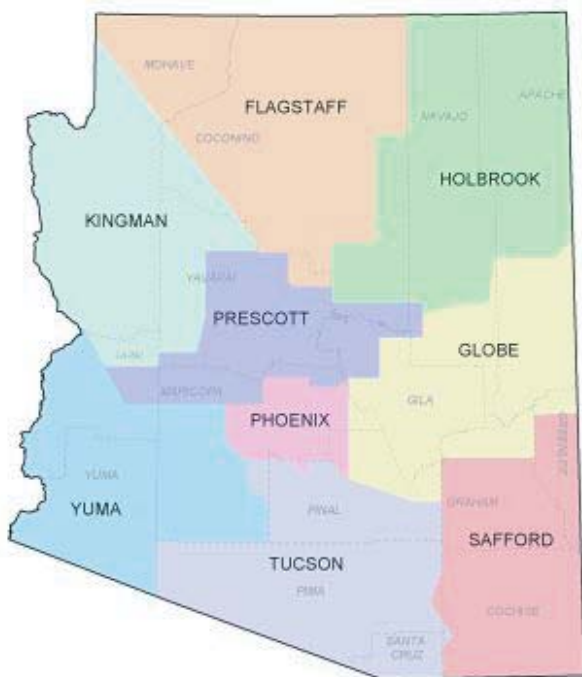
- The state-wide **Traffic Engineering Group's Traffic Operations Section** (48 FTE funded by maintenance appropriation) provides signing and striping, which involves painting traffic lines on pavement, for interstate highways and manufactures most of the highway signs. It also maintains highway lighting and traffic signals.
- The state-wide **Natural Resources Group** (33 FTE funded by maintenance appropriation) is responsible for managing land and vegetation along roadway corridors throughout the State for safety and maintenance, which includes providing weed and erosion control. This group has regional operations in Flagstaff, Phoenix, Prescott, and Tucson.
- The **Transportation Technology Group** (19 FTE funded by maintenance appropriation) houses the Traffic Operations Center in Phoenix that operates 24 hours every day and is part of the Freeway Management System (see textbox). Among other duties, the Center monitors freeway cameras and traffic volume sensors, and controls variable message signs and traffic interchange signals. It operates in part to help manage congestion caused by heavy traffic or accidents.
- **Nine Engineering Districts** (816 FTE funded by maintenance appropriation) have responsibility for highway maintenance work within their established geographic areas, as shown in Figure 1 (see page 4). Four of the nine districts—Flagstaff, Phoenix, Prescott, and Tucson—have regional responsibility for highway striping, signing, and traffic signals for all nine districts. The five other districts do not perform these duties. District duties also vary based upon climate and geographic differences. District maintenance responsibilities extend from the right-of-way fence on one side of the road to the right-of-way fence on the other side, and include:
 - Surface maintenance, such as filling potholes, sealing cracks, and leveling pavement;
 - Shoulder maintenance, such as repairing unpaved shoulders;

Freeway Management System—Transportation technology system used on 100 miles of freeway in the Phoenix area. System includes management of ramp meters, closed-circuit cameras, variable-message signs, and other communication systems used for monitoring and controlling traffic to reduce congestion, enhance safety, and save fuel.

Traffic Operations Center—24-hour facility intended to help maintain public safety and reduce urban congestion by monitoring real-time traffic conditions in the Phoenix area as well as state-wide weather and roadway conditions, providing timely public information on traffic conditions, and managing traffic-related incidents state-wide.

Districts are responsible for maintenance in their geographic areas.

Figure 1: Nine Maintenance Districts



Source: ADOT Web site map of construction and maintenance districts.

- Roadside maintenance, such as guardrail and fence repair;
- Drainage maintenance, such as cleaning out ditches to ensure water properly drains off pavement;
- Keeping roadways free from obstructions and debris; and
- Snow and ice removal.
- The Materials Group's state-wide **Pavement Management Section** (8 FTE, not funded by maintenance appropriation) administers pavement preservation projects done by contractors. The projects, which include removing and replacing the top few inches of pavement, prolong the time before a road requires more expensive reconstruction, according to ADOT officials. The section also surveys highway conditions and tests roads for cracking, roughness, and other characteristics used for planning pavement preservation projects.

In addition to in-house crews, the Division uses contractors to provide maintenance services. For example, contractors perform median cable barrier repair, rest area maintenance, pavement sweeping, landscape maintenance, and litter pickup, and provide services for all pavement preservation projects. According to division officials, ADOT uses contractors for any maintenance, reconstruction, or construction project valued at \$50,000 or more. Laws 2007, Chapter 77, §1 increases this contracting threshold to \$189,000 and beginning in fiscal year 2009 provides for annual inflation adjustments.

Budget

ADOT's Highways Program had available monies of almost \$1.2 billion for fiscal year 2007, with \$118.6 million of this amount, or about 10 percent, provided for highway maintenance in a special line-item appropriation. Beginning in fiscal year 2006, the Legislature appropriated highway program revenues to maintenance using a special line item. Prior to that year, the maintenance amount was noted in a General Appropriations Act footnote, but it was not a special line-item appropriation. According to the appropriations report for fiscal year 2006, the special line item was created to highlight highway maintenance expenditures. Including \$5.7 million

provided from Proposition 400 transportation excise tax revenues, ADOT has a total of \$124.3 million for highway maintenance activities in fiscal year 2007.

The highway maintenance line item is funded mostly by revenue from the State Highway Fund with some monies coming from the Safety Enforcement and Transportation Infrastructure Fund. The Division's highway maintenance actual and estimated revenues and expenditures for fiscal years 2005 through 2007 are shown in Table 2 (see page 6). The highway maintenance appropriation is nonlapsing until 2 months after fiscal year-end, allowing the Division 14 months to expend maintenance monies. As Table 2 shows, the Division's total expenditures for highway maintenance were approximately \$106.7 million in fiscal year 2005 and \$113.5 million for fiscal year 2006, compared with \$127.9 estimated for fiscal year 2007. In fiscal years 2005 and 2006, the Division expended approximately 38 percent of its expenditures on employee salaries and benefits. The other operating expense category is large because it includes maintenance materials, equipment costs, contractor-provided maintenance, and costs for maintaining maintenance facilities throughout the State.

In addition to maintenance expenditures funded directly from its operating budget, the Division also expends significant amounts that come from two other sources, as follows:

- The State Transportation Board approves pavement preservation projects in ADOT's *Five-Year Transportation Facilities Construction Program* that are funded by state monies and federal highway trust monies. In fiscal years 2005 and 2006, the Division reported that it spent an estimated \$90 million and \$77.3 million, respectively, for such projects, and has projects with estimated costs totaling \$93.4 million planned for fiscal year 2007.
- The Maricopa Association of Governments (MAG) also allocates monies from the special half-cent transportation excise tax authorized by voters as Proposition 400 in November 2004 to the Division, which it uses for landscape maintenance, litter control, and sweeping for the Maricopa Regional Freeway system. The allocations for each of fiscal years 2006 and 2007 were \$5.9 million, of which the Division received \$5.7 million. Over the 20-year life of Proposition 400, MAG has earmarked \$279 million total for these maintenance activities administered by the Division.

A special tax provides monies for landscape maintenance, litter control, and sweeping for the Maricopa Regional Freeway system.

Scope and methodology

This audit focused on how the Division spent special line-item monies for highway maintenance, highway conditions, and how the Division identified and planned needed maintenance activities. The audit includes the following findings and associated recommendations:

Table 2: Intermodal Transportation Division—Highway Maintenance
Activities Schedule of Revenues and Expenditures, in Thousands¹
Fiscal Years 2005, 2006, and 2007
(Unaudited)

	2005 (Actual)	2006 (Actual)	2007 (Estimate)
Revenues:			
Appropriations			
State Highway Fund ²	\$106,112.0	\$110,818.7	\$118,087.1
Safety Enforcement and Transportation Infrastructure Fund ³	558.7	558.7	558.7
Transportation excise taxes ⁴		5,700.0	5,700.0
Total revenues	<u>106,670.7</u>	<u>117,077.4</u>	<u>124,345.8</u>
Expenditures and operating transfers:			
Personal services and related benefits	40,430.1	42,687.1	45,900.0
Professional and outside services	847.4	1,253.5	1,109.6
Travel	730.7	712.6	760.0
Other operating ⁵	60,840.8	66,097.2	77,668.4
Equipment	<u>3,816.0</u>	<u>2,764.5</u>	<u>2,470.0</u>
Total expenditures	<u>106,665.0</u>	<u>113,514.9</u>	<u>127,908.0</u>
Excess (deficiency) of revenues over expenditures ⁶	<u>\$ 5.7</u>	<u>\$ 3,562.5</u>	<u>\$ (3,562.2)</u>

- ¹ The table includes only the Arizona Department of Transportation's (ADOT) operating revenues and expenditures relating to the Intermodal Transportation Division's highway maintenance activities. Consequently, the table does not include pavement preservation capital expenditures used for pavement overlay projects included in ADOT's 5-year construction program paid with highway construction monies. In addition, the table is presented on a budgetary basis, in which expenditures are reported in the budget year incurred.
- ² Consists of the Division's portion of the Department's appropriation from State Highway Fund monies used to pay for its highway maintenance activities. The State Highway Fund receives monies from the Highway User Revenue Fund, and fuel and motor carrier taxes.
- ³ Consists of the Division's portion of the Department's appropriation from Safety Enforcement and Transportation Infrastructure Fund monies used to pay for its highway maintenance activities. This Fund receives monies primarily from motor vehicle licenses and registration fees.
- ⁴ Consists of monies from the special half-cent transportation excise tax authorized by voters as Proposition 400 in November 2004, which is allocated by MAG.
- ⁵ Consists of various highway maintenance costs such as payments for utilities; landscaping; cable barrier and guardrail repair; rest area maintenance; traffic control; equipment, building, and land rental; general repair and maintenance; and materials.
- ⁶ The estimated deficiency of revenues over expenditures for fiscal year 2007 will be funded with unexpended Proposition 400 monies carried forward from fiscal year 2006.

Source: Auditor General staff analysis of financial information provided by the Arizona Department of Transportation for fiscal years 2005, 2006, and 2007.

- Monies provided for highway maintenance activities represent about 10 percent of ADOT's highway program funding and support more than 250 different maintenance activities provided throughout the State.
- Arizona's state highway system as a whole has mostly smooth and good-quality pavement, and was in better condition in 2005 than in 1995. In addition, Arizona's state-maintained roads compare favorably with roads in contiguous states based upon data published by the Federal Highway Administration (FHWA).
- The Division could better measure and identify annual maintenance work needed to maximize the state highway system's life expectancy, operational efficiency, appearance, and safety. The Division has taken steps to better measure maintenance needs, but needs to do more, including identifying work that should be done but cannot be accomplished with existing resources, and establishing guidelines for maintenance and inspection frequencies and work priorities.

In addition, the report contains other pertinent information on the Division's litter control activities.

Auditors used a variety of methods to review and study the issues addressed in this audit. Audit methods included interviews with management and staff at ADOT, the Division, and the Federal Highway Administration. Auditors reviewed various policies and procedures, including performance guidelines for conducting maintenance work activities, to understand the type of work performed by the Division. Auditors also reviewed and analyzed budget requests for the state highway maintenance program. Further, auditors observed maintenance crews and made site visits to ten maintenance facilities.

Auditors also used the following methods in each finding area:

- To determine how highway maintenance monies were spent and to identify changing spending patterns and maintenance activities, auditors reviewed Joint Legislative Budget Committee (JLBC) appropriations reports for fiscal years 2006 and 2007, budget allocation reports prepared by the State Maintenance Engineer for the same periods, a state-wide activity spending report from PeCoS for fiscal year 2006, and ADOT's plan for highway construction, called the *Five-Year Transportation Facilities Construction Program*, for fiscal years 2007 through 2011, and previous plans back to fiscal year 1997. The Division uses PeCoS to report labor, equipment, materials, and other costs by more than 250 maintenance activity codes. Auditors consulted with the State Maintenance Engineer about how to categorize activity and program costs from PeCoS into fewer meaningful higher-level classifications to illustrate how maintenance monies were used. The PeCoS system provides the only source of information

on expenditures by maintenance type. Auditors compared total costs reported in PeCoS to total costs in Advantage, ADOT's financial and accounting software system, and concluded that PeCoS costs were reasonably complete for high-level category analysis. Finally, auditors obtained revenue and spending data on pavement preservation and maintenance activities funded by Proposition 400 from division officials for fiscal years 2006 and 2007 to document other highway maintenance spending.

- To evaluate changes in state-maintained highway pavement conditions, auditors obtained a spreadsheet with annual highway condition ratings at each milepost for calendar years 1995 to 2005. This data was from ADOT's Pavement Management System (PMS), which is the Division's system for tracking pavement quality. Auditors analyzed and summarized this data on six rating criteria to determine how roadway pavement conditions had changed from 1995 to 2005. Specifically, auditors used rating criteria the Division uses to evaluate pavement quality, including measures of pavement roughness; the percentage of pavement with cracking; the depth of ruts or height of ridges in the pavement; the percentage of pavement with patching; flushing, which measures the extent of asphalt oil seeping up from pavement; and friction, which measures a vehicle's ability to stop on pavement. Auditors sampled 50 ratings from the downloaded highway condition rating spreadsheet for the years 1995 and 2005 from each rating factor used in the analysis and compared them to source data in PMS and found without exception that spreadsheet data matched PMS data. To evaluate PMS data reliability, auditors interviewed division employees who gather roadway condition data, observed employees gathering data, reviewed equipment calibration logs, and verified internal controls over data recording, and concluded that internal controls were adequate. Auditors also compared state road condition data reported by the FHWA in its annual *Highway Statistics* publications from 1995 to 2004 to determine how Arizona roads compared to surrounding state roads. However, the FHWA does not collect data for the purpose of comparison, and cautions that not all states use the same collection and measurement methods. Auditors concluded that data for the surrounding states was reasonably comparable by consulting with an FHWA official, reviewing a FHWA document detailing each state's International Roughness Index (IRI) measurement and collection methods, and reviewing a California Department of Transportation study completed in July 2004, which compared the methodologies different states use to gather IRI data.
- To evaluate the Division's ability to identify, quantify, and estimate costs for maintenance activities needed to maximize the state highway system's life expectancy, operational efficiency, safety, and appearance, auditors interviewed maintenance supervisors at all levels within the Division to determine how they identified, measured, and documented highway maintenance needs. Auditors also evaluated division methods and processes for preparing highway

maintenance budget requests. To determine an appropriate inflationary index to use when comparing historical financial information, auditors interviewed an economist and department chair for the Western Bureau of Labor Statistics Information Office, an Arizona State University (ASU) professor with Realty Studies at the ASU Polytechnic College, and ADOT's Chief Economist. Auditors analyzed state-wide activity reports the State Maintenance Engineer provided from PeCoS data for fiscal years 1997 through 2006 and compared spending by maintenance activity between fiscal years 1997 and 2006 to identify significant differences or trends in work activities and spending levels, evaluated spending for pavement preservation during the same period, and compared annual maintenance expenditures to annual construction expenditures to identify significant trends or inequities. Finally, auditors reviewed literature on how preventive maintenance activities could reduce overall highway life-cycle costs if done at the right time.

- To gather information regarding division litter control activities, auditors interviewed maintenance managers and the ADOT Adopt-a-Highway coordinator, who provided highway miles and litter pickup frequencies for adopted highway segments. Auditors analyzed activity reports from PeCoS to compare district litter efforts and a Phoenix district log sheet for June 2006 showing daily litter pickup by route and milepost performed by contractors. Auditors reviewed provisions in a 5-year Inmate Work Contract executed in 2005 between ADOT and the Department of Corrections that included inmate litter pickup activities. Finally, auditors reviewed Proposition 400 provisions, MAG regional transportation plan updates, and MAG reports on Proposition 400's implementation to understand litter funding from that source.
- To complete the report's Introduction and Background section, auditors interviewed agency officials and compiled unaudited information from the ADOT Web site, *State Highway System Logs*, and other agency-prepared documents. To document historical changes in the number of centerline miles, lane miles, and maintenance lane miles, auditors reviewed annual FHWA *Highway Statistics* reports and *State Highway System Logs*, which contain detail on such things as the miles of state-maintained roadways by route and maintenance district, as well as detailed information on roadway characteristics, including surface and shoulder widths and pavement composition.

This audit was conducted in accordance with government auditing standards.

The Auditor General and staff express appreciation to the Director of the Arizona Department of Transportation, the State Engineer, the State Maintenance Engineer, and their staff for their cooperation and assistance throughout the audit.

♦

FINDING 1

Maintenance monies support numerous activities

The Division uses maintenance monies to provide many different types of maintenance activities around the State. Legislative appropriations for maintenance represent about 10 percent of ADOT's total \$1.2 billion in highway monies. Nearly 9 of 10 maintenance dollars are spent on maintenance activities related to nonpavement features, such as highway shoulders, drainage, and guardrails. Expenditures for pavement preservation projects come primarily from federal and state monies made available through ADOT's *Five-Year Transportation Facilities Construction Program*. The Division also spends Proposition 400 monies that are earmarked for landscaping, litter control, and sweeping in Maricopa County.

Maintenance receives about 10 percent of ADOT's highways funding

In fiscal year 2007, the Legislature appropriated approximately \$118.6 million for highway maintenance. This amount represents approximately 10 percent of the \$1.2 billion total for ADOT's highways program.

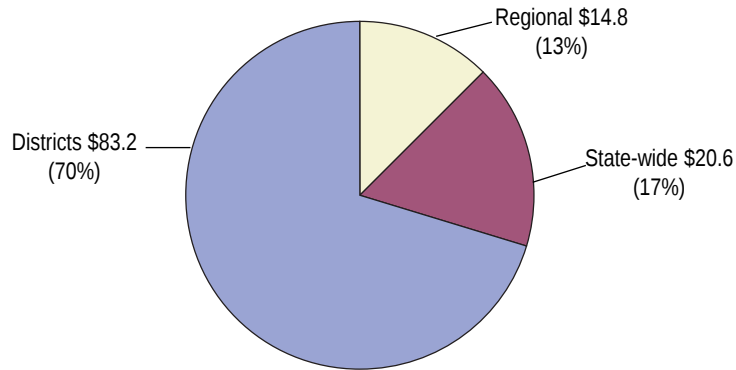
The Division allocates maintenance monies to be used at state-wide, district, and regional levels, as shown in the textbox and Figure 2 (see page 12). In fiscal year 2007, it allocated approximately 70 percent (\$83.2 million) of its total maintenance monies to its nine districts, another 13 percent (\$14.8 million) to regional activities provided by the Flagstaff, Phoenix, Prescott, and Tucson districts, and 17 percent (\$20.6 million) to its state-wide maintenance functions. The district regional activities include traffic engineering functions such as highway striping, signing, and traffic signals.

Division's allocation of fiscal year 2007 special line-item appropriation to district, state-wide, and regional functions (In millions)

<u>Districts:</u>		<u>State-wide:</u>	
Phoenix	\$21.5	Traffic Engineering	\$8.2
Tucson	10.7	Maintenance Group	7.5
Flagstaff	9.9	Natural Resources	3.4
Globe	8.9	Transportation Tech	1.5
Holbrook	8.1		
Prescott	6.7	<u>Regional:</u>	
Safford	6.7	Phoenix	\$5.7
Kingman	5.8	Prescott	3.2
Yuma	4.9	Tucson	3.1
		Flagstaff	2.8

Source: Auditor General staff analysis of ADOT's *Allocation Report for the FY 2007 Highway Maintenance Budget* and fiscal year 2007 budget data provided by the Division's Phoenix Maintenance District.

Figure 2: Distribution of Special-Line-Item Appropriated Monies To State-wide, Regional, and District Functions
Totaling \$118.6 Million
Fiscal Year 2007
In Millions
(Unaudited)



Source: Auditor General staff analysis of ADOT's *Allocation Report for the FY 2007 Highway Maintenance Budget* and fiscal year 2007 budget data provided by the Division's Phoenix Maintenance District.

In addition to these appropriated operating budget monies, ADOT uses monies from the Transportation Facilities Construction Program for pavement preservation. Specifically, ADOT's pavement management section has planned projects totaling \$103.3 million for fiscal year 2007 for pavement preservation projects approved by the State Transportation Board in ADOT's *2007-2011 Five-Year Transportation Facilities Construction Program*. The Division also received \$5.7 million in fiscal year 2007 from Proposition 400 monies, which it will use for regional landscape maintenance, litter control, and sweeping on state highways in Maricopa County. (See page 16 for more details on these two funding sources.)

Maintenance appropriations pay for many services

The Division provides a wide array of road-related maintenance in addition to pavement maintenance, which composes less than 10 percent of maintenance expenditures. The Division uses a Maintenance Management System called PeCoS and has defined more than 250 activities to which maintenance costs are assigned. For summary purposes, in consultation with the State Maintenance Engineer, auditors grouped these activities into 10 broad categories. As Table 3 illustrates (see page 13), 7 of the 10 categories are related specifically to the Division's direct maintenance activities. The other three categories comprise various activities and costs that could not be grouped with one of the seven maintenance categories.

The Maintenance Management System tracks maintenance costs for more than 250 activities.

Table 3: Maintenance Expenditures by Broad Category
Fiscal Year 2006
(Unaudited)

Category	Labor	Equipment	Materials	Service Contracts	Other ¹	Total
Direct Maintenance:						
Roadside	\$ 7,797,747	\$ 2,986,481	\$ 2,538,651	\$ 5,715,587		\$ 19,038,466
Traffic	3,942,935	1,014,964	7,441,147	31,237		12,430,283
Other direct maintenance ²	3,161,610	2,954,964	157,106	3,782,936		10,056,616
Paved surfaces ³	2,216,706	1,116,023	3,207,443	3,094,595		9,634,767
Landscape and vegetation	2,630,043	672,775	1,330,487	2,938,347		7,571,652
Rest area	96,171	28,307	18,663	1,975,120	\$ 312,364	2,430,625
Winter	<u>894,403</u>	<u>417,361</u>	<u>1,056,807</u>			<u>2,368,571</u>
Subtotal	<u>20,739,615</u>	<u>9,190,875</u>	<u>15,750,304</u>	<u>17,537,822</u>	<u>312,364</u>	<u>63,530,980</u>
Other Maintenance Costs: ⁵						
Other operating expenditures	8,424,478	249,788	30,012		12,488,169	21,192,447
Unallocated equipment costs ⁶		10,637,813			1,866,372	12,504,185
State-wide maintenance	<u>10,308,361</u>	<u>620,199</u>	<u>362,516</u>			<u>11,291,076</u>
Subtotal	<u>18,732,839</u>	<u>11,507,800</u>	<u>392,528</u>		<u>14,354,541</u>	<u>44,987,708</u>
Total	<u>\$39,472,454</u>	<u>\$20,698,675</u>	<u>\$16,142,832</u>	<u>\$17,537,822</u>	<u>\$14,666,905</u>	<u>\$108,518,688⁴</u>

¹ This includes expenditures such as utilities, travel, office supplies, and equipment direct billing, which according to ADOT officials, is fuel surcharges from ADOT Equipment Services. The rest area other expenditures are for utilities.

² Includes miscellaneous maintenance-related activities such as contracted miscellaneous maintenance, materials handling, building and yard maintenance, encroachment permits, and staff and equipment loaned to other than the assigned crew.

³ Excludes pavement preservation expenditures for pavement overlay projects included in ADOT's 5-year construction program that are paid for with highway construction monies.

⁴ This amount includes \$106,273,126 reported in the PeCoS state-wide maintenance activity report and \$2,245,562 in additional equipment costs that were not included in the PeCoS report. ADOT's financial accounting system, ADVANTAGE, shows \$113,514,900 in maintenance expenditures for fiscal year 2006. ADOT officials stated the \$4,996,212 (4.4 percent) difference might be attributable to maintenance materials purchases, which are recorded as expenditures on ADVANTAGE, but not recorded as expenditures in the PeCoS system until used, and some costs that are not recorded in PeCoS. They also attributed differences to carry-over funds captured in different fiscal years in the two systems and to materials costs, which in PeCoS are average inventory costs while ADVANTAGE uses actual purchase costs.

⁵ Includes expenditures such as leave, supervision, training, and recordkeeping that cannot be matched to a specific daily maintenance activity, but are essential for operations.

⁶ Unallocated equipment costs represent equipment costs, including the cost of maintaining and repairing equipment, remaining after charging equipment usage to direct maintenance categories.

Source: Auditor General staff analysis of expenditure data from the Division's PeCoS maintenance management system and ADOT's financial accounting system for fiscal year 2006.

Categories related directly to Division's maintenance programs— Auditor-grouped categories for direct maintenance represent costs coded to specific PeCoS activity codes that directly impact the preservation, rehabilitation, and enhancement of highway pavement, shoulders, and other highway features. These categories composed 59 percent of expenditures for fiscal year 2006:

- **Roadside maintenance (\$19 million)**—These expenditures were for activities such as litter pickup and maintenance of roadside features, including shoulders, drainage structures, guardrails, and fences. These activities included \$5.7 million in contract services and \$13.3 million of in-house activities.
- **Traffic maintenance (\$12.4 million)**—These expenditures were for maintaining traffic control features such as signs, signals, and pavement markings. Thirty-one thousand dollars was spent on contract services; the remainder was for in-house activities.
- **Other direct maintenance (\$10.1 million)**—These expenditures were for various miscellaneous maintenance-related activities, including contracted miscellaneous maintenance (\$3.7 million), materials handling, encroachment permits and related activities, building and yard maintenance, and contracted prison labor. In fiscal year 2006, ADOT expended approximately \$3.8 million for contracted services in this category, and the remainder was for in-house activities.
- **Paved surfaces (\$9.6 million)**—These expenditures were for pavement maintenance activities such as crack filling, seal coats, flushing, and patching. These activities included \$3.1 million in contract services and \$6.5 million for in-house activities.
- **Landscape and vegetation maintenance (\$7.6 million)**—These expenditures were for activities such as landscape maintenance, mowing, and vegetation control. Three million dollars was spent on contracted services in this category, while \$4.6 million was expended on in-house activities.
- **Rest area maintenance (\$2.4 million)**—These expenditures were for interstate and noninterstate rest area maintenance. Almost \$2 million was spent for contract services, over \$300,000 for rest area utilities, and the remainder for other in-house activities.
- **Winter maintenance (\$2.4 million)**—These expenditures were for activities such as snow removal and de-icing. The fiscal year 2006 amount was approximately half the winter maintenance total expended in fiscal year 2005 and varies annually based upon the weather. All these expenditures were for in-house activities.

Categories not directly coded in PeCoS to specific maintenance programs or activities—These auditor-grouped categories include expenditures such as leave, supervision, training, and recordkeeping that cannot be matched to a specific daily maintenance activity, but are essential for operations. Division officials state they are planning future PeCoS changes that will allow them to better distribute some of these costs directly to maintenance activities. The following nonspecific cost categories composed 41 percent of fiscal year 2006 expenditures:

- **Other operating expenditures (\$21.2 million)**—These expenditures included activities such as leave (\$5.5 million), other operating expenditures (\$5.2 million), roadway utilities (\$3.5 million), training (\$1.9 million), nonhighway utilities (\$1.3 million), professional and outside services (\$1 million), recordkeeping (\$610,235), and to nine other expenditure classifications.
- **Unallocated equipment costs (\$12.5 million)**—These expenditures were related to costs associated with ADOT-owned and rented equipment not included in the direct maintenance categories. ADOT's maintenance crews reported the hours that equipment was used in each activity, and PeCoS converted that information into a dollar amount and charged the amount to the appropriate category, such as roadside maintenance. Unallocated costs represented equipment costs, including the cost of maintaining and repairing equipment, remaining after charging equipment usage to direct maintenance categories.
- **State-wide maintenance (\$11.3 million)**—These expenditures were not directly coded to maintenance categories or were for services benefiting state-wide programs. These included supervision (\$4.8 million), administrative support (\$2.8 million), other support activity (\$1.9 million), salaries for Traffic Operations Center employees (\$1 million), transport equipment (\$0.7 million), and the remainder for contract support services. All these expenditures were for in-house activities.

As shown by Table 3 (see page 13), the largest expenditure was for division staff labor, which totaled nearly \$39.5 million for fiscal year 2006. The remaining expenditure types in descending amount order were equipment, contractors, materials, and other operating expenses. In fiscal year 2006, the Division paid contractors more than \$17.5 million to provide highway maintenance services, which represented 15.9 percent of maintenance spending that year. By comparison, the Division spent \$4.1 million, or 5.9 percent of maintenance spending, for contractor services in fiscal year 1997. According to an ADOT official, contractor usage increased because the Division received maintenance appropriation increases in response to highway system growth and the Division

used the increased funding to hire contractors because its staffing levels did not increase during the period, but actually decreased. The Division had 951 maintenance employees in fiscal year 1997 and 922 (29 fewer) in fiscal year 2006.

Five-Year Program funds pavement preservation

Pavement preservation usually involves replacement or overlay of 1 to 3 inches of asphalt.

Another substantial funding source involves monies adopted by the State Transportation Board for pavement preservation projects in ADOT's *Five-Year Transportation Facilities Construction Program*. Contractors perform these projects, which usually involve removing and replacing 1 to 3 inches of pavement or overlaying existing pavement with 1 to 3 inches of asphalt. According to an ADOT official, the projects are generally designed to add about 10 years of additional life to pavement. In fiscal year 2006, ADOT spent \$77.3 million on 25 pavement preservation projects for an estimated 399 lane miles, and plans to spend \$103.3 million for pavement preservation in fiscal year 2007. Approximately 90 percent of these monies (\$93.4 million) are planned for pavement preservation projects, which include removing and replacing a layer of pavement, but additional monies will be used for preventive maintenance (\$5.5 million) and for spot pavement preservation projects (\$4.4 million), which remove and replace a layer of pavement in a small area.

Proposition 400 monies support landscape maintenance and litter pickup in Maricopa County

ADOT also receives monies for specific highway maintenance activities in Maricopa County. In November 2004, Maricopa County voters approved Proposition 400, which extended the County's one-half cent transportation excise tax, of which a portion is allocated for regional landscape maintenance and litter pickup. The MAG Transportation Policy Committee (Committee) determines the uses and allocations of Proposition 400 monies, while ADOT implements them. The Committee identified approximately \$279 million of Proposition 400 monies that will be provided in fiscal years 2006 through 2025 for litter pickup and landscape maintenance in the MAG region. In fiscal years 2006 and 2007, MAG approved \$5.9 million per year, of which ADOT uses \$5.7 million for landscape maintenance (\$3.5 million), litter control (\$1.8 million), and sweeping (\$0.4 million). According to ADOT management, \$200,000 from each year's allocation was to be spent on a litter prevention and education program under a MAG solicitation. (See Other Pertinent Information, pages 37 through 39, for information on ADOT's litter control activities.)

ADOT did not spend the full amount it received in the first year of the Proposition 400 program. Specifically, in fiscal year 2006, ADOT spent only about 37.3 percent of the \$5.7 million allocated to it from Proposition 400 monies. According to ADOT officials, monies were not spent because they became available in January 2006, halfway through the fiscal year. ADOT intends to supplement its fiscal year 2007 Proposition 400 allocation with the unspent portion of the fiscal year 2006 monies. Proposition 400 monies are intended to supplement and not supplant other monies; as such, ADOT officials indicate that ADOT segregates these monies from its appropriated maintenance monies and accounts for Proposition 400 maintenance activities separately from its other maintenance activities.

FINDING 2

Most Arizona pavement rated satisfactory

Road pavement in Arizona's state highway system has generally received satisfactory ratings, and overall ratings were higher in 2005 than in 1995. Well-maintained pavement provides several benefits, and the Division evaluates pavement quality using various measures. Arizona's roads compared favorably with contiguous states' and improved in measured criteria in the last 10 years. These measures indicate that Arizona's state highway system has mostly smooth and good-quality pavement. While all road types were improved in 2005 compared to 1995, interstate roads, which have the highest traffic volume, received better ratings than state routes and U.S. highway roads. Lastly, a 2005 consumer satisfaction survey showed that Arizona residents were generally satisfied with highway maintenance efforts, but still wanted improvements in all maintenance areas.

Division uses several criteria and methods to rate pavement

Well-maintained pavement provides several benefits and the Division uses several criteria to evaluate pavement quality. A 2005 research report by the Kentucky Transportation Center at the University of Kentucky says that well-maintained pavement provides various benefits including increased safety, fewer auto repair expenses, improved quality of the overall road network, and higher user comfort.¹ The Division's foremost measure is the IRI, which measures roadway smoothness and is a nationally accepted pavement quality measure used by other states and the FHWA. The Division uses the IRI and other measures to evaluate pavement quality (see textbox on page 20). Division manuals and agency officials specify how these measures are applied to rate pavement as satisfactory, tolerable, or objectionable (see textbox on page 20).

The Division uses the nationally accepted IRI, among other measures, to assess quality.

Specialized division crews survey all Arizona highways and collect data to evaluate pavement conditions through observation or using special equipment. Crews annually measure pavement for roughness, cracking, rut depth, patching, and

¹ Kreis, Doug, Lenahan O'Connell, and Brian Howell. *Long-Term Maintenance Needs Planning*. Lexington, KY: Kentucky Transportation Center, College of Engineering, University of Kentucky, 2005.

Division's rating criteria to evaluate pavement quality:

Measure	Description of Measure	Satisfactory	Objectionable	Arizona Averages
Roughness (IRI)	Aggregate measure of vehicle bounce in inches as computed by infrared sensors over a 1-mile of roadway.	less than 94	greater than 143	78
Cracking	Percentage of linear feet of cracking measured over a 1,000 square foot area at each milepost.	less than 10%	greater than 30%	2.4%
Rut Depth	Depressions or ridges in roadway wheel path, in inches.	less than 0.25 in.	greater than 0.51 in.	0.12 in.
Patching	Percentage of surface treatment measured over a 1,000 square foot area at each milepost.	less than 10%	greater than 30%	1.8%
Flushing	Extent of asphalt oil seeping up from pavement decreasing friction or stopping ability, rated on a 5-point scale.	greater than or equal to 3	less than or equal to 2	4
Friction	The ability of the pavement to stop a vehicle, rated on a 100-point scale.	greater than or equal to 43	less than or equal to 34	61

Source: Auditor General staff summary of information in ADOT's *Preliminary Engineering and Design Manual* and information received in interviews with ADOT officials.

The Division has standardized data collection methods.

flushing. ADOT officials state that they intend to collect friction data biennially, but equipment difficulties and other work priorities make regular collection of this data inconsistent. The Division has standardized its data collection methods to ensure rating uniformity. For example, crews always measure pavement conditions in the increasing milepost direction for single-lane roads and in the right lane for each side of a divided highway. Crews regularly calibrate all equipment used for measuring IRI and friction to ensure consistent and accurate readings. The Division has separated data collection and data uploading duties, and an employee checks collected data against prior-year information to identify any significant inconsistencies. Division officials stated that collected condition data is used to perform analyses and generate reports for planning needed pavement preservation and rehabilitation projects.

The Division's road condition measurement focuses on pavement condition and does not address nonpavement features such as guardrails, shoulders, and drainage systems. However, the Division plans to evaluate these features using Level of Service (LOS) indicators in connection with the Maintenance Budgeting System, which is under development (see Finding 3, pages 31 through 32 for more information on the LOS indicators).

Arizona pavement smoothness compares favorably with other states

According to state IRI data the FHWA publishes annually in its *Highway Statistics* reports, Arizona road smoothness compares favorably to roads in the five surrounding states.^{1,2} The FHWA classifies the road surface as good if it has an IRI score of less than 95, similar to the Division's ranking of road smoothness as satisfactory if the IRI score is below 94. As shown in Table 4, in 2005—the most recent year for which data is available—Arizona's percentage of interstate roads with good ratings was higher than all five contiguous states, while two other states ranked higher in the percentage of other roads with good ratings. Arizona's ratings were different for urban than for rural roads. Most Arizona noninterstate roads are considered rural, and for those roads, nearly 79 percent had a good rating. For urban noninterstate roads, only 48 percent had a good rating. By comparison, the five contiguous states' percentage of urban noninterstate roads with good ratings ranged from approximately 25 percent in California to approximately 78 percent in Nevada.

Arizona pavement quality better in 2005 than in 1995

Arizona road ratings for smoothness, cracking, rut depth, and flushing were better in 2005 than they were 10 years earlier in 1995. As shown in Figure 3 on page 22, a comparison of data from 2005—the most recent data available—and data from 1995 shows that the percentage of Arizona roads receiving good or satisfactory ratings for these measures has increased. Similarly, the percentage of roads receiving poor or objectionable ratings was as low in 2005 as in 1995 in every category. Some measures have not changed substantially in recent years. For example, over 97 percent of roads had satisfactory ratings for patching in 1995, and in 2005 the percentage of roads with satisfactory ratings was still between 97 and 98 percent.

Table 4: Comparison of IRI for State Highway System Roadways between Arizona and Surrounding States Calendar Year 2005

Interstate Highways	Percentage with Good Rating ¹	Lane Miles Reported
Arizona	95.2%	1,165
New Mexico	92.8	1,000
Nevada	88.1	561
Utah	72.5	939
Colorado	50.8	956
California	50.2	2,458
Other Roads		
Nevada	96.4%	1,573
New Mexico	78.4	1,935
Arizona	70.5	1,554
Utah	59.1	1,237
California	53.0	5,172
Colorado	52.8	2,614

¹ A "good" rating is defined as roads receiving an IRI rating of less than 95.

Source: Auditor General staff analysis of roadway condition data in *Highway Statistics 2005* published by FHWA.

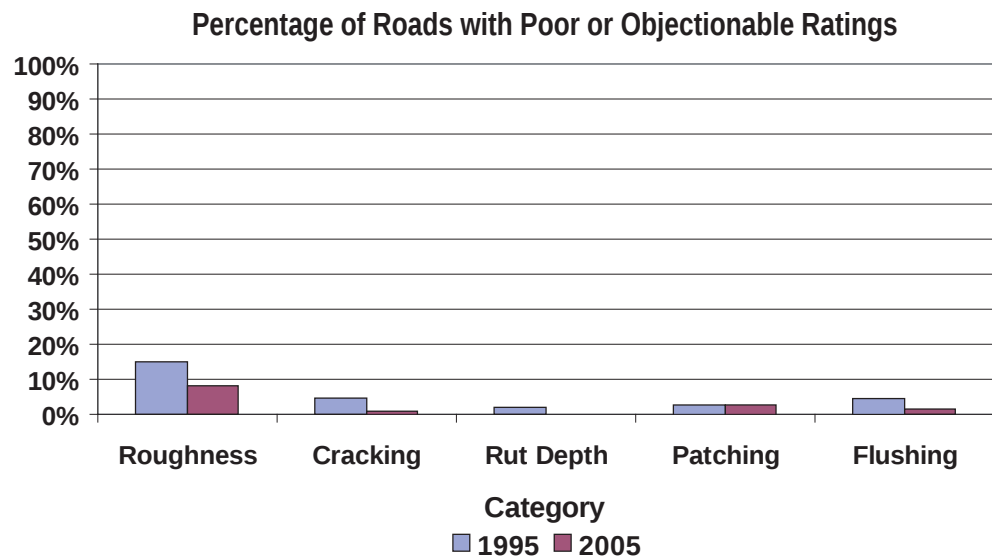
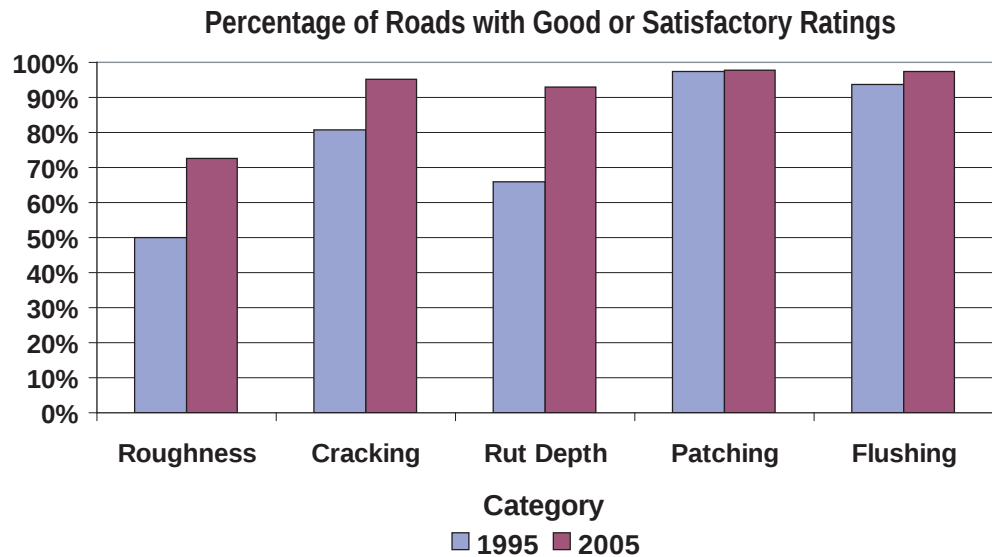
The percentage of Arizona roads with good or satisfactory ratings has increased.

¹ An FHWA official stated that pavement condition data is supposed to be reported on a 2-year cycle, preferably with one-half of each state's highway system reported each year, but many states report a large portion of the data every year.

² U.S. Department of Transportation. Federal Highway Administration. Office of Highway Policy Information, *Highway Statistics 2005*.

Figure 3:

Comparison of the Percentage of Arizona Highway System Roads Receiving Good or Satisfactory or Poor or Objectionable Ratings¹ in Roughness, Cracking, Rut Depth,² Patching, and Flushing Calendar Years 1995 and 2005



¹ Figures exclude percentage of roads rated between good or satisfactory and poor or objectionable.

² Rut depth data is for 2004 because, according to an ADOT official, ADOT does not have complete data for 2005 due to a transition in its data collection method during the year.

Source: Auditor General staff analysis of roadway condition data from ADOT's Pavement Management System.

Adequate maintenance and preservation is needed to maintain the favorable ratings. ADOT officials cautioned that the need for highway maintenance activities is not diminished by the current quantity of good or satisfactory pavement ratings because adequate maintenance is still required to maintain favorable ratings. Increased ratings after 1995 could in part be attributed to a substantial increase in the amount of pavement preservation completed in fiscal years 1998 and 1999. ADOT officials stated that not enough preventive maintenance and pavement preservation work has been completed in recent years, and this would eventually lead to declined ratings. During the audit, the officials were unable to quantify how much needed preventive maintenance and pavement preservation work was not being completed (see Finding 3, pages 25 to 35). However, after the end of audit fieldwork, ADOT's Materials Group provided unaudited data which estimated that anticipated pavement preservation project budgets for fiscal years 2008 through 2012, totaling \$590 million, were \$300 million less than needed to maintain Arizona highways at fiscal year 2007 condition ratings.

Arizona interstate roads rated better than other roads

Pavement ratings differ by road system type, with Arizona's interstate roads receiving the best ratings despite having the highest traffic volume. As shown in Table 5,

Table 5: Percentage of Arizona Interstate, State Route, and U.S. Highway Roads Receiving a Satisfactory Rating in Roughness, Rut Depth, Cracking, Patching, and Flushing¹ Calendar Year 2005

	Interstate	State Route	U.S. Highway
Road miles surveyed	2,342	3,683	1,990
Miles with high traffic volume²	91.8%	23.8%	13.6%
Road condition ratings			
Roughness	91.3%	65.3%	63.6%
Rut Depth ³	94.0	92.8	92.0
Cracking	98.7	95.2	90.6
Patching	98.9	98.1	96.3
Flushing	99.4	96.8	96.6

¹ See textbox on page 20 for descriptions of ratings and rating criteria.

² Percentage of roads with average daily traffic volume of more than 10,000 vehicles in 2004.

³ Rut depth data is for 2004 because, according to an ADOT official, ADOT does not have complete data for 2005 due to a transition in its data collection method during the year.

Source: Auditor General staff analysis of road condition data from ADOT's Pavement Management System.

interstate roads have superior smoothness and slightly better ratings in other measures when compared to state route and U.S. highway roads. Nearly all interstate roads—almost 92 percent—have daily traffic volume of more than 10,000 vehicles, while less than one-fourth of state routes and only about 14 percent of U.S. highways have traffic volumes that high.

Arizona citizens generally satisfied with highway maintenance

Arizona citizens are mostly satisfied with highway maintenance, but want more.

According to a consultant survey, most Arizona citizens are generally satisfied with highway maintenance efforts, but want more maintenance. In 2005, an ADOT consultant conducted a state-wide telephone survey of 403 residents to obtain public perception of Arizona's highway maintenance program.¹ Consultants asked residents to rate current and desired maintenance levels for paved roadway surfaces, road shoulders, roadside, vegetation, landscaping, drainage, structures, traffic control and safety, rest areas, and snow and ice removal. The survey found that although 79 percent of polled residents were generally satisfied with current highway maintenance efforts in each category, they also wanted improved maintenance in all categories. The survey also found that urban residents rated maintenance more favorably than rural residents. Residents surveyed also indicated they were more satisfied with ADOT road maintenance when compared to local road maintenance.

¹ According to the December 2005 consultant report by the Dye Management Group, Inc., the telephone survey was statistically valid. The report does not identify the survey's margin of error.

FINDING 3

Division should improve method to determine maintenance needs and allocate maintenance dollars

The Division should improve its method of identifying annual maintenance needs and allocating maintenance monies to maximize the life expectancy, operational efficiency, appearance, and safety of the state highway system. Although funding has increased, materials and other costs have also risen along with maintenance demands. Although ADOT officials cite an increasing gap between needed maintenance and resources, the Division's approach for allocating monies relies mainly on modifying the previous year's allocations instead of on identified needs. The Division is taking steps to better identify maintenance needs through data system improvements, but it should establish a more systematic method that identifies all needed maintenance and allocates funding according to prioritized needs.

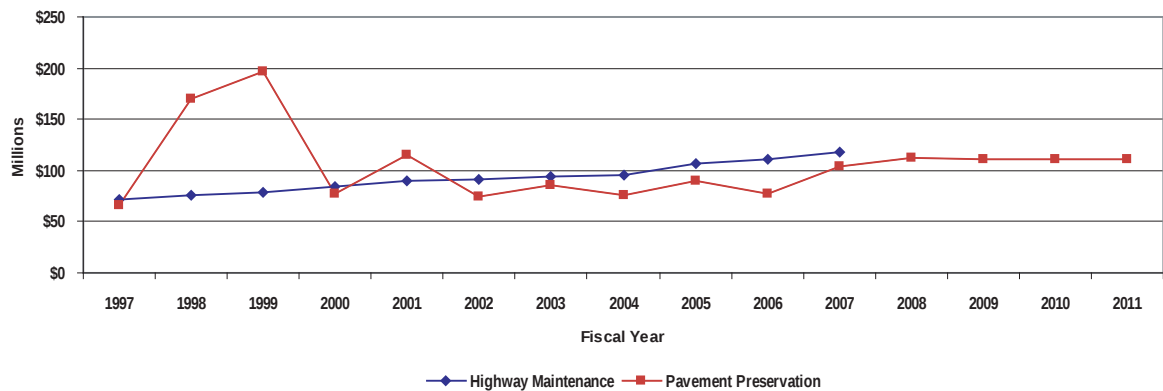
Funding, demands, and costs increasing

ADOT has received increased funding for maintenance, but associated maintenance costs and demands have also increased. Highway maintenance funding has gradually increased and pavement preservation funding has fluctuated, but will increase in the future. However, division officials believe increased material costs reduce their ability to do some maintenance. They also cited increased maintenance demands caused by lane mile additions, rising traffic volume, public expectations, environmental laws, more sophisticated equipment, and other factors that reduce their ability to provide adequate highway system maintenance.

Added lane miles and rising traffic volume have increased maintenance demands.

Funding increasing—As shown in Figure 4 (see page 26), highway maintenance monies have gradually increased while pavement preservation spending has fluctuated but is planned to increase in fiscal year 2008.

Figure 4: Highway Maintenance Actual Expenditures and Pavement Preservation Bid Amounts¹
Fiscal Years 1997 through 2006²
and Estimated Expenditures
Fiscal Years 2007 through 2011



- ¹ The Materials Group was only able to provide bid amounts for pavement preservation projects for fiscal years 1997 through 2006. ADOT officials believe these amounts are a close approximation of actual expenditures for the projects.
- ² Pavement preservation amounts for fiscal years 1997 to 2006 exclude "minor pavement preservation" projects that began in fiscal year 1998 and were budgeted between \$1 million and \$4 million per year, and "preventive maintenance" projects that began in fiscal year 2005 and were budgeted at \$5 million each year.

Source: Auditor General staff analysis of data obtained from ADOT's Maintenance Group, Materials Group, and the *2007-2011 Five-Year Transportation Facilities Construction Program*.

Highway maintenance expenditures increased 56.6 percent between fiscal years 1997 and 2006, averaging a 5.1 percent annual increase. During that same time period, estimated pavement preservation expenditures fluctuated from \$66 million to \$115.5 million, except for fiscal years 1998 and 1999, which had \$169.8 million and \$196.2 million, respectively, because of increased federal funding. Although estimated pavement preservation expenditures declined between fiscal years 2001 and 2006, ADOT's *Five-Year Transportation Facilities Construction Program* shows increased funding for fiscal years 2007 through 2011.

Materials costs escalating—Highway maintenance materials costs are increasing and division officials believe they are doing less preventive maintenance as a result. ADOT's Arizona Transportation Research Center (Center) reported substantial construction price increases in the past 10 years as of August 2006, based upon the Producer Price Index.¹ For example, as shown in Table 6 (see page 27), the Center found that the price of asphalt had increased by 171 percent, while labor had risen by 33 percent. The price of lumber—the only measured commodity that did not have a substantial increase—had actually gone down by 1 percent, but lumber has little relevance to maintenance activities. In addition, the Associated General Contractors of America issued an alert in September 2006 stating that construction materials inflation had increased far faster than consumer goods inflation since 2004 and was expected to be between 6 and 8 percent

Asphalt prices increased 171 percent from 1997 to 2006.

¹ Semmens, John and Jeff Romine. *Price Trends for Major Roadway Inputs. Final Report 622*. Phoenix: Arizona Transportation Research Center and Maricopa Association of Governments, Dec. 2006.

Table 6: Percentage Changes in Construction Costs
As of August 2006

	Asphalt	Diesel	Gasoline	Labor	Lumber	Portland Cement Concrete	Plastic	Steel
Past year	77%	1%	21%	3%	-6%	11%	20%	11%
Past 5 years	*	147	151	11	4	33	38	59
Past 10 years	171	205	216	33	-1	48	39	49

*There is a gap in the data for asphalt that prevents a calculation of the price change over this time span.

Source: Arizona Transportation Research Center, Report 622, *Price Trends for Major Roadway Inputs*, December 2006.

annually.¹ After the end of our audit fieldwork, ADOT officials provided an inflation index they were developing specifically for their maintenance inputs including materials, vehicle fuels, and electricity. The index is designed to be weighted according to the mix of maintenance materials and is based upon changes in the Producer Price Index. ADOT officials reported they intend to continually update this index to document how price increases affect ADOT's maintenance budget.

The Division's fiscal year 2008 budget request stated that because of increased materials costs, districts have reduced pavement preventive maintenance such as fog sealing, seal coating, and crack sealing. According to ADOT officials, these activities significantly extend the useful life of pavement and have the highest return on investment (see textbox). A 2005 University of Kentucky study reported that routine maintenance must be carried out in a timely manner at specified intervals if serious damage to highways is to be prevented and maintenance costs are to be reduced.

Examples of Pavement Preventive Maintenance

Fog sealing—A light spray application of an asphalt mixture to restore or rejuvenate pavement surfaces. It may delay more costly overlays for 1 to 2 years.

Seal coating—An application of liquid asphalt and cover material to seal and restore surface life, flexibility, and skid resistance.

Crack sealing—Cleaning and then filling pavement cracks with asphalt materials to prevent passage of water through and into the road's base or sub-grade.

Maintenance demands increasing—Growing maintenance demands between 1997 and 2006 also affect the amount of maintenance activities required. Specifically:

- Travel lane miles increased 8 percent between fiscal years 1997 and 2006 and maintenance lane miles increased 10.5 percent between fiscal years 2001 and 2006. Division officials said the majority of these were urban lane miles, which are more costly to maintain because of heavy traffic volume, and landscaping, median barriers, lighting, and other features not present in rural lane miles.

¹ Associated General Contractors of America. AGC's *Construction Inflation Alert*. Arlington, VA: Associated General Contractors of America, Sept. 2006.

- Traffic volume throughout the state highway system increased 59 percent between fiscal years 1997 and 2006. Increasing traffic loads cause higher pavement costs because more frequent roadway rehabilitation is needed.¹ In addition, increased traffic often dictates that maintenance work has to be done at off-peak driving times when labor costs are higher because crews must work at night and on the weekends.
- Increased emergency incidents reduce time and money available for planned maintenance because crews must respond to incidents and repair damaged features, such as guardrails and fences, in a timely manner. Division internal reports show that the time ADOT maintenance crews spent on emergency responses alone, excluding time spent repairing any highway features damaged by accidents, increased 25 percent between fiscal years 2004 and 2006. Although state-wide expenditures for emergency responses and six related activities for repairing damaged features represented less than 4 percent of maintenance spending in fiscal year 2006, emergency responses can affect some crews more than others. For example, between fiscal years 2004 and 2006, the Cordes Junction maintenance crew had an average of 346 emergency responses annually, consuming almost 9 percent of its total crew hours, while three nearby crews averaged less than 2 percent of total crew hours for emergency responses.
- Other demands also increase ADOT's maintenance costs and workload, according to an ADOT official. For example, the official stated that public expectations now require ADOT to use de-icing chemicals instead of less-expensive cinders to clear roads in winter. In addition, the official said that more time and activities are required to comply with more stringent federal and state environmental laws, and using more sophisticated equipment such as cameras to manage traffic increases the number of features that must be maintained.

Gap between resources and needs reported—According to ADOT officials there is a widening gap between current resources and maintenance needs. However, lacking an adequate planning process, the officials were unable to provide specific details regarding needed maintenance work that was not getting done. Division maintenance expenditures, excluding pavement preservation and Proposition 400 monies, represented \$6,339 per travel lane mile (adjusted for inflation) in fiscal year 2001 and were \$6,019, or approximately 5 percent, less per travel lane mile in fiscal year 2006, illustrating a potential resource decrease.²

Similar to the maintenance gap, ADOT officials reported a gap between resources and pavement preservation needs. After the end of audit fieldwork, ADOT's Materials Group provided unaudited data regarding the size of the gap.

• ¹ Labi, Samuel and Kumares C. Sinha. *The Effectiveness of Maintenance and its Impact on Capital Expenditures*. Springfield, VA: National Technical Information Service, June 2003.

² Auditors used the GDP price deflator index for state and local governments to adjust fiscal year 2001 expenditures.

Specifically, the Materials Group estimated that pavement preservation project budgets for fiscal years 2008 through 2012, which are anticipated to total \$590 million, would be \$300 million less than needed to maintain Arizona highways at fiscal year 2007 condition ratings. Although the Materials Group could not quantify the resource gap in previous years, one official stated that materials cost increases caused the Materials Group to reschedule past pavement preservation projects to later years, and that it would soon be about 2 years behind on its projects.

Division lacks adequate planning process

The Division does not have an adequate and comprehensive planning process for state highway maintenance. The districts plan annual work based on their historical activity and current budget, not on an analysis and prioritization of everything that needs to be done. Lacking an adequate planning process, ADOT allocates maintenance funding mainly on a historical basis, rather than by documented needs. ADOT should establish frequency guidelines for conducting inspections and addressing problems found in the inspections as well as for performing scheduled maintenance where applicable, and should also establish work priorities to facilitate a more systematic needs-based allocation to help plan needed maintenance.

Division does not identify all needed work—State-wide and district maintenance planning is based on annual budgets and not upon annual work that needs to be done. Therefore, the Division is unable to demonstrate which activities are not getting done because of the perceived funding gap. Districts create their annual maintenance plans to fit their allotted budget using previous years' activity as a starting point. District subunits, called "orgs," identify each anticipated maintenance activity's amount and cost and enter them into PeCoS to create the district consolidated work plan. Submitted plans must conform to budgets provided to the org and district.

ADOT allocates maintenance funding mainly on a historical basis instead of according to needs.

Allocations not based on documented needs—Because the Division does not have a systematic approach to identify needed maintenance activities and priorities, it cannot allocate maintenance monies based upon state-wide needs and priorities. Instead, the Division allocates the total annual maintenance budgets to the regions, districts, and other maintenance groups based mainly on their historical budgets. This could prevent one district from performing higher-priority work, while another district does lower-priority work. Further, this method does not consider roadway miles, traffic volume, population, and other factors that may determine district or region maintenance workload. Division officials reported that they allocated a \$2.8 million budget increase in fiscal year 2007 for maintaining new features based on needs, inventory growth, recent cost increases, and other metrics. However, auditors could not verify this because ADOT lacked

documentation showing how allocations were calculated. As shown in Table 7, districts differ in budget and employee resources considering their maintenance lane miles (MLM) and traffic volume, measured in daily vehicle miles traveled (VMT).

Although Table 7 shows potential inequities among districts, one measure by itself is not sufficient to demonstrate inequity, and a combination of measures, including relative road quality, may provide better allocations. For example, it may be appropriate for a district with relatively high urban miles to receive more funding per mile than a district with high rural mileage that is less costly to maintain. In addition, a district with more unsatisfactory pavement ratings may need more resources than a district with relatively high overall pavement ratings. Districts may also differ in the number and type of nonpavement features that they must maintain. The Division's allocation method is not needs-based and does not address specific factors that dictate resources needed to provide adequate maintenance.

Table 7: Comparisons of District Budget and FTE Allocations to District Maintenance Lane Miles and Traffic Volume¹
Fiscal Year 2006

	Budget per Mile	Budget per VMT	Miles per FTE	VMT per FTE
Average district ratio per category	\$2,796	\$1.47	43	105,980
Lowest district ratio per category	1,627	0.53	28	30,860
Highest district ratio per category	4,745	3.39	68	253,025

¹ Traffic volume is measured by daily vehicle miles traveled (VMT). A "vehicle miles traveled" unit is one vehicle traveling the distance of one mile. Thus, total vehicle miles traveled is the total mileage traveled by all vehicles.

Source: Auditor General staff analysis of data from ADOT's *Allocation Report for the FY 2007 Highway Maintenance Budget*, the *2005 State Highway System Log*, and VMT data provided by the Transportation Planning Division.

Division should develop maintenance frequency schedules and establish work priorities—The Division has not developed adequate guidelines to aid districts in identifying maintenance needs. Although the Division has established written *Performance Guidelines* for 253 maintenance activities, few of these include the frequency at which specific activities should be provided. The Division should establish frequency guidelines for conducting inspections and addressing problems discovered during inspections. In addition, the Division should establish frequency guidelines for maintenance activities where appropriate. Because maintenance needs are affected by several variables

including accidents, weather, and traffic volume, the Division should consider these factors in developing the frequency guidelines. The Division also lacks specific state-wide guidelines on how to prioritize maintenance work to ensure that the most important work is completed first within available resources. Moreover, the Division does not have guidelines on how districts should report any needed work that cannot be done with available resources in order to enable the Division to allocate monies appropriately.

The Division could facilitate a more systematic needs-based allocation by establishing maintenance and inspection frequency schedules and work priorities. First, establishing these frequency schedules would help districts quantify annual maintenance needs, leading to a determination of state-wide needs. Second, establishing priorities for maintenance activities would help ensure that one district does not perform lower-priority work while another is unable to provide higher-priority maintenance work. The Division could then use all this data, combined with road mileage by highway type, pavement conditions, number of various nonpavement features, and other factors to develop an equitable resource allocation.

Similar approaches can identify needed maintenance work and allocate monies. For example, Texas uses a model not only to identify needs, but also to allocate monies based on those needs.¹ Under the Texas model, district allocations are based on combining several individual roadway feature and condition factor formulas. Formulas include many important variables such as state average costs, lane miles, traffic flow, rainfall, and mowing/litter acres.

Texas uses a needs-based approach to identify maintenance needs and allocate funding.

Division can further improve needs measurement

The Division is taking steps to better measure maintenance needs through data system improvements, but could do more by considering a new approach to identify needs and allocate funding. The Division is developing four computerized systems to help measure maintenance needs and funding requirements. However, because the systems are still being developed and put into operation, auditors could not confirm that they will perform as anticipated, and implementing the systems by themselves will not identify all needed maintenance. In addition to the steps it is already taking, the Division should consider taking an integrative approach to systematically identify needed maintenance and to allocate monies.

Some steps taken to improve—The Division is developing several computerized systems to help it measure maintenance needs and funding requirements, but these systems by themselves will not identify all needed maintenance. Specifically:

¹ Graff, Joe S. "Texas Department of Transportation Maintenance Budget Allocation." Paper presented at the 1997 AASHTO/TRB Maintenance Management Conference, Saratoga Springs, NY.

ADOT is developing a new system to use letter grades to help identify overall maintenance needs and estimate funding required.

- **New system to determine overall funding needs**—The Maintenance Budgeting System (MBS) is intended to determine funding required for maintaining six groupings of road system features at specified condition levels. For example, one grouping is “paved surfaces,” which includes potholes, cracking, unpaved shoulders, and four other roadway features (see textbox). The MBS will use cost data from PeCoS and condition assessments expressed as letter grades from Level of Service (LOS) ratings to estimate funding needed to maintain the six broad highway features categories at specified condition levels (see textbox). An ADOT official explained that the letter grades will be determined based upon the percentage of system components that require maintenance. However, while the Division has raw LOS condition data, it has not yet developed official letter grades. According to an ADOT official, the MBS system will be finalized in July 2007 and used for the fiscal year 2009 budget. Although the MBS system may help estimate funding by feature groupings, it will not identify where and when specific maintenance is needed, nor funding for each feature type in the grouping.

Maintenance Budgeting System

The Division is working with a consultant to develop an MBS to estimate operating budget needed to maintain components of the highway system at specific LOS letter grades. For example, if the Legislature wanted an A grade for one indicator and a B grade for another, the MBS would estimate funds needed to accomplish that level of service.

Level of Service Indicators

Maintenance LOS ratings will be expressed as letter grades A, B, C, D, and F, with plus and minus grades used if finer gradations are desired. LOS grades will be assigned to these six broad roadway feature groupings:

- Paved surfaces (7 items, including potholes, cracking, and unpaved shoulders)
- Roadside (9 items, including guardrail, litter, fences, unpaved ditches, and drainage)
- Traffic (4 items, including signposts, delineators, striping, and pavement markings)
- Vegetation (7 items, including trees and brush in clear zone, and sign marker visibility)
- Landscape (12 items, including litter, irrigation, pruning and trimming)
- Rest Areas (24 items, including parking lots, sidewalks, trash bins, and restrooms)

- **Replacement system to track highway features**—The Division is implementing a new feature inventory system (FIS) that will use Global Positioning System (GPS) technology to record exact locations of all roadway features, such as guardrails, fences, and drainage pipes, and will record essential attributes of each feature. According to an ADOT official, no other state transportation department has successfully implemented a GPS-based FIS system. FIS is important to help identify which features need to be maintained. For example, it will help supervisors know the location of drainage pipes that need cleaning

or what materials are needed for various repairs without visiting repair sites. The new FIS was developed because the old system did not include new feature types added since the 1970s. Although a December 2005 report by the ADOT Information Technology Group stated that the new FIS was completed in March 2003, it has not yet been populated with data and the Division does not have a firm timetable of when the system will be fully functional. Although the FIS will help quantify features in the highway system, it does not include feature condition ratings, which could be useful in identifying the timing and location of needed nonpavement maintenance activities.

- **Redesigned maintenance management system**—Maintenance work crews use the PeCoS maintenance management system to plan and track maintenance activity costs and accomplishments. The Division expects to fully implement a major upgrade to PeCoS in August 2008. This upgrade is intended to be a new system rather than an enhancement because the original database structure has not significantly changed since the 1970s. The Division intends that the new PeCoS will provide an interface with other ADOT databases including LOS ratings and the FIS. In addition, ADOT expects the new system to reduce redundant data entry, increase data accuracy, reduce technical support costs, and enhance the user interface. However, the system will not prioritize nor identify specific maintenance work that needs to be done.
- **Replacement system to identify needed pavement maintenance**—The Highway Pavement Management Application (HPMA) replaces an older application and was designed to use pavement inventory, condition data, and decision trees for identifying the time, location, and type of pavement preservation and preventive maintenance treatments needed. The application also considers various pavement treatment costs and available funding to suggest an appropriate prioritized treatment plan. The Materials Group reports that as of January 2007, it began producing specific reports that identify pavement segments for pavement preservation projects at various funding levels, and they are still refining how the system will be used. Although district staff will have access to the system to view the HPMA-suggested prioritized treatment plan for pavement preservation, the HPMA has not been set up for planning the type of pavement maintenance activities provided by in-house maintenance crews. The Division does not have estimates of when the maintenance crew pavement activities will be implemented in the HPMA.

The Division considers these computerized systems to be the cutting edge of technology and expects them to greatly assist in planning maintenance needs. Because these systems are either not fully developed or not yet fully used, auditors could not confirm that the systems will accomplish their intended benefits. In addition, they will not be sufficient to identify all needed state-wide maintenance.

More systematic approach needed—As the Division continues to implement its computerized systems, it should further implement a new overall, integrative planning approach to identify needed maintenance throughout the state highway system and to more systematically allocate maintenance monies among districts and groups. A more systematic approach would:

- establish frequency schedules, as appropriate, for maintenance activities;
- identify all needed maintenance state-wide;
- estimate monies and resources required to perform the needed maintenance;
- provide a prioritization method to ensure that the most important and cost-effective maintenance is performed within resource constraints; and
- provide a systematic method for allocating resources to meet maintenance needs.

This approach could also identify maintenance that could not be provided with current resources and identify funding gaps.

Recommendations:

1. To better ensure that the state highway system's life expectancy, operational efficiency, appearance, and safety are maximized, the Division should:
 - a. Develop and implement guidelines on how to identify annually needed maintenance work which would include frequency schedules, as appropriate, and periodic inspections to identify needed work;
 - b. Develop and implement guidelines on how to prioritize maintenance work to ensure that the most important state-wide maintenance needs are met first within available resources;
 - c. Identify, quantify, and prioritize maintenance that needs to be done annually; and
 - d. Identify work that cannot be done with existing resources to identify any maintenance funding gap.
2. To ensure that state-wide maintenance needs are addressed, the Division should develop and implement a methodology to allocate monies to districts and regions based on state-wide needs and priorities, and each district's and region's relative needs and roadway responsibilities (for example, lane miles and traffic flow).

OTHER PERTINENT INFORMATION

During this audit, auditors collected other pertinent information regarding the various activities and methods used in litter pickup along state-maintained roadways.

ADOT provides for litter pickup on state roads

The Division is responsible for managing litter control throughout the state highway system, but litter pickup activities vary state-wide. ADOT uses a combination of paid contractors, the Adopt-a-Highway program, prison labor, and in-house maintenance crews to provide litter control on roads in the state highway system.

Litter control practices vary across the State—Because of Proposition 400 funding beginning in fiscal year 2006, Maricopa County roads receive the most litter control attention of highways state-wide (see textbox). According to an ADOT Phoenix District official, the Division plans for each of the 276 greater Phoenix area roadway miles covered by the program to receive weekly litter pickup. Most of this work is done by private contractors paid for with Proposition 400 monies, augmented by the Adopt-a-Highway sponsor program (see page 38). The Tucson and Flagstaff districts also use the Adopt-a-Highway sponsor program, but on a much smaller scale than Phoenix. ADOT officials explained that highways in districts other than Phoenix, Tucson, and Flagstaff receive substantially less litter control attention because of less available money and limited interest in highway sponsorship through the Adopt-a-Highway program. In these districts, ADOT's maintenance crews do mostly spot litter pickup on a public complaint basis or when they observe debris on roadways that may pose safety hazards. The Adopt-a-Highway volunteer program also provides supplemental litter pickup in all nine districts throughout the State.

Proposition 400

In November 2004, Maricopa County voters approved the extension of its half-cent transportation excise tax, which continues during the calendar years 2006 through 2025. Based on estimated revenues, a total of approximately \$279 million will be allocated to pay for litter pickup and landscape maintenance.

Division uses multiple methods for litter pickup

The Division uses five methods for litter control on roads in the state highway system:

- **Proposition 400 contractors**—According to an ADOT Phoenix district official, Proposition 400 monies (see textbox, page 37) fund litter control for 276 roadway miles in the Maricopa County Regional Freeway system. In fiscal year 2006, \$1.8 million was designated from Proposition 400 monies to pay for this litter control and \$200,000 was used for a litter prevention and education campaign. The official explained that the Division receives these monies and hires contractors to pick up litter on roadway shoulders, medians, and pavement. The Division has a full-time inspector who verifies contractor work quality to ensure adequate litter control.

Table 8: Adopt-a-Highway Sponsor Program Statistics By District
Fiscal Year 2006
(Unaudited)

District	Number of Sponsors	Sponsored Miles	District Centerline Miles ¹
Phoenix	113	352.6	545.7
Tucson	2	14.2	972.8
Flagstaff	4	4.0	833.0
Total	<u>119</u>	<u>370.8</u>	<u>2,351.5</u>

¹ The most recent centerline mile information is from December 31, 2005.

Source: Auditor General staff analysis of data provided by the program coordinator in ADOT's Communication and Community Partnerships Office and ADOT's 2005 State Highway System Log.

- **Adopt-a-Highway sponsors**—The Adopt-a-Highway sponsor program allows businesses and other organizations that contract directly with one of several pre-approved maintenance providers to remove litter in the busier urban areas where more frequent litter removal is necessary. As shown in Table 8, the Division reports that as of January 2007, 119 groups sponsored more than 370 roadway miles in the Phoenix, Tucson, and Flagstaff districts. According to the program coordinator, most litter control paid by sponsors is done every other week. However, in Flagstaff and Tucson, some sponsored litter pickup is done only 12 to 18 times a year. In Maricopa County, the Division has a full-time inspector who ensures the quality of sponsored litter control done by contractors, according to a Phoenix district official. Division officials state that for Maricopa County, sponsored and Proposition 400 work are coordinated to ensure weekly litter pickup on each roadway segment.

- **Adopt-a-Highway volunteers**—Under the Adopt-a-Highway volunteer program, volunteer associations such as civic groups and schools pick up litter approximately twice a year on their adopted highway segment. As shown in Table 9, as of February 2006, ADOT had 2,235 volunteer groups enrolled in the program throughout the State caring for an estimated 2,467 roadway miles.

- **Prison labor**—ADOT maintenance districts use contracted prison labor to perform litter pickup along some Arizona highways. According to ADOT records, ADOT used nearly 86,000 hours of inmate labor in fiscal year 2006 at a total cost of almost \$62,000. Under its agreement with the Department of Corrections (DOC), ADOT coordinates with prison officials to set work hours, work locations, and job assignments subject to DOC agreement and the availability of inmate workers. DOC provides security supervision, and ADOT is responsible for inmate labor expenses at \$0.50 per hour, Correctional Officer supervision expenses at the DOC rate in accordance with its policy, transportation costs at the state rate per mile, and other related costs. Agency officials state that inmate labor is typically limited to areas within close proximity of the prison and more rural areas.

- **In-house maintenance crews**—ADOT officials stated that maintenance crews pick up litter in rural regions on a complaint basis or when crews observe items on the roadway that could pose safety hazards. According to ADOT officials, in-house maintenance crews assume limited responsibility for litter control because they emphasize roadway functionality and safety, with litter pickup being a lower priority. ADOT records show that in fiscal year 2006, approximately \$1 million was spent on litter pickup performed by in-house maintenance crews throughout the State. According to ADOT officials, in-house maintenance crews are also responsible for collecting litter bags filled by Adopt-a-Highway volunteers.

Table 9: Adopt-a-Highway Volunteer Program Statistics By District
Fiscal Year 2006
(Unaudited)

District	Number of Volunteer Groups	Adopted Miles	District Centerline Miles ²
Flagstaff	216	356.6	833.0
Globe	461	265.0	898.3
Holbrook	173	173.0	921.6
Kingman	131	250.8	577.8
Phoenix	102	119.7	545.7
Prescott	337	349.8	587.8
Safford	349	349.0	816.6
Tucson	371	449.7	972.8
Yuma	95	153.5	647.3
Total	<u>2,235</u>	<u>2,467.1¹</u>	<u>6,800.9</u>

¹ According to the program coordinator, the Safford and Holbrook districts did not have exact information regarding the number of miles cared for so a minimum estimation of 1 mile per group was used. It is likely that this value is higher since the program encourages groups to adopt 2-mile segments, and most districts have a mixture of groups that adopt 1-mile and those that adopt 2-mile segments.

² The most recent centerline mile information is from December 31, 2005.

Source: Auditor General staff analysis of data provided by the program coordinator in ADOT's Communication and Community Partnerships Office and the ADOT 2005 State Highway System Log.

AGENCY RESPONSE



Janet Napolitano
Governor

Victor M. Mendez
Director

Arizona Department of Transportation

Office of the Director

206 South Seventeenth Avenue Phoenix, Arizona 85007-3213

Richard Travis
Deputy Director

May 31, 2007

Debbie K. Davenport
Auditor General
2910 North 44th Street
Phoenix, Arizona 85008

Dear Mrs. Davenport:

Our thanks to you and your staff for the open dialogue and professionalism displayed during the audit of the Arizona Department of Transportation (ADOT) Highway Maintenance Program.

Finding 3: Division should improve method to determine maintenance needs and allocate maintenance dollars.

Recommendations:

1. **To better ensure that the state highway system's life expectancy, operational efficiency, appearance, and safety are maximized, the Division should:**
 - a. Develop and implement guidelines on how to identify annually needed maintenance work which would include frequency schedules, as appropriate, and periodic inspections to identify needed work;
 - b. Develop and implement guidelines on how to prioritize maintenance work to ensure that the most important state-wide maintenance needs are met first within available resources;
 - c. Identify, quantify, and prioritize maintenance needs to be done annually; and
 - d. Identify work that cannot be done with existing resources to identify any maintenance funding gap.

Agency Response:

The finding of the Auditor General is agreed to and the audit recommendations will be implemented.

As described in the American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Maintenance Management Systems (MMS), MMS have evolved from output-focused systems (work units, quantities, expenditures) of the 1970's to the integrated, performance-based, outcome-driven systems of today. The Level of Service (LOS) Maintenance Budgeting System program that ADOT has developed is a critical component of our MMS, it represents the state-of-the-art in

performance-based maintenance budgeting and its structure is consistent with the AASHTO guidelines.

LOS is a performance-based system that does not quantify work to be done or maintenance needs at a detailed level, but rather identifies the performance level or target that is desired and the resources necessary to deliver that performance level. The LOS Maintenance Budgeting System is designed to prioritize maintenance work statewide by the process of setting target grades for each category. For example, setting a target of A for traffic vs. a target of a B+ for roadside is setting a statewide priority of traffic control features above roadside features.

There has been some level of frequency recommendation for many years in the maintenance activity guidelines. For example, the activity for Routine Signal/Lighting Maintenance and Inspection specifies bi-monthly frequency for ramp meters and signals and semi-annual frequency for highway lighting. The Pavement Management System (PMS) is capable of setting the recommended frequencies for pavement activities. The guidelines will be reviewed for appropriate frequency recommendations and changes made as necessary.

The upgraded PECOS application will allow districts to identify maintenance work to be done and will enable the district to set priorities in the planning module of the application. When planning work annually, each org supervisor has a variety of resources available, including PECOS reports, LOS data, PMS data, accident data, and more. When implemented, the new PECOS will provide a highly-integrated maintenance management system that will include interfaces with the LOS, Feature Inventory System, Sign Management System, Pavement Management System and the Equipment Services database. The integration will better position the agency to identify and quantify the gap in resources.

2. **To ensure that state-wide maintenance needs are addressed, the Division should develop and implement a methodology to allocate monies to districts and regions based on state-wide needs and priorities, and each district's and region's relative needs and roadway responsibilities (for example, lane miles and traffic flow).**

Agency Response:

The finding of the Auditor General is agreed to and the audit recommendations will be implemented.

Debbie K. Davenport
Page three
May 31, 2007

The current allocation process has not resulted in any significant imbalance or differences in conditions among districts as supported by the data in the pavement management system, preliminary Level-of-Service (LOS) data, or any other currently available measure. We will review the current allocation process. The new LOS Maintenance Budgeting System will improve our ability to do state-wide prioritization and allocation of monies to the districts.

We will implement these recommendations, which we believe will improve our internal processes.

Sincerely,

Victor M. Mendez

Performance Audit Division reports issued within the last 24 months

05-02	Department of Administration— Financial Services Division	05-16	Department of Revenue Sunset Factors
05-03	Government Information Technology Agency (GITA) & Information Technology Authorization Committee (ITAC)	06-01	Governor's Regulatory Review Council
05-04	Department of Economic Security—Information Security	06-02	Arizona Health Care Cost Containment System— Healthcare Group Program
05-05	Department of Economic Security—Service Integration Initiative	06-03	Pinal County Transportation Excise Tax
05-06	Department of Revenue—Audit Division	06-04	Arizona Department of Education—Accountability Programs
05-07	Department of Economic Security—Division of Developmental Disabilities	06-05	Arizona Department of Transportation—Aspects of Construction Management
05-08	Department of Economic Security—Sunset Factors	06-06	Arizona Department of Education—Administration and Allocation of Funds
05-09	Arizona State Retirement System	06-07	Arizona Department of Education—Information Management
05-10	Foster Care Review Board	06-08	Arizona Supreme Court, Administrative Office of the Courts—Information Technology and FARE Program
05-11	Department of Administration— Information Services Division and Telecommunications Program Office	06-09	Department of Health Services—Behavioral Health Services for Adults with Serious Mental Illness in Maricopa County
05-12	Department of Administration— Human Resources Division	07-01	Arizona Board of Fingerprinting
05-13	Department of Administration— Sunset Factors	07-02	Arizona Department of Racing and Arizona Racing Commission
05-14	Department of Revenue— Collections Division		
05-15	Department of Revenue— Business Reengineering/ Integrated Tax System		

Future Performance Audit Division reports

Arizona School Facilities Board