

PERFORMANCE AUDIT

DEPARTMENT OF TRANSPORTATION

Highway Division – Highway
Maintenance Function

Report to the Arizona Legislature
By the Auditor General
August 1987
87-5

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August 17, 1987

Members of the Arizona Legislature
The Honorable Evan Mecham, Governor
Charles L. Miller, Director
Arizona Department of Transportation

Transmitted herewith is a report of the Auditor General, A Performance Audit of the Arizona Department of Transportation Highways Division - Highway Maintenance Function. This report is in response to a July 26, 1985, resolution of the Joint Legislative Oversight Committee.

The report addresses several areas for improvement. We found that ADOT could increase its effectiveness by expanding its contracting of routine maintenance activities. We also found that ADOT could improve its effectiveness by implementing changes in the PeCos system used by the Maintenance Section to plan, budget, and control maintenance activities; and by establishing a method to evaluate district maintenance conditions. Finally, we found that ADOT's central office needs to strengthen its oversight of the maintenance function.

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

Respectfully submitted,



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SUMMARY

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Transportation (ADOT) in response to a July 26, 1985, resolution of the Joint Legislative Oversight Committee. This performance audit was conducted as part of the Sunset Review set forth in the Arizona Revised Statutes (A.R.S.) §§41-2351 through 41-2379.

This is the third of several reports to be issued on the Arizona Department of Transportation. The report focuses on the Highway Maintenance Section of the Highways Division of ADOT.

Highway maintenance organizations (orgs) perform numerous maintenance activities including maintenance of paved surfaces, unpaved surfaces, unpaved shoulders, vegetation, roadsides, rest areas and landscapes. Major highway maintenance projects such as pavement overlays or reconstruction are generally performed by private contractors through the Construction Section of the Highways Division.

ADOT Should Continue To Expand Its Contract Maintenance Program (see pages 5 through 13)

ADOT should expand its contracting of routine maintenance activities. ADOT's Maintenance Section uses private firms for maintenance activities such as rest and picnic area maintenance, litter pickup, sweeping, trash collection, mowing, pumping and landscaping. The contract maintenance program has demonstrated that contractors are able to perform some maintenance activities at a lower cost than ADOT, while generally providing an improved level of service. In 1986, the approximate savings from the program were more than \$1,200,000.

Because of its cost effectiveness and improved level of service, the contracting program should be expanded. Many maintenance activities such as shoulder maintenance, culvert cleaning, guardrail repair, and hand patching with premix are successfully contracted by other states. At a minimum, ADOT should evaluate the

feasibility of contracting out these activities. In addition, the Legislature may wish to establish a technical advisory committee (consisting of representatives from ADOT, private contractors and other persons knowledgeable in contracting and highway maintenance), to conduct a systematic evaluation of all maintenance activities to identify other activities that should be contracted.

**ADOT's System For Planning, Budgeting And Controlling
Highway Maintenance Continues To Need Significant Improvement To Meet
Central Office And Field Management Needs** (see pages 15 through 26)

Despite its \$720,000 annual cost, ADOT's system for planning, budgeting and controlling highway maintenance, called PeCos, does not work as intended.

PeCos is designed to help the central office plan an annual work program and budget available resources to accomplish the annual plan. PeCos should indicate the labor hours, and amount of materials and equipment required to do a given amount of work.

PeCos' usefulness is limited because key elements for: (1) projecting annual maintenance requirements, (2) setting production rates for field crews, and (3) assessing maintenance costs and resource requirements are inaccurate and unreliable. In eight of 12 activities reviewed, actual field productivity had no relationship to PeCos estimates. For example, for one of these activities, blading unpaved shoulders, daily production is estimated at either 4.5 or 4.6 shoulder miles; however, actual daily production ranged from .5 to 7.1 shoulder miles. This reduces PeCos usefulness as a planning and budgeting tool because reliable production estimates are necessary to develop a viable budget.

Nor does PeCos meet operational needs in the field. It does not enable area personnel to effectively plan and control the work of maintenance crews. Our analysis showed that confidence in PeCos is so low that 11 of the 12 org supervisors interviewed do not use, or even consider, PeCos planned work when scheduling maintenance activities.

**ADOT Should Establish A Method For Evaluating
District Maintenance Conditions** (see pages 27 through 30)

In addition to implementing needed improvements to its maintenance management system, ADOT needs to establish a method for evaluating the level of service provided by maintenance field crews. Field staff report the amount of work done but do not systematically survey and report highway conditions. As a result, ADOT central office cannot compare highway conditions Statewide to direct resources to areas and activities of greatest need.

ADOT should consider adopting some methods used in other states. Florida and Ohio have supplemented their maintenance management systems by developing systematic approaches to evaluating maintenance conditions throughout their highway systems. Both states have developed condition standards. For example, one Florida standard requires that shoulders have no more than a 3 inch drop-off. Another standard requires that potholes be no greater than 1.5 square feet in area and 1.5 inches deep. Both Florida and Ohio send observers into the field each quarter to test for compliance with their standards.

**Central Office Needs To Strengthen Its Oversight
Of The Maintenance Function** (see pages 31 through 35)

Central office needs to strengthen its Statewide oversight of the maintenance function. Upper management, which oversees district operations, needs to take a greater interest in maintenance management. The Deputy State Engineer of the Highway Operations Group, who oversees district operations, does not review any reports prepared by the Maintenance Section of the central office. The Maintenance Section prepares and allocates the budget and oversees the maintenance management system; however, it has no line authority over district maintenance operations. As a result, Statewide oversight and enforcement is lacking. Deviations in field performance, such as an org that performs 100 percent less work on an activity than was planned, are not routinely pursued to determine if problems exist and corrective action is needed.

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INTRODUCTION AND BACKGROUND

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Transportation in response to a July 26, 1985, resolution of the Joint Legislative Oversight Committee. This performance audit was conducted as part of the Sunset Review set forth in Arizona Revised Statutes §§41-2351 through 41-2379.

This is the third of several reports to be issued on the Arizona Department of Transportation. The report focuses on the Highway Maintenance Section of the Highways Division of ADOT.

The Highway Maintenance function's goal is stated in the Highway Maintenance Management Manual.

" . . . the preservation, upkeep, and restoration of roadways, structures, landscaped areas, and facilities to, as near as possible, their original condition of construction, or subsequent improvement, in the most efficient and economical manner."

To meet this goal, ADOT performs numerous maintenance activities including maintenance of paved surfaces, unpaved surfaces, unpaved shoulders, vegetation, roadsides, rest areas and landscapes. Maintenance crews also handle snow and ice control, traffic signing and striping, and materials processing. Major highway maintenance projects such as pavement overlays or reconstruction are generally performed by private contractors through the Construction Section of the Highways Division.

Staffing And Budget

For fiscal year 1986-87, ADOT had 793 maintenance staff allocated Statewide. Maintenance staff are assigned to specific organizations (orgs) throughout the State. ADOT has 66 maintenance orgs, which are: 46 roadway orgs, eight sign and stripe orgs, seven landscape orgs, one pump org, and four area orgs.

Monies for highway maintenance are appropriated from the State Highway Fund. Expenditures for highway maintenance for fiscal years 1984-85 through 1986-87 are presented in Table 1.

TABLE 1
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY MAINTENANCE EXPENDITURES
FOR FISCAL YEARS 1984-85 THROUGH 1986-87

(Unaudited)

| | <u>ACTUAL</u> <u>1984-85</u> | <u>ACTUAL</u> <u>1985-86</u> | <u>ESTIMATED</u> <u>1986-87</u> |
|-------------------------------|---------------------------------|---------------------------------|------------------------------------|
| FTEs | 754 (1) | 760 (a) | 793 |
| Personal Services | \$13,971,077 | \$14,374,375 | \$16,143,460 |
| Employee Related Expenditures | 3,989,588 | 3,906,663 | 4,442,040 |
| Professional Services | 63,972 | 0 | 0 |
| Travel | 256,800 | 255,410 | 290,000 |
| Other Operating Expenditures | 1,294,062 | 1,492,965 | 1,405,100 |
| Materials | 6,867,025 | 9,965,360 | 10,005,700 |
| Equipment | 14,938,061 | 13,158,595 | 15,305,600 |
| Contracting | 1,344,203 | 2,036,614 | 2,623,600 |
| Contingency | <u>137,330</u> | <u>81,184</u> | <u>668,700</u> |
| Total | <u>\$42,862,118</u> | <u>\$45,271,166</u> | <u>\$50,884,200</u> |

(a) FTEs projected for fiscal year.

Source: Maintenance Planning Services staff's financial reports and State of Arizona Appropriations Reports.

In the early 1970s, ADOT management determined that greater control over the maintenance program was needed. To ensure cost effective management of resources, ADOT contracted with Jorgenson and Jorgenson Associates, Inc., for the development of the Performance Controlled system, called PeCos. PeCos was implemented in 1971 and is still used to plan, budget and control ADOT's maintenance allocation.

Scope Of Audit

Our audit of the Department of Transportation's Highways Division was limited to the routine maintenance function within the Highway Maintenance Section. The report presents findings in the following areas.

- Whether more maintenance activities should be contracted out,
- The adequacy of the Highway Maintenance Management System for planning, budgeting and controlling work,
- The need to establish a method for evaluating district maintenance conditions, and
- The adequacy of central office's role in maintenance management.

Limited time was devoted to addressing the 12 statutory sunset factors. Sunset factors will be addressed on a Departmental basis at the completion of the series of ADOT audits.

The audit was conducted in accordance with generally accepted governmental auditing standards.

The Auditor General and staff express appreciation to the Director and staff of the Department of Transportation for their cooperation and assistance during the course of our audit.

FINDING I

ADOT SHOULD CONTINUE TO EXPAND ITS CONTRACT MAINTENANCE PROGRAM

ADOT should expand its contracting of routine maintenance activities. The contract maintenance program has shown that contractors are able to perform some maintenance activities at a lower cost than ADOT, while providing an improved level of service. In calendar year 1986, the contracting program saved ADOT approximately \$1.2 million. Because of the success of the program, ADOT should evaluate the feasibility of contracting additional areas, and request additional resources for contract administration.

Legislative Interest In Contracting

In 1981, a technical advisory committee was requested by the Legislature to conduct a study of the feasibility of a contract maintenance program. The committee, which included representatives of the business community, construction industry, local and county government and ADOT, issued a report in 1982 which recommended that six activity categories be considered for the pilot contracting program. These categories were: asphalt patching with premix, crack sealing, swath machine mowing, litter pickup, urban curb sweeping and landscape maintenance. The committee also recommended that guardrail and rest area maintenance be studied for contracting feasibility.

In 1986, the Maintenance Section of the Highways Division had 48 maintenance contracts in effect, worth more than \$2.5 million. The contracts range from \$780 for trash collection in Cordes Junction to \$400,310 for landscape maintenance in Phoenix. The following table summarizes the 48 contracts in effect during 1986.

TABLE 2
MAINTENANCE CONTRACTS IN EFFECT FOR FISCAL YEAR 1986

| <u>Activity</u> | <u>Number of Contracts in Effect</u> | <u>Contract Amount</u> |
|-----------------------------|--|----------------------------|
| Rest Area | 24 | \$ 895,521 |
| Landscaping | 4 | 660,063 |
| Sweeping | 4 | 347,245 |
| Mowing | 3 | 252,291 |
| Mechanical Debris Retrieval | 1 | 164,320 |
| Litter Pick Up | 4 | 101,611 |
| Pumping | 1 | 48,000 |
| Picnic Area | 3 | 28,452 |
| Building Demolition | 1 | 7,950 |
| Maintenance Yard Sanitorial | 1 | 4,116 |
| Trash Service | <u>2</u> | <u>2,820</u> |
| Total | <u>48</u> | <u>\$2,512,389</u> |

Source: "Highway Maintenance by Contract, a four year experience, 1983-1987,"
Maintenance Planning Services.

**Program Saved More Than
\$1.2 Million In 1986**

The contract maintenance program has demonstrated that contractors are able to perform some maintenance activities at a lower cost than ADOT. In 1986, the contracting program saved approximately \$1.2 million. Contracted activities have, in some cases, also resulted in a better level of service.

Significant savings - As the number of maintenance contracts has increased, so has the amount of cost savings for ADOT. ADOT determines its cost savings by comparing the contractors costs to complete an activity to its costs to perform the same activity. ⁽¹⁾

(1) Contractors generally bid on a cost per unit (i.e., \$20 per swath mile for mowing or \$10 per curb mile for curb sweeping). The total cost is the cost per unit multiplied by the total number of units to be completed per the contract. ADOT's maintenance contract administrator derives ADOT's cost per unit and total cost to perform an activity from maintenance expenditure reports. The maintenance expenditure reports reflect fiscal year expenditure estimates, by activity, for labor, equipment and material.

Contracting of maintenance activities appears to have been cost effective. Savings from contracting have increased by more than \$1 million since 1983, as shown in Table 3. For 1986, the cost savings from contracting totalled approximately \$1,277,415.

TABLE 3
CONTRACT SAVINGS FOR
CALENDAR YEARS 1982 THROUGH 1986

| <u>Calendar Year</u> | <u>Estimated ADOT Cost</u> | <u>Contract Cost</u> | <u>Approximate Savings (a)</u> | <u>Savings as a % of Estimated ADOT Cost</u> |
|----------------------|----------------------------|----------------------|--------------------------------|--|
| 1982 & 1983 | \$1,267,831 | \$1,073,039 | \$ 194,792 | 15% |
| 1984 | 1,744,873 | 1,260,598 | 484,275 | 28 |
| 1985 | 2,987,001 | 2,074,155 | 912,846 | 31 |
| 1986 | 3,777,738 | 2,500,323 (b) | 1,277,415 | 34 |

(a) Actual cost savings may be 5 to 10 percent less to account for overhead costs to administer the contract program.

(b) This figure excludes two contracts, totalling \$12,066, for which no ADOT data were available to make a cost saving comparison.

Source: "Analysis of "Highway Maintenance by Contract, a Four Year Experience, 1983-1987, " Maintenance Planning Services.

According to the Deputy State Engineer of the Highway Operations Group, the main reason contractors are able to perform some activities at a lower cost than ADOT is labor expenses. ADOT maintenance employees are paid an average of \$14.45 an hour, including employee related expense (ERE), no matter what activity they perform. Maintenance staff are assigned many different types of activities to perform, with varying skill levels required. For example, a maintenance employee may be assigned to pick up litter one day and repair a guardrail on another day. Contractors, on the other hand, are able to hire employees to perform a specific activity. Depending on the activity, the contractor is often able to hire employees at a much lower hourly rate. The following table shows the difference between ADOT and contractor labor costs.

TABLE 4
CONTRACTOR VS. ADOT LABOR COST COMPARISON

| <u>Contract Type</u> | <u>Avg. Hourly Wage (a)</u> | <u>% ERE</u> | <u>Total Hourly Wage (b)</u> |
|----------------------------------|-----------------------------|---------------|------------------------------|
| Contractor | | | |
| Sweeping | \$7.75 | 27% (c) | \$9.92 |
| Mowing | 6.50 | 0 | 6.50 |
| Rest Area | 5.58 | 0 | 5.58 |
| Litter Pick Up | 4.75 | 0 | 4.75 |
| ADOT - ALL ACTIVITIES | \$11.32 | 27.68% | \$14.45 |

(a) Hourly wages are estimates based on wages reported by selected contractors who were available and willing to provide information. The number of employees at each salary level was not provided.

(b) Includes employee related expenses

(c) ERE is estimated based on ranges provided by two contractors.

Source: Interviews with six maintenance contractors who have current contracts with ADOT.

Better work methods may also contribute to contractors' lower operating costs. This factor is evident in an evaluation done on the swath mowing contract in District 3 in 1983. This contract was for mowing more than 4,000 miles of roadside grass and vegetation, and proved to be cost effective with a better overall result. Mechanical breakdown has always been a problem with ADOT mowing equipment, particularly the slow turnaround time on repair and the subsequent loss of productivity. During the course of the contract, the contractor also experienced numerous equipment problems. However, the contractor's mowing equipment was supported by a service truck with the capability to make on-the-spot repairs, which minimized downtime.

Better service is provided - In addition to cost savings, contracting has also resulted in better service in some cases. ADOT maintenance contracts are limited to specific activities, and clearly indicate the amount and frequency of work to be performed. The contractors must meet the contract requirements, or risk not being paid. ADOT, on the other hand, is responsible for numerous maintenance activities with differing priorities. Because of limited resources and varying priorities, some activities do not get accomplished. In addition, there is no financial incentive to ensure that work is completed. As a result, contractors have generally provided an improved level of service. All contracted work is inspected for compliance with the contract specifications and approved by ADOT personnel before payment is made. The following case examples highlight some of the benefits that can be obtained through contracting.

- Case 1 - ADOT contracted swath mowing in District 3 in 1983. In 1983, 286 more miles were mowed than were planned. The contractor was able to achieve 107 percent of planned activity, while the previous year under ADOT only 74 percent was achieved. It was observed mid-term in the contract that the roads looked better because there were no longer intermittent sections of mowed and unmowed shoulder. The current contract for this activity calls for 3,337 swath miles to be mowed, at a cost of \$22.50 per mile for mountainous terrain and \$20 per mile for flat terrain. ADOT's average cost per mile for mowing is \$25.51. Overall, the contract represents a savings of more than \$17,000 over what it would cost ADOT to do this activity.
- Case 2 - ADOT contracted urban curb sweeping in District I during 1983. The level of service set forth in the contract called for 20 sweepings on 153.3 curb

miles, or 3,066 total curb miles. Midway through the contract, District Management decided that the contractor was performing more than adequately, and the decision was made to increase the sweeping frequency by 38 percent, or 1,173 curb miles. This was still less costly than having an ADOT crew perform the work on the original 3,066 curb miles. The current contract for this activity represents a savings of nearly \$60,000 over ADOT's cost.

Contracting Program Should Be Expanded

Because contracting of routine maintenance activities has proven cost effective while providing an improved level of service, expansion should be encouraged. Contracting has considerable untapped potential. However, ADOT management has not committed sufficient resources to contracting and does not systematically review all contracting possibilities.

Contracting has untapped potential - Although ADOT has contracted some routine activities, the contracting program has not realized its full potential. According to a survey conducted by the Transportation Research Board (TRB), Arizona ranks about average among states in the number and extent of maintenance activities contracted. ADOT currently has contracts in force for six major activities. Several states, however, have successfully contracted out numerous additional activities. Massachusetts, Pennsylvania and Texas all contract more than 20 activities. Twenty states have more extensive programs than ADOT in both number and percentage of activities contracted. ⁽¹⁾

Of the agencies that responded to the TRB survey, 70 percent indicated that they found contracting to be cost effective, and 64 percent indicated that they were satisfied with both the quality and quantity of work completed by the contractors. Some of the benefits these agencies see from contracting include: the ability to complete more work at a lower cost, greater success in meeting schedules, elimination of the need to purchase and maintain specialized equipment, the flexibility to reassign staff to other work, and the potential to accomplish work that otherwise wouldn't be performed.

(1) In Arizona, Pima County contracts more than 20 activities, and its contract expenditures constitute almost 50 percent of its total maintenance budget. By contrast, ADOT's contract expenditures are approximately 5 percent of its total maintenance budget.

Maintenance planning staff and district personnel have identified numerous activities to consider for contracting. Many of these activities are currently contracted by other states. The following table highlights some of these activities. In addition to the activities indicated in the table, ADOT personnel have recommended contracting of crack filling, blading unpaved roads, tumbleweed disposal, annual fence inspection and routine fence maintenance.

TABLE 5
OTHER STATES' ACTIVITIES NOT CONTRACTED BY ADOT

| <u>Activity</u> | <u>Number of States</u> |
|------------------------------|-------------------------|
| Roadway Striping | 19 |
| Hand Patching/Premix | 17 |
| Material Supply | 14 |
| Guardrail Repair | 14 |
| Snow/Ice Removal | 14 |
| Shoulder Maintenance | 10 |
| Culvert Cleaning | 5 |
| Unpaved Shoulder Maintenance | 4 |

Source: "Maintenance Activities Accomplished by Contract," National Cooperative Highway Research Program-Synthesis of Highway Practice 125, Transportation Research Board, July 1986.

Reasons for limited contracting - ADOT's expansion of the contract program is limited. ADOT lacks sufficient resources to effectively administer the contracting program. In addition, ADOT lacks a mechanism to ensure that possible areas for contracting are identified and evaluated.

Resources for maintenance contract administration are very limited. Currently, ADOT has only one full-time employee for this function. Some responsibilities of the position include: negotiating extensions for expired contracts, selecting the panel and evaluating bid proposals, encumbering funds for each contract, answering inquiries about contracts, and monitoring expenditures of all contracts. Because the Contract Administrator has extensive responsibilities, he is unable to even evaluate all district requests for contracting.

The Maintenance Planning Section requested an additional position for both fiscal years 1986-87 and 1987-88 to assist in contract administration. However, the budget request, totalling \$47,500, was denied by ADOT management each time.

Funding an additional position for contracts administration would be cost effective. The Contract Administrator has received 21 contract requests from district and area staff that he is unable to process. These requests represent more than \$1.6 million worth of work. From 1983 through 1986, ADOT averaged approximately 27 percent in savings from maintenance contracting. If ADOT processed the current requests and realized only a 10 percent savings on these additional activities, the savings would total \$160,000.

ADOT's lack of a mechanism for identifying possible contracting areas may have limited growth of the contracting program. Currently, areas for contract review are generated by both district personnel and the central office Contract Administrator.

ADOT would benefit from a process whereby all maintenance activities were systematically reviewed for contract feasibility. As discussed previously, other states contract several activities not contracted by ADOT. Experience in contracting government services at the Federal level shows that: (1) a systematic review of activities is needed, and (2) legislation may be needed to require agencies to conduct such reviews. The Federal government, through OMB Circular A-76,⁽¹⁾ states that for an agency to have a successful contracting program, all activities that could benefit from competitive cost comparison must be analyzed. Such analysis may not occur, however, without a legislative requirement to do so. In 1978, 1981 and 1986, the U.S. General Accounting Office studied the Federal A-76 program and recommended that Congress enact legislation to require agencies to fully implement A-76.

RECOMMENDATIONS

1. ADOT should immediately assign additional staff to the maintenance contracts administration function to allow all current requests for contracting to be evaluated. Additional staff should be added, as necessary, as the number and type of contracts increase.
2. ADOT should continue expanding its contract maintenance program by identifying additional activities that would be cost effective to contract out.
3. The Legislature should consider establishing a technical advisory committee (similar to the 1981 committee which included ADOT officials, private contractors and other knowledgeable persons) to conduct a systematic review of all maintenance activities to identify other activities that may be feasible to contract.

(1) The Office of Management and Budget circular A-76, "Performance of Commercial Activities," provides a means for examining the multitude of government activities that are also performed in the private sector, determining the most economical way to perform those activities, and implementing those procedures. Federal agencies are required to review their in-house commercial activities and determine the least costly means of providing these services.

FINDING II

ADOT'S SYSTEM FOR PLANNING, BUDGETING AND CONTROLLING HIGHWAY MAINTENANCE CONTINUES TO NEED SIGNIFICANT IMPROVEMENT TO MEET CENTRAL OFFICE AND FIELD MANAGEMENT NEEDS

Despite its \$720,000 annual cost, ADOT's automated management system for planning, budgeting and controlling highway maintenance, called PeCos, does not work as intended. PeCos does not provide adequate management support to ADOT's central office Maintenance Section, nor does it meet field management's operational needs. ADOT, aware of PeCos deficiencies, should take steps to upgrade the system.

PeCos is intended to assist central office and field managers in planning, budgeting and controlling ADOT's maintenance allocation. The central office Maintenance Section and Maintenance Field offices are responsible for managing the annual highway maintenance program and budget. PeCos was implemented in 1971 to provide management support through an objective basis from which the maintenance program can be planned and executed. Based on a survey conducted by our Office, ⁽¹⁾ the system has annual administrative costs of approximately \$720,000 for PeCos related activities. Thus, ADOT has made a substantial financial commitment to this management system.

PeCos Does Not Provide Adequate Management Support To The Central Office Maintenance Section

PeCos does not provide adequate management support to the central office Maintenance Section in developing or overseeing the maintenance program and budget. The central office's ability to plan and budget maintenance activities is limited because key elements for: (1) projecting annual maintenance requirements, (2) setting production rates for field staff, and (3) assessing maintenance costs and resource requirements are inaccurate and unreliable. Further, reports generated by the PeCos system are not very useful.

(1) An employee survey was conducted to identify the approximate annual labor costs devoted to PeCos. Maintenance staff estimated time spent on PeCos related activities. These time estimates were used with salary information to determine approximate annual costs. Survey response was 86 percent, and total costs were estimated at approximately \$720,000.

ADOT's central office Maintenance Section is responsible for preparing the annual maintenance program and budget. The Section uses the PeCos system to conduct these activities. PeCos contains several key elements that the Maintenance Section uses for planning and budgeting.

- quantity standards – These are numerical values used by Section staff to plan the field staff's annual work load for each maintenance activity.
- average daily productivity – PeCos uses work standards to plan the amount of work a crew should produce in a day.
- maintenance cost estimates – Daily maintenance costs are estimated by PeCos for each maintenance activity. The estimates are used to determine the costs for equipment, personnel and materials to conduct an activity.

Figure 1 illustrates how these elements interact and are used by the Section to plan and budget the annual maintenance program.

FIGURE 1

INTERACTION OF PLANNING AND BUDGETING ELEMENTS
Example: Swath Mowing

Quantity Standard = 2 mowings a year
Average Daily Production = 12 miles a day
Crew Day Cost = \$100
Feature Inventory ⁽¹⁾ = 1000 swath miles

2 mowings a year
x 1,000 miles needing swath mowing in a region
= 2,000 miles of swath mowing needed for that region.

2,000 total miles of needed swath mowing
+ average daily production of 12 miles a day (for a
typical maintenance crew)
= 166 crew days required

166 crew days required for the year
x daily crew day cost of \$100
= \$16,600 annual cost for swath mowing.

Source: Highway Maintenance Management System Manual.

(1) A maintenance feature is defined by the PeCos manual as a distinct feature of the roadway system for which one or more work activities will be required. Swath miles then are a "distinct feature" for which swath mowing is required to maintain a road in as near the original condition as possible.

Our office analyzed PeCos planning and budgeting elements for 12 labor intensive activities. We reviewed the quantity standards, average daily productivity and unit cost estimates for the following activities. ⁽¹⁾

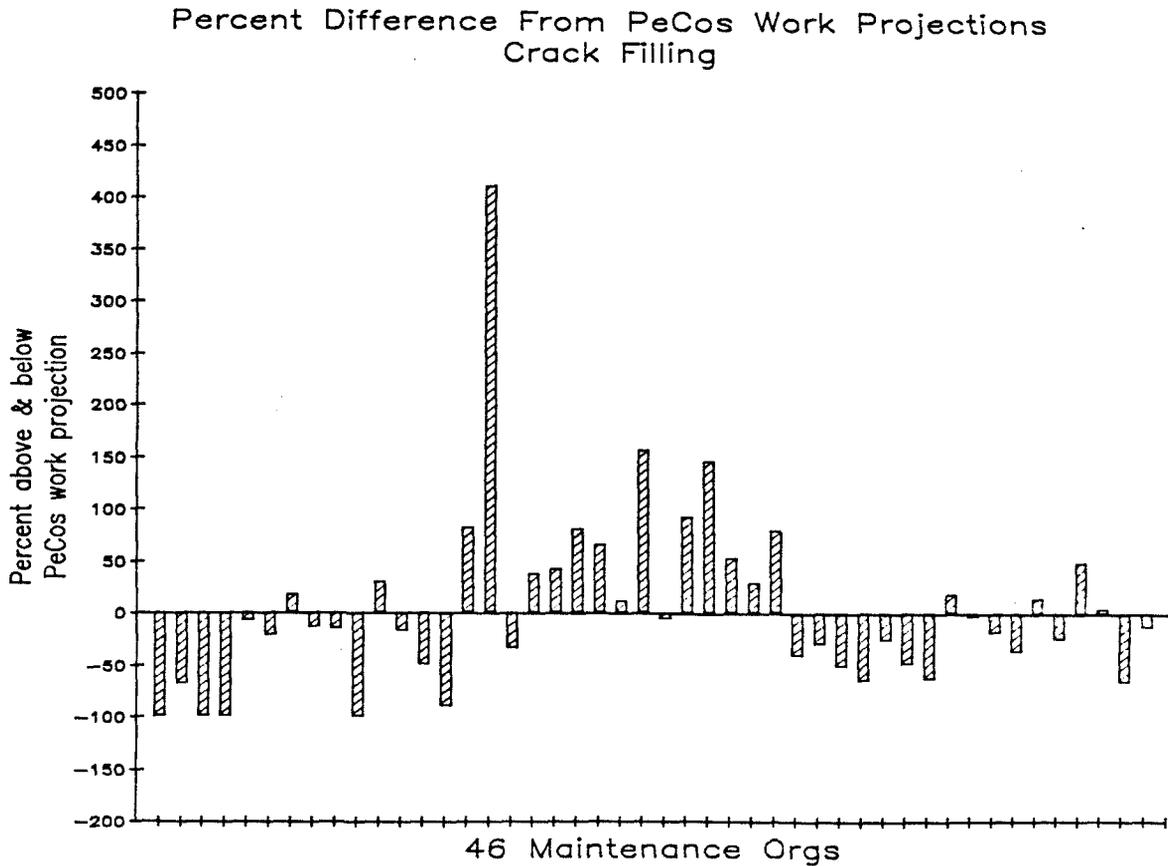
- ACTIVITY 101 - Hand Patching with Premix
- ACTIVITY 103 - Crack Filling
- ACTIVITY 131 - Blading Unpaved Shoulders
- ACTIVITY 132 - Repairing Unpaved Shoulders
- ACTIVITY 141 - Swath Machine Mowing
- ACTIVITY 146 - Tree and Brush Removal
- ACTIVITY 153 - Accident Guardrail Repair
- ACTIVITY 155 - Routine Fence Maintenance
- ACTIVITY 161 - Routine Drainage Maintenance
- ACTIVITY 163 - Clean Cuts
- ACTIVITY 306 - Manual Weed Control
- ACTIVITY 312 - Shrub Trimming

These 12 activities represent 45 percent of all labor hours controlled by PeCos.

Quantity standards - Our analysis shows that PeCos quantity standards do not adequately assist Section staff in projecting maintenance requirements. In 49 percent of the activities reviewed, work completed by maintenance staff differed from PeCos projections by more than 50 percent. Figure 2 illustrates that org accomplishments for the maintenance activity of crack filling (fiscal year 1985-86) ranged from 100 percent lower to 411 percent higher than planned by the Maintenance Section.

(1) An industrial engineer from Arizona State University was hired by our Office to help determine a useful strategy for evaluating PeCos effectiveness. He advised us to analyze these key planning and budgeting elements to determine their reliability and validity.

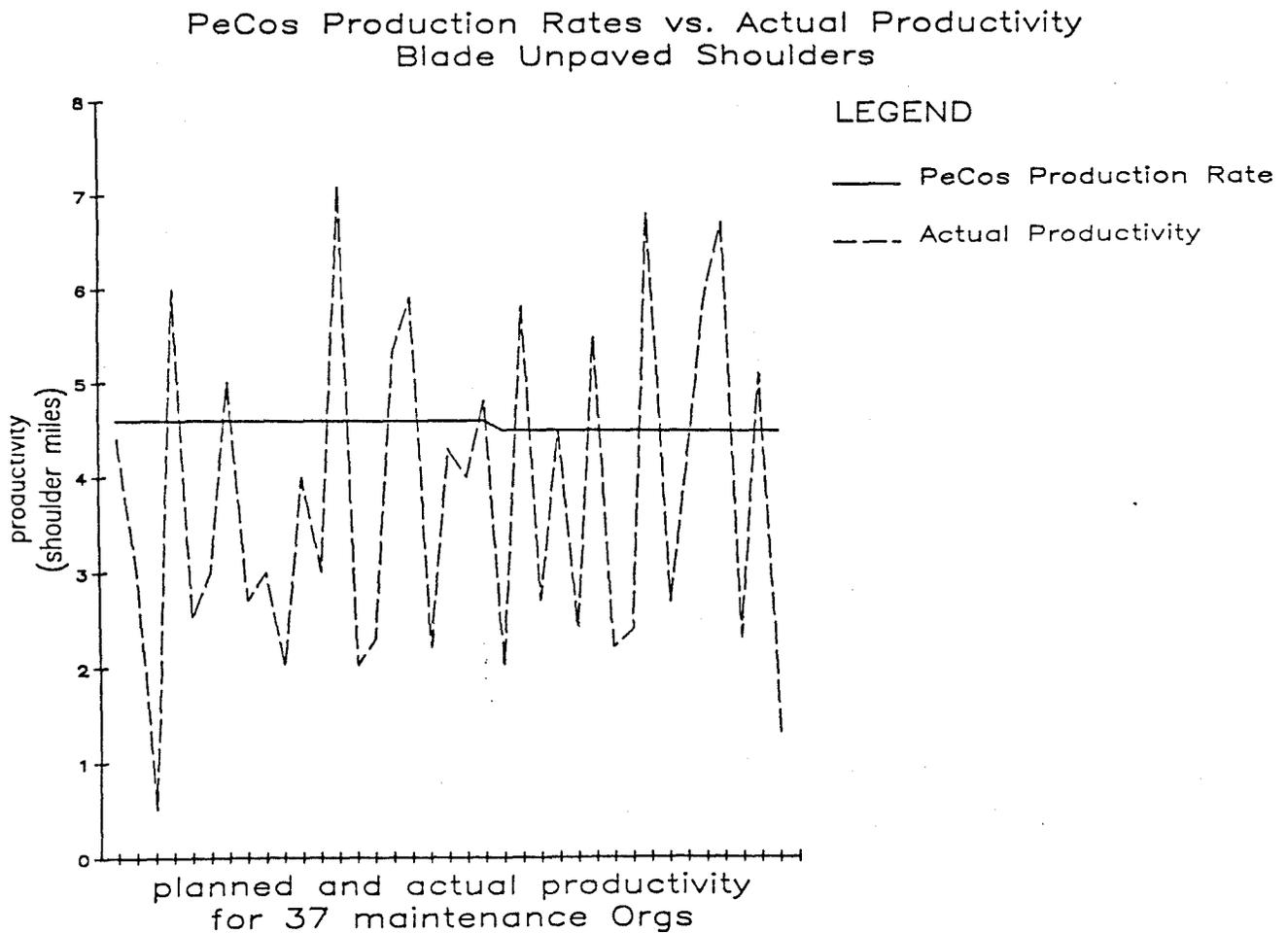
FIGURE 2



Our review of quantity standards raises serious questions about PeCos credibility as a planning tool. Quantity standards are critical to an effective maintenance management system. They are used to plan maintenance goals and objectives, and for compiling the annual work program and budget. The serious discrepancies between planned and actual work completed, uncovered by our analysis, indicate that PeCos is not providing an accurate prediction of maintenance work to be completed.

Average daily productivity - Our study indicates that production rates used by the Section to plan and budget maintenance are frequently invalid. The relationship between planned and actual production was tested to determine if differences between the two are statistically significant. For eight of 12 of the activities reviewed, differences were significant enough to conclude that actual field productivity had no relationship to PeCos estimates. Figure 3 illustrates that although daily production for blading unpaved shoulders is estimated at either 4.5 or 4.6 shoulder miles depending on the org, actual daily productivity ranged from .5 to 7.1 shoulder miles.

FIGURE 3

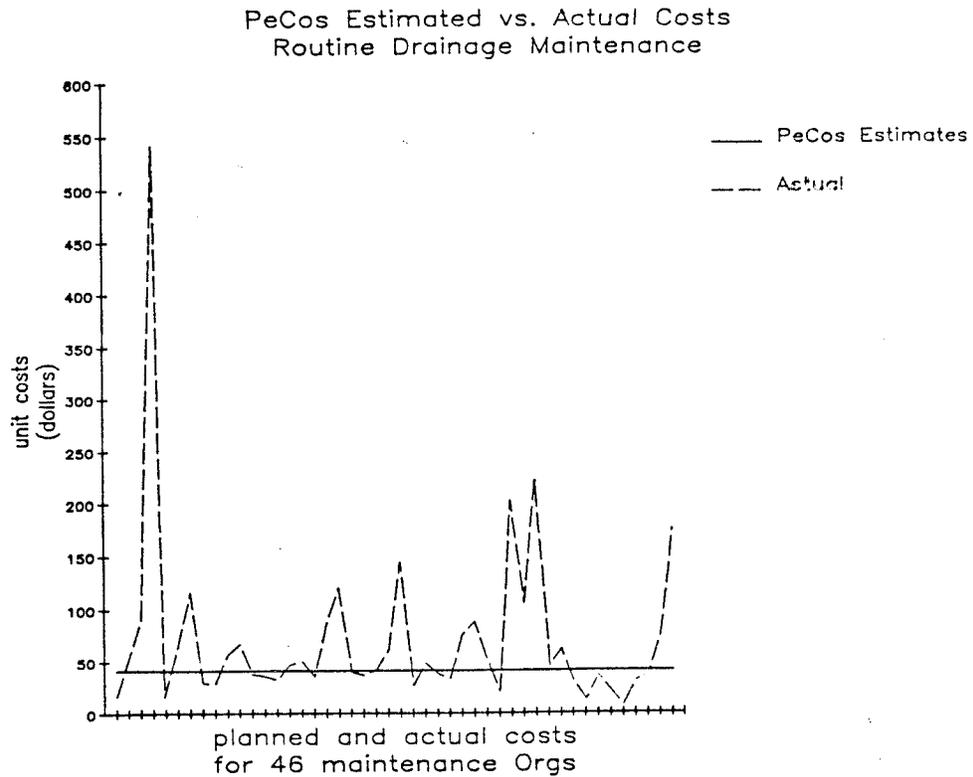


The lack of validity displayed by many of PeCos production rates seriously diminishes PeCos utility as a planning and budgeting tool. Without reliable production rates, the Maintenance Section lacks a realistic basis for determining the resources needed to perform the work scheduled in the annual maintenance program. Likewise, reliable production rates are necessary to develop a viable budget.

Maintenance cost estimates - Our review indicates that PeCos unit cost estimates, which the Maintenance Section uses to allocate maintenance monies, are also invalid. We found that actual unit costs, as reported by the PeCos system, had no relationship to PeCos estimates for 92 percent of the activities tested. ⁽¹⁾ For example, the unit cost estimate in 1985-86 for routine drainage maintenance was approximately \$41 (see Figure 4). One org, however, spent about \$542 on a unit cost basis (13 times as much money as was budgeted) to conduct this activity.

(1) Expenditures reported by the PeCos system are derived from Statewide cost averages for personnel, equipment and materials. In 1984, however, a private consultant hired by ADOT disclosed that expenditures reported by PeCos differ from the Arizona Financial Information System's (AFIS) fiscal report by "as much as 8 percent." The consultant noted that "when cost figures differ significantly, (which is frequently the case) PeCos loses credibility, since AFIS accounts for real dollars 'and the real bottom line.'"

FIGURE 4



As with the problems displayed by PeCos quantity standards and production rates, the lack of validity exhibited by most PeCos unit cost estimates tested undermines its value as a budget tool. PeCos unit cost estimates are used to calculate labor, equipment and materials costs for a standard crew day of work on each activity. Without reliable crew day cost estimates, the PeCos work program cannot be executed as intended, and significant modifications and adjustments need to be made in the field.

PeCos reports - Furthermore, the reports generated by the system are inadequate. In addition to its role in preparing and distributing the annual maintenance program and budget, the Maintenance Section is responsible for monitoring and evaluating field performance. For each maintenance org and activity, the PeCos system contains planned vs. actual work accomplished; and planned versus actual performance, in terms of average daily productivity and unit costs. However, current PeCos reports are too cumbersome to be used effectively by Maintenance Section officials. In the current format for example, a performance report, depicting the performance of 66 maintenance orgs, is hundreds of pages long and not practical for ongoing analysis. The administrator of the Maintenance Section's Planning Services Unit confirmed that the size of these reports inhibits comprehensive review.

Because PeCos planning and budgeting elements are not systematically reviewed by the central office, the deficiencies, described on page 23, go undetected by central office staff responsible for monitoring the system. Following up on deviations in standards could improve the accuracy of quantity standards used to determine annual maintenance needs, and the productivity standards and cost estimates used to determine its budget needs.

PeCos Does Not Fulfill Field Management's Operational Needs

PeCos does not meet the operational needs in the field. PeCos does not enable area personnel to effectively plan and control the work of maintenance crews.

In addition to being a management tool for ADOT's central office, PeCos was developed to provide field managers with operational support. PeCos has a similar function at the field office level that it has at the central office level. It is expected to enhance maintenance management by providing standards for maintenance planning, budgeting and control.

However, we uncovered a variety of cases which demonstrate that PeCos fails to provide adequate operational support at the local level.

- Confidence in PeCos is so low that 11 of 12 (92 percent) of the org supervisors interviewed do not use, or even consider, PeCos planned accomplishments when scheduling maintenance activities. Org supervisors emphasized that PeCos does not control the work to be done. Planned maintenance accomplishments are derived from PeCos quantity standards. The lack of attention to work planned through PeCos illustrates that quantity standards are not establishing meaningful maintenance goals and objectives.
- Field personnel do not find PeCos production standards useful for evaluating worker productivity. According to area and org officials interviewed, PeCos production rates are not sensitive to local conditions that impact productivity, such as: road condition, road class, travel time, traffic control and local terrain. Because of this imprecision, field staff often do not evaluate workers' performance based on their compliance with standards. In addition, some stated that PeCos performance reports raise too many "red flags" to follow up on. PeCos is intended to provide field managers with a means to measure actual performance against plan, and take corrective action if necessary. However, inherent flaws with the system's production rates prevent field personnel from using PeCos for this important purpose.
- PeCos specifies the annual and daily requirements for labor, equipment and materials to be used in completing the work program. According to field staff, however, very often the equipment and manpower at the orgs simply do not match PeCos specifications. For example, PeCos specified that one maintenance org needed 15 full-time equivalent employees (FTEs) to complete its work program, even though that org was only authorized to have 12 FTEs. Moreover, other orgs had more FTEs on hand than PeCos planned for. This inherent flaw of the system hinders an org's ability to comply with the work program.
- Five of the 11 area offices have developed their own procedures for tracking maintenance expenditures because PeCos does not provide effective assistance. Many field staff have lost confidence in the accuracy of PeCos expenditure reports, which are based on PeCos cost estimates. To compensate, field personnel at five area offices compile manual logs of actual expenditures based on "real" dollars. A sixth area office simply discards PeCos expenditure reports and waits for the AFIS report.

**ADOT Must Take Steps
To Upgrade PeCos**

ADOT is aware of the system's deficiencies and should take steps to upgrade PeCos. The system's defects and potential improvements have been outlined for the Department, but ADOT decided not to expend the resources to fully upgrade PeCos. ADOT should investigate its options, and move to upgrade the system.

PeCos deficiencies and potential improvements previously noted - Since 1982, PeCos deficiencies and potential improvements have been outlined for ADOT on several occasions.

- In 1984, Burke and Associates, a private consultant hired by ADOT, reported that PeCos quantity standards, performance standards, cost estimates, report formats and other related areas were deficient and required management attention. Burke presented 12 recommendations to make PeCos a more viable system. Included were recommendations that ADOT: (1) refine its quantity standards by incorporating variables such as road condition and road class; (2) refine performance standards to reconcile climactic, regional, area and org exceptions to current production rates and resource specifications; and (3) upgrade the information system to produce more effective management reports.
- In 1984, ADOT tested a procedure that could improve its capability to plan, budget and set priorities for maintenance objectives. Developed by Woodward-Clyde Consultants, this procedure is designed to systematically set Statewide maintenance service levels. At the time it was tested, a Maintenance Section official described this procedure as ". . . a logical next step . . . in [the] development of maintenance management systems.
- In 1982, the Auditor General's Office reported that PeCos was an inadequate control tool, and concluded that field personnel were not efficiently deployed as a result. At that time, we reported that worker productivity fell outside the prescribed range recommended by PeCos more than 50 percent of the time. We recommended that ADOT modify PeCos to make it a more useful evaluation and control tool.

Despite these various critiques and recommendations, ADOT has not made a concerted effort to upgrade the system. According to the administrator of the Maintenance Section, uncertain revenue projections and the preeminence of the construction program have caused upper management to treat maintenance as a secondary concern. Further, the Deputy State Engineer in charge of Highway Operations states that he has been unwilling to divert money from field operations to address problems with PeCos.

Consequently, PeCos improvements have either been postponed or addressed on a part-time basis. Two Maintenance Section Planning Services staff, for example, have been working part time since early 1984 toward implementing the Burke recommendations. Some improvements have been addressed. For example, the Section automated the feature inventory update process. However, as our analysis demonstrates, there are many more substantive problems that have not been corrected.

ADOT should explore its options and upgrade PeCos - ADOT should investigate its options and move to upgrade the system. One option is to reexamine prior recommendations made by our Office and Burke and Associates. Most of the substantive problems disclosed in those two reports have not been addressed. A second option is to review and implement Woodward-Clyde's systematic approach to planning, budgeting and setting priorities for maintenance. Finally, ADOT should evaluate innovations and new processes used by other states. We found that other states have experienced similar problems. Some states, like California and Florida, have acted, and are in the process of implementing new systems and procedures.

Additionally, ADOT needs to explore other means of overseeing the maintenance program, as a supplement to its use of PeCos. For example, in Finding III (page 27) we recommend that ADOT adopt an inspection program to assess maintenance conditions Statewide. Also, in order to better utilize PeCos information, ADOT needs to strengthen central oversight of the maintenance function (see Finding IV, page 31).

RECOMMENDATIONS

1. ADOT should examine its options and move to upgrade its maintenance management system (PeCos). ADOT's options include: (1) fully implementing recommendations previously made by our Office and its own consultant, Burke and Associates; (2) implementing the process developed by Woodward-Clyde Consultants to systematically plan and budget maintenance activities; and (3) incorporating some innovations and new approaches to maintenance management that are currently employed by other states.
2. After reviewing its options, ADOT should report to the Legislature and present its plan for improving PeCos, including total costs and a timetable.

FINDING III

ADOT SHOULD ESTABLISH A METHOD FOR EVALUATING DISTRICT MAINTENANCE CONDITIONS

To supplement its maintenance management system, ADOT needs to establish a method for evaluating the level of service being provided by maintenance field crews. Since field staff do not systematically survey the condition of district highways, central office has no means of knowing the overall condition of the highway system. Ohio and Florida, on the other hand, have developed systematic methods of evaluating maintenance conditions throughout their states.

Maintenance Conditions Unknown To Central Office

Although ADOT may know the location and quantity of work done, the Department does not have a method to determine whether maintenance needs are being satisfied. Currently, central office lacks a mechanism for capturing maintenance conditions. Field staff do perform inspections; however, these inspections do not provide the needed information to evaluate maintenance conditions Statewide.

Central office has no means of assessing the condition of the highway system. Field staff do not systematically survey the condition of district highways. In addition, management reports generated by the maintenance management system do not indicate whether maintenance needs are being met. For example, central office Maintenance Section may know that an org has been provided resources to complete 200 cubic yards of pothole patching, but if the year-end report shows that 150 cubic yards of patching was done, central office does not know whether the amount of work completed was sufficient to meet maintenance needs. Further, as discussed in Finding II (page 15), our review of planned maintenance accomplishments shows that nearly half of the maintenance orgs are performing either 50 percent more or 50 percent less than the work planned. Thus, without a condition report, central office lacks important planning information to know whether resources are being utilized effectively.

Although district, area and org personnel perform field inspections, these inspections do not currently provide the needed information to evaluate maintenance

conditions Statewide. District engineers, area engineers, area supervisors and org supervisors conduct inspections within their geographic boundaries. However, ADOT has not developed a standardized method for evaluating maintenance conditions Statewide. Because central management does not have a uniform Statewide basis for comparison, it is unable to direct resources to those roads and conditions most in need. In making budget cuts to the 1986-87 work program, central management made across-the-board, cuts to maintenance activities. Central management did not know the impact of cuts on the level of service provided.

Other States Have Developed Condition Evaluation Systems

By contrast, at least two states have supplemented their maintenance management systems by developing systematic methods of evaluating maintenance conditions throughout the state. Florida has developed a maintenance condition rating system, and Ohio has developed a recordable condition survey for assessing maintenance conditions.

Florida's maintenance condition standards - Florida's Department of Transportation has developed a maintenance condition rating system that uses condition standards to define what service levels are necessary for acceptable road conditions. For example, shoulders should have no more than a 3 inch drop off, potholes should be no greater than 1.5 square feet in area and 1.5 inches deep, and grass should be no higher than 12 inches or be mowed no closer than 4 inches. ⁽¹⁾ Florida has teams that go into the field quarterly and randomly sample the highway system, ⁽²⁾ testing for compliance with the standards. The data gathered by the teams is summarized and an overall rating is derived for each sample site. The maintenance units are expected to attain an overall maintenance condition rating of 80 out of a possible 100 points.

(1) Florida's service levels for grass vary depending on the type of highway.

(2) A computerized random site selection program is used to identify sites for the survey by section and mile post.

Florida moved to its maintenance condition rating system because of inconsistencies in maintenance decisions and problems in monitoring maintenance field staff. Florida's Department of Transportation found that field supervisors were making inconsistent decisions as to maintenance priorities, thus leading to the need for a systematic decision-making mechanism. Further, Florida's Department of Transportation found that the maintenance management system alone was not sufficient to monitor maintenance field staff performance.

Although Florida still uses its maintenance management system to show the work that needs to be done, it now evaluates its maintenance units on their ability to meet maintenance condition standards. Florida uses trained observers to inspect the condition of pavements, roadsides, drainage, traffic services and aesthetics.

The maintenance condition standard system has been beneficial to Florida's maintenance management. According to the Director of Maintenance, the new system is more simplified than relying on a maintenance management system, and it provides a more valid measure. Florida ties its budget to the maintenance condition standard system, rather than to the maintenance management system. A report on the system presented by Florida's State Maintenance Engineer indicates that the system allows the state to predict maintenance outputs and the required resources.

" . . . By having a rating system which actually measures the results of the activities performed to maintain a highway facility an agency can adjust programs and resources to either achieve a specified level of service or design a program for a particular budget allocation and predict its results."

Ohio's recordable condition survey - Ohio's Department of Transportation established its maintenance quality system in the early 1970s. Ohio has identified 15 conditions by which to evaluate its highway system. For example, there should be no more than ten pieces of litter in a tenth-mile segment. Ohio uses observers who go into the field quarterly and randomly sample the highway system, testing for compliance with the condition requirements.

Ohio observers inspect: the condition of the pavement for deterioration, obstructions, flushing (bleeding), striping deterioration and auxiliary marking deterioration; shoulders for drop-off and obstructions; guardrails for appearance and deterioration; signs for deterioration; vegetation appearance; amount of litter; culverts for obstructions and deterioration; and drainage ditches for obstructions. According to Ohio's "Recordable Conditions Manual," the purpose of the recordable condition survey is "to develop numerical data from observations and measurements using a sample of the Ohio highway system." Ohio summarizes the information into measured deficiencies versus maintenance costs, and concluded that: ". . . the study has proved remarkably flexible in showing where our maintenance dollar is going and how efficiently it is being used."

RECOMMENDATIONS

1. ADOT should consider developing a maintenance condition system to evaluate Statewide maintenance conditions.
2. ADOT should establish uniform inspection standards and reporting to be maintained by each district.
3. Central office should incorporate results of inspections into the annual planning process to ensure that resources are utilized to meet priority needs.

FINDING IV

CENTRAL OFFICE NEEDS TO STRENGTHEN ITS OVERSIGHT OF THE MAINTENANCE FUNCTION

Central office needs to strengthen its Statewide oversight of the maintenance function. ADOT's upper management is not active in maintenance management, and the authority and role of the Maintenance Section is limited. ADOT needs to strengthen its central oversight to increase enforcement and to ensure implementation of innovative district methods.

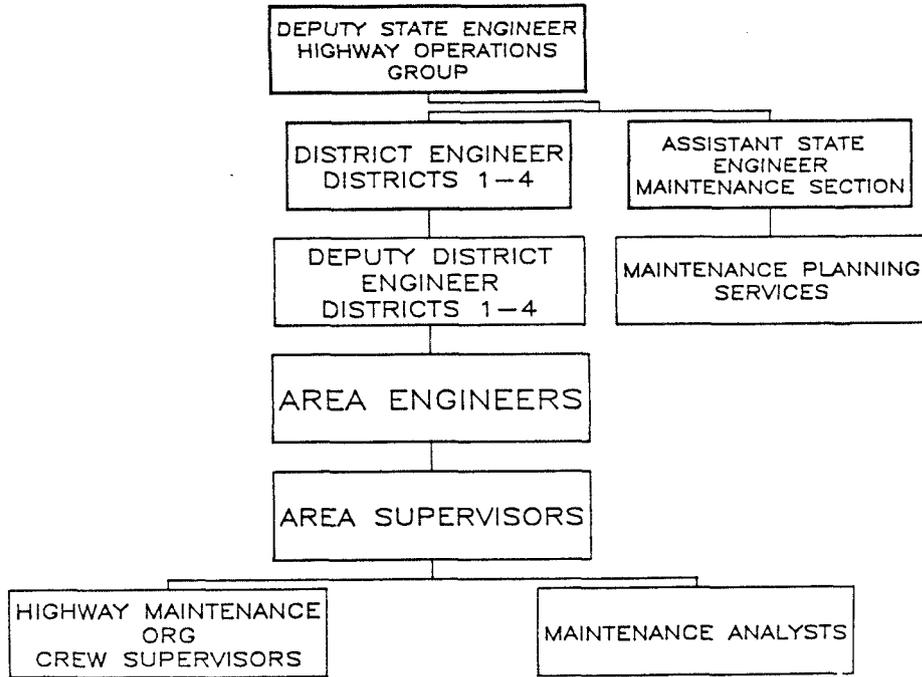
Upper Management Not Active In Maintenance Management.

Upper management, which oversees the district operations, does not take an active interest in maintenance management. The Deputy State Engineer of the Highway Operations Group does not review any management reports prepared by the Maintenance Section. He considers the monitoring of maintenance districts to be the responsibility of the Maintenance Section.

However, the central office unit devoted exclusively to maintenance has no line authority over district maintenance staff. Although Maintenance Planning Services staff prepare and allocate the budget, and oversee the maintenance management system, the staff has limited authority over the districts' maintenance staff. The Assistant State Engineer of the Maintenance Section and the District Engineers report to the Deputy State Engineer of the Highway Operations Group. Figure 5 depicts the organizational structure.

FIGURE 5

ARIZONA DEPARTMENT OF TRANSPORTATION
ORGANIZATION CHART FOR HIGHWAY MAINTENANCE



According to the Assistant State Engineer of the Maintenance Section, one result of the Section's limited authority is confusion as to the Maintenance Section's responsibility to monitor and control field performance. He indicated that since the reorganization of the department, it is difficult to identify his section's responsibility and the field's responsibility. Thus, although the section prepares detailed reports (hundreds of pages long) on the maintenance efforts of the districts, his section does not review conformance with performance standards or dictate how resources should be allocated.

Central Oversight Is Needed

ADOT needs to increase its oversight of the districts. Statewide oversight and enforcement are lacking, as evidenced by the deviations in field performance. Further, central oversight is needed to facilitate implementation of innovative methods.

Statewide oversight and enforcement are lacking - Because of limited upper management involvement and the weak role of the Maintenance Section, ADOT has limited Statewide maintenance oversight and enforcement. As indicated in Finding II, maintenance orgs experience wide variations in meeting quantity standards, cost estimates and productivity standards. For example, for the 12 activities we reviewed, nearly 50 percent of the maintenance orgs deviated from planned quantity standards by more than 50 percent. However, central office does not routinely follow up on these deviations nor review district compliance with standards. Thus, those maintenance orgs that have problems may not be identified for corrective action.

Innovative methods - Central oversight would also facilitate Statewide implementation of innovative methods that are being used in some districts. During staff visits to area offices, we found that some areas had developed unique managerial methods for maintenance that may benefit other area management. Examples of some of the practices are as follows.

- Measurable performance evaluations - Maintenance management in some areas had implemented the use of measurable performance evaluations. The evaluations based performance on the ability of the org supervisor or maintenance worker to meet predetermined goals.

- **Work control module report** - Maintenance staff in several areas have begun using a work control module report. ⁽¹⁾ The report compares labor hours planned and spent for each activity for a given month. It allows org supervisors and area management to track whether orgs are spending labor hours on the work outlined in their monthly and six-month schedules. The report was developed in one district, and has been shared among areas in the same and in other districts.
- **Crew evaluation system** - Area management in District 2, Area 2 conduct field inspections of maintenance work crews. An evaluator observes crews to determine if the crews are following safety requirements, are using the proper equipment, and are following recommended work methods. The observation is recorded on a standardized form.

Although Maintenance Section management is responsible for implementing improved methods, it could do more to evaluate unique managerial methods, and if warranted, encourage implementation of the methods Statewide. Per the Highway Maintenance Management Manual, it is the responsibility of the Maintenance Section management to "participate in the research, investigation, and adoption of improved managerial and technological development and methods applicable to solving highway maintenance problems." However, as shown in the previous examples, some managerial improvements have not been implemented Statewide. Only one of the three methods have been evaluated by the Maintenance Section and shared with other districts.

(1) According to the Burke report: ". . . the report represents a positive step toward getting org supervisors into the work control process. However, the report is not tied to the annual work program; nor does it include data on accomplishments and expenditures. Thus, it lacks all of the ingredients necessary to monitor actual performance."

RECOMMENDATIONS

1. Central Office should take a more active role in overseeing maintenance performance in the districts. Specifically, central office should compare field performance against quantity standards, productivity standards and cost estimates. Further, central office should review procedures used by field crews, and take action to either correct the standards or improve field performance.
2. ADOT should establish a system to review innovative maintenance management ideas, and if warranted, implement the methods statewide.

OTHER PERTINENT INFORMATION

During the audit we developed other information pertinent to highway maintenance. Our office conducted a follow-up analysis of our 1982 report to determine whether ADOT had increased controlled maintenance activities. We found that little progress has been made in controlling activities, since there is still a larger percentage of uncontrolled activities than controlled activities.

ADOT's maintenance activities can be categorized as either "controlled" or "uncontrolled." Controlled activities are activity categories for which the work units are expressed in quantified measures of work accomplished (e.g., swath miles mowed). Uncontrolled activities are activity categories for which the work units are the labor expended - a value equal to the resource input with no measure of highway accomplishments.

Uncontrolled activities lack a recordable accomplishment. For example, activity 168, roadway pump maintenance, has no work unit attached. This means that a crew could service one or 100 pumps, but there is no recorded measure of what was accomplished by the crew in an eight-hour day. Thus, there is no way to compare the crew's performance against any established standard, or against the crew's performance on any other workday.

A 1982 analysis of fiscal year 1980-81 labor hours showed that 48 percent of the maintenance labor hours were expended on uncontrolled maintenance activities and only 37 percent of the labor hours were expended on controlled activities. Our consultant ⁽¹⁾ analyzed the fiscal year 1985-86 labor hours to determine the progress made in controlling activities. The analysis shows that 45.7 percent of the labor hours were spent on uncontrolled maintenance, while 39.1 percent of the labor hours were spent on controlled activities. Thus, only slight progress has been made in controlling activities. The results of the analysis are presented in Table 6.

(1) Our Office contracted with Dr. Bill Moor, an Industrial Engineer from Arizona State University, to assist in our study of highway maintenance.

TABLE 6

**COMPARISON OF CONTROLLED AND UNCONTROLLED HOURS IN 1980-81
TO CONTROLLED AND UNCONTROLLED HOURS IN 1985-86**

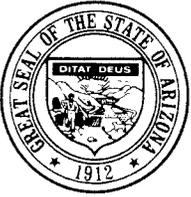
| | <u>1980-81</u> | <u>1985-86</u> |
|---|----------------|----------------|
| <u>Total Hours Expended</u> | 1,590,358 | 1,606,983 |
| <u>Controlled Hours</u> | | |
| Type A - Clear causal work units (a) | 28.4% | 31.4% |
| Type B - Quantitative work units (b) acceptable for Statewide planning | 5.6 | 7.5 |
| Type C - Fiat staffing (c) | <u>3.0</u> | <u>.2</u> |
| Total Controlled Hours | <u>37.0</u> | <u>39.1</u> |
| <u>Uncontrolled Hours</u> | | |
| Type D - No quantitative work units other than labor hours | 24.2 | 21.5 |
| Type E - Overhead, etc. (labor hours) | 9.4 | 7.7 |
| Type F - Support (labor hours) | 13.0 | 13.2 |
| Type G - Training | <u>1.4</u> | <u>3.3</u> |
| Total Uncontrolled Hours | <u>48.0</u> | <u>45.7</u> |
| Type H - Leave | <u>15.1</u> | <u>15.3</u> |
| | <u>100.1</u> | <u>100.1</u> |

Source: Arizona Office of the Auditor General, Performance Audit of the Arizona Department of Transportation Highway Maintenance System, December 1982; and 1985-86 maintenance management system data analyzed by Bill Moor, Associate Professor, College of Engineering, Arizona State University.

-
- (a) The work units counted for the activity have a clear causal relationship to the staff resource input.
- (b) The work unit count has a less clear causal relationship to the staff resource input, but is probably valid for Statewide planning.
- (c) The work unit is implicit in the activity.

According to our consultant on the 1982 audit of the Highway Maintenance Management System, ⁽¹⁾ when more labor hours are spent on uncontrolled versus controlled activities, there may be a significant under utilization of labor resources. Specifically, he reported: "It is usually taken as axiomatic that when an organization does not work to specific output goals, and this characterizes most of ADOT's highway maintenance, it is most common to achieve only 65 to 70 percent of the 100 percent feasible without undue exertion."

(1) Our office employed the services of Dr. Marvin E. Mundel, an internationally recognized authority on productivity and work measurement, for the 1982 study.



ARIZONA DEPARTMENT OF TRANSPORTATION

206 South Seventeenth Avenue Phoenix, Arizona 85007

EVAN MECHAM
Governor

CHARLES L. MILLER
Director

August 12, 1987

Mr. Douglas R. Norton
Auditor General
2700 N. Central Ave., Suite 700
Phoenix, Arizona 85004

Dear Mr. Norton:

We appreciate the opportunity to discuss your findings in "A Performance Audit of the Highway Maintenance Function" prior to the finalization of the report. We have taken this report as constructive criticism and are appreciative of the information which you have transmitted to us.

It is apparent that the comments contained in the findings are in substantial alignment with our current thinking, which is to refine and strengthen the maintenance management system. We have attached the specific responses to your report so that you will understand our views with regard to the maintenance operation. In most instances, the methods which ADOT intends to implement will, in fact, be parallel to your recommendations. It is my understanding that these comments will be appended to your final report.

Thank you again for the opportunity to make comments on the findings. I am confident our response will clarify the points you have made. These are mentioned individually in our response. Please accept my compliments to your staff for the professional manner in which they conducted themselves while visiting our agency.

Sincerely,

A handwritten signature in cursive script, appearing to read "Charles L. Miller".

CHARLES L. MILLER
Director

CLM:hlo
Att.



**ADOT'S RESPONSE TO
PERFORMANCE AUDIT OF MAINTENANCE SECTION**

FINDING I: ADOT SHOULD CONTINUE TO EXPAND ITS CONTRACT MAINTENANCE PROGRAM:

We concur with this finding.

With respect to the three specific recommendations, we have the following comments:

1. The administrative costs of the contract maintenance program must be funded from the Department's administrative budget, which also serves to fund the other various administrative needs of the agency. Department priorities have precluded the establishment of an additional position to the current budget. However, requests for the fiscal 1988-89 budget do include an additional position for the contract maintenance office, and if approved, will result in additional staff being added to that office July 1, 1988

2. In anticipation of receiving an additional FTE, we will evaluate the effectiveness of contracting for the following maintenance activities: roadway striping, hand patching, guardrail repair, snow and ice removal, shoulder maintenance, culvert cleaning, crack filling, blading unpaved roads, tumbleweed disposal, annual fence inspection, and routine fence maintenance. Those activities indicating a positive benefit/cost ratio will be made part of the contract maintenance program.

3. Should the legislature decide to establish a committee to review maintenance activities, we would be pleased to assist them in any way possible. We would note that several activities were evaluated for contract maintenance as a result of the report issued by the legislature's technical advisory committee in 1982. At that time, crack sealing, hand patching with premix, and guardrail repair did not prove to be cost effective. However, as indicated, these activities will be reevaluated.

FINDING II: ADOT'S SYSTEM FOR PLANNING, BUDGETING AND CONTROLLING HIGHWAY MAINTENANCE CONTINUES TO NEED SIGNIFICANT IMPROVEMENT TO MEET CENTRAL OFFICE AND FIELD MANAGEMENT NEEDS.

We generally agree with this finding as currently worded; therefore, we will make improvements in the system that will strengthen it and will enable it to better meet the needs of the maintenance central office and field management needs.

There is a general misconception stated in the first paragraph on Page 15 of the audit report, and that is that "PeCoS does not work as intended." In fact, PeCoS does currently work for ADOT as originally intended which was to serve as a budgeting tool to determine fiscal and manpower needs for maintenance activities on a statewide basis. Naturally, these needs are transferred down to the org level, but the emphasis from the central office has been to control the overall statewide picture. We acknowledge the need to strengthen control at the org level in the future.

We have the following comments regarding the specific recommendations:

1. As a result of the December 1982 audit of the Highway Maintenance Management System, ADOT employed Burke and Associates to review and evaluate PeCoS. Burke's work was completed in January, 1984, and included twelve specific recommendations for improving our maintenance management system. We support the Burke report, and with consultant assistance, will fully implement all twelve recommendations by July 1, 1989. We expect this effort to cost approximately \$350,000.00

2. The total costs and timetable for implementing the recommendations included in the Burke report are shown in Attachment A.

FINDING III: ADOT SHOULD ESTABLISH A METHOD FOR EVALUATING DISTRICT MAINTENANCE CONDITIONS

We partially concur with this finding.

Currently, pavement condition and pavement striping condition are surveyed on a statewide basis and the results are recorded. This information assists in the development of the annual Pavement Management Program and Pavement Striping Program. Additionally, District and Area personnel review roadway conditions and routinely report deficiencies to maintenance orgs for corrective action. Therefore, we do continuously evaluate maintenance conditions, but do not systematically document all inspections.

We have the following comments regarding the specific recommendations.

1. We will develop a maintenance condition reporting system. This will be carried out at District level and at the area level. This will enable it to be applicable to the various geographical and climatic conditions of the state. Therefore, it can be used to evaluate statewide maintenance condition and needs. The reporting system will be implemented by January 1, 1988, and the first inspection completed by July 1, 1988.

2. The above mentioned system will include the establishment of uniform inspection and reporting standards.

3. The central office does incorporate the results of inspections into the annual planning process, and will continue to do so in the future. This activity has been enhanced over the past two years through the establishment of the annual Area Maintenance Program Meeting, and will be further enhanced with the development of uniform reporting standards.

FINDING IV: CENTRAL OFFICE NEEDS TO STRENGTHEN ITS OVERSIGHT OF THE MAINTENANCE FUNCTION

We concur with this finding, but take exception to the philosophical position regarding the function of the Central Maintenance Section.

Maintenance, like construction, can best be administered at the local level. For that very reason, the Department has established District and Area offices, to oversee both maintenance and construction activities. These responsibilities are under the Deputy State Engineer - Operations. The Assistant State Engineer - Maintenance reports on an equal level with the District Engineers to the Deputy State Engineer - Operations. This is by no means unique in the various state highway and transportation departments, and we do not support any change to this reporting structure.

The Assistant State Engineer - Maintenance and his staff routinely work directly with the District, Area and Maintenance org personnel to address maintenance needs. In those instances where differing opinions exist, the matter is referred to the Deputy State Engineer - Operations for resolution.

We have the following comment regarding the specific recommendation:

1. The Maintenance Section does and will continue to compare field maintenance performance to standards and report findings to the Deputy State Engineer - Operations, and to the District and Area Engineers. Also, implementation of the Burke report will strengthen PeCoS which will inherently strengthen the central office's role in the oversight of maintenance performance.
2. In order to assist in this, and strengthen the oversight function by Central Maintenance, there has been established an Area Maintenance Superintendent position in each of the 10 Area offices. This individual is to have as his full-time responsibility the supervision of the maintenance function in his area. On a regular basis the area superintendents will meet as a committee with the Assistant State Engineer of the Maintenance Section with the following goals:
 - A. The revision of productivity standards for each maintenance activity.
 - B. The review of the maintenance program accomplishments with respect to level-of-service.
 - C. The communication of maintenance philosophy with regard to standardization for statewide continuity of work efforts.
 - D. Problem-Solving.

ATTACHMENT A.

RECOMMENDED PeCoS REQUIREMENTS;
ESTIMATED COST AND COMPLETION DATE
(To Complete Burke Recommendations)

| REFINEMENT | COST | COMPLETION DATE |
|--|------------------------|-----------------|
| 1. Feature Inventory Refinements | \$12,000 | 2/88 |
| 2. Maintenance Activity Refinements | \$0 | ---- |
| 3. Automatic Activity/ Inventory Correlation | \$0 | ---- |
| 4. Quantity Standard Update Refinements | \$22,200 | 2/88 |
| 5. Performance Standard Update Refinements | \$46,000 | 2/88 |
| 6. Work Program & Budget Field Applications | \$12,600 | 12/87 |
| 7. PeCoS/AFIS Budget Compatibility | \$26,000 | 4/88 |
| 8. Resource Description Refinements | \$30,000 | 2/88 |
| 9. Work Calendar & Resource Ident. | \$64,000 | * 6/89 |
| 10. Work Scheduling Refinements | COST AND TIME INCLUDED | |
| 11. Work Reporting Procedure Refinements | \$73,200 | * 6/89 |
| 12. Work Control Procedure Refinements | \$64,000 | * 6/89 |
| | \$350,000 | |

* The completion of these projects within the timeframe indicated is contingent upon the programming being done by means of consulting contract.