Performance Audit of

The Arizona Department of Transportation

A Review of the Maricopa County Regional Freeway System

July 2000

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DEBRA K. DAVENPORT, CPA
AUDITOR GENERAL

STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

August 1, 2000

Members of the Arizona Legislature

The Honorable Jane Dee Hull, Governor

Members of the Citizens Transportation Oversight Committee

Ms. Mary Peters, Director
Arizona Department of Transportation

Transmitted herewith is the report A Performance Audit of the Arizona Department of Transportation's Regional Freeway System for Maricopa County This audit was conducted by the consulting firm Sjoberg Evashenk Consulting under contract with the Auditor General and was in response to the requirements of A.R.S. §41-1279.03.

A response to the audit from the Department of Transportation can be found at the end of the audit report. As outlined in its response, the Department indicates that it will implement 12 of the 13 recommendations and will not implement one recommendation. The Department states that it will not reconsider revising cost estimates to reflect the estimated effects of inflation rather, ADOT has chosen to maintain the consistency of its current method that accounts for cost inflation by adjusting its revenues

This report will be released to the public on August 2, 2000.

Sincerely,

Debbie Davenport
Auditor General

Enclosure

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SJOBERG EVASHENK
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July 25, 2000

Ms. Debra Davenport
Auditor General
Arizona Office of Auditor General
2910 N. 44th Street, Suite 410
Phoenix, Arizona 85018-7243

Dear Ms. Davenport:

Sjoberg Evashenk Consulting is pleased to submit our final report for the *Performance Audit of the Arizona Department of Transportation (ADOT): A Review of the Maricopa County Regional Freeway System*. This report assesses ADOT's management over the planning and construction of the Regional Freeway System and recommends ways to improve ADOT's efficiency and effectiveness in fulfilling its overall responsibilities. Additionally, our performance audit responds to those key stakeholder concerns identified prior to the start of our review.

This report concludes that the timelines and assumptions underlying ADOT's plan to accelerate the completion of the Regional Freeway System appear reasonable and realistic, although we cannot predict with certainty that ADOT will meet their 2007 deadline. Over the last few years, ADOT has made some noteworthy strides in improving its administration and has taken positive steps to implement past audit recommendations. However, to help ADOT meet its delivery dates and stay within cost estimates for the Regional Freeway System, it could better manage and tighten controls over the system. Specifically, we found that ADOT could improve its management by closely tracking project progress, including assessing variances from milestones, and monitoring actual expenditures against initial cost estimates. Further, there is a general absence of written documentation that allows ADOT staff and management to quickly locate project information to demonstrate the achievement of key milestones. Based on our observations, we recommend that ADOT take a number of steps to improve its project management and oversight over the freeway system.

We appreciate the opportunity to have been of service to the Office of the Auditor General and it has been our pleasure to work with you. We also appreciate the cooperation we received from all those who assisted us throughout the course of our review including ADOT, the Maricopa Association of Governments, the Regional Public Transit Authority, and your staff.

Respectfully Submitted,

Kurt R. Sjoberg
Partner

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Executive Summary

In 1985, Maricopa County voters approved a transportation privilege tax (sales tax) that authorized the Arizona Department of Transportation (ADOT) to embark on a 20-year program to build a comprehensive network of regional freeways in the Phoenix metropolitan area within Maricopa County. However, early on it became evident that the Maricopa County Regional Freeway System would have to be scaled back and the target completion date extended, and that ADOT must improve internal processes and practices. In 1999, a plan was implemented to restore some projects previously eliminated and to accelerate the completion of the freeway system. Since then, ADOT has made noteworthy strides in improving its administration, but still could better manage and tighten controls over the regional freeway program.

We found that the timelines and assumptions underlying ADOT's accelerated plan of completing the Regional Freeway System appear reasonable and realistic, although we cannot predict with certainty that they will meet the 2007 deadline. Specifically, we and our engineering consultant found ADOT's nine scheduling assumptions adequately address the critical steps needed to deliver the Regional Freeway System on time, barring unforeseeable events. However, although ADOT has several day-to-day management processes in place to help meet its delivery dates, we believe additional improvements are needed.

To help ADOT meet its accelerated schedule and stay within budget, ADOT could better manage and tighten project management controls over the Regional Freeway System. Specifically, we found that ADOT's project leader or manager within individual Regional Freeway System projects do not have full authority to produce expected results, meet schedules, stay within cost estimates, and be fully accountable to stakeholders. Despite ADOT's dedication of staff and contract resources to function in "oversight" capacities over the day-to-day operational management of the Regional Freeway System, ADOT could improve its management by closely tracking project progress, assessing variances against initial milestones, and monitoring to initial cost estimates. Moreover, little documentation exists demonstrating the overall project management activities related to the major aspects of the freeway construction process. Without tightening controls, these limitations could hamper coordination of efforts, cause a divergence of plan approach, or result in forgotten agreements which could delay or increase costs of completing individual projects within the Regional Freeway System.

Because of the general absence of written documentation and the lack of focus on project-wide management, ADOT staff and management cannot quickly locate project information to demonstrate its achievement of steps or to document some project decisions. Although ADOT contends that its hands-on, team approach to managing the individual program elements has enabled it to meet delivery dates, better techniques to more closely track progress and control costs will assure that its use of taxpayer funds is maximized. Also, because many current practices rely on individual memories, any significant staff vacancies and turnover throughout the department could prove detrimental to the delivery of the system. Since ADOT officials and managers cannot predict when key personnel may leave, they should strongly emphasize and require staff to fully utilize all project management techniques, employ existing management tools such as Primavera, and document key decisions reached.

Among other things, ADOT could enhance its effectiveness by exercising widely used project management techniques. Although it has developed policies incorporating some of these techniques and has purchased expensive and sophisticated automated tools (Primavera) that would contribute to more effective management, in reality, staff has not fully implemented policies or effectively used the tools at their disposal. Rather than taking advantage of available tools, ADOT relies on institutional memory and manually prepared reports to manage projects. In effect, ADOT may be wasting some resources and unnecessarily duplicating its efforts.

In an effort to address these concerns, we found that ADOT is moving toward more fully utilizing its existing automated project management system. Specifically, ADOT management is pushing for all project managers to use the Primavera system that would allow the comparison of initial schedules and cost estimates with actual progress. This tool can provide ADOT, the governor, the Legislature, and other stakeholders with extremely useful management information. However, unless ADOT requires the universal adoption and consistent use of the automated system, such an initiative will not generate the full benefits the system can provide.

Moreover, while ADOT tracks and provides data required for its performance measurement reporting system as one of its efforts to monitor departmental progress, few of its measures directly relate to its Regional Freeway System and some of these measures are not comprehensive. For example, the department has not established measures to assess the timeliness or cost-effectiveness of its regional freeway projects even though this is a key departmental goal. Further, while we found ADOT has

adopted performance measures and appears to gather data monthly, no person is clearly assigned to follow-up on missed targets, to assure corrective action, or to assess impact of any shortfalls on the freeway projects. To make this process more meaningful and value driven, ADOT should develop more useful performance measures and follow-up on the impact of variances and measures not reaching targets.

However, ADOT has made some noteworthy improvements in recent years in its management of highway transportation projects. By implementing past audit recommendations to increase the accuracy of revenue estimates, ADOT has taken several positive steps to improve its operations over the Regional Freeway System. Additionally, ADOT has demonstrated a desire to enhance its reputation by strengthening partnerships and communication with external stakeholders in Maricopa County's transportation network.

Although ADOT is progressing toward its 2007 goal, a pending issue outside of its immediate control could impact the Regional Freeway System completion deadline. Namely, a threat of future sanctions related to air quality violations by the federal Environmental Protection Agency (EPA) could, if assessed, grind all freeway construction projects to a halt. The department, the Maricopa Association of Governments, the Arizona Department of Environmental Quality, and the Maricopa County Department of Environmental Services are closely tracking this issue.

Finally, as requested by Arizona stakeholders and the Auditor General, we investigated a variety of subject areas ranging from the accuracy of statutory revenue distributions to the feasibility of traffic modeling used on regional freeway projects. While our primary reportable issues in the stakeholder areas are discussed in Chapters 1 and 2, we address each of the requested topics separately in Appendix A.

To provide greater assurance that ADOT completes the Regional Freeway System by 2007 and to bring better accountability to Arizona stakeholders, we recommend that ADOT take a number of steps to improve its project management and oversight of the Regional Freeway System, including:

- Establishing a single project manager accountable for an entire project,

- Fully utilizing its project management system and documenting all key decisions reached,

- Comparing initial cost estimates to actual experience in design and right-of-way to improve cost controls,
- Modifying the performance measurement system to increase its value, and
- Monitoring the EPA's air quality sanctions and continuing to integrate air quality plans into all phases of highway projects.

Introduction

The Maricopa County Regional Freeway System

With the enactment of legislation in 1985, Chapter 308, Section 29, the Arizona State Legislature gave Maricopa County residents the opportunity to approve future sales tax increases designated for transportation purposes. In October 1985, Maricopa County voters overwhelmingly approved a 20-year, one-half cent sales tax increase to fund the urban highway plan for metropolitan Phoenix. Initially, the plan called for developing approximately 230 miles of freeways and expressways—collectively known as the Maricopa County Regional Freeway System.

By 1991, it was evident that revenue generated from the sales tax would be insufficient to complete the plan within the original 20-year time-period ending in 2006. With six of the 20 years elapsed, only 16 miles of the system completed, and costs escalating, the Arizona Auditor General procured a performance audit in 1991. The resulting report made numerous significant recommendations to improve the Arizona Department of Transportation's (ADOT) effectiveness in fulfilling its regional freeway program responsibilities.

Subsequently, progress on the Regional Freeway System continued to suffer. By 1995, the original plan needed to be altered by markedly reducing the scope of the overall program and expanding funding options. At the prompting of the Governor, the Maricopa Association of Governments adopted a plan to scale back the original system by 37 percent from 230 miles to 144 miles of freeway and remove three freeway corridors. Other reductions included the elimination of certain highway lighting and landscaping projects. Further, the timeline for completing the freeways was pushed back to 2014.

Recently, a cooperative effort among ADOT, the Maricopa Association of Governments, the Governor, the Legislature, and the business community reenergized the freeway program. Specifically, a plan was developed in 1999 to restore some projects eliminated in 1995 and to accelerate the completion of the Regional Freeway System program by seven years from 2014 to 2007. Innovative financing, earlier availability of funds, and increased highways monies are the driving force behind ADOT's plan to complete projects by 2007. This plan places the completion of the program only one year behind the original 2006 target.

To date, over 58 miles—or 40 percent—of the Regional Freeway System have been completed, 26 miles—or 18 percent—are under construction, and 60 miles—or 42 percent—are remaining to be completed by the end of 2007.

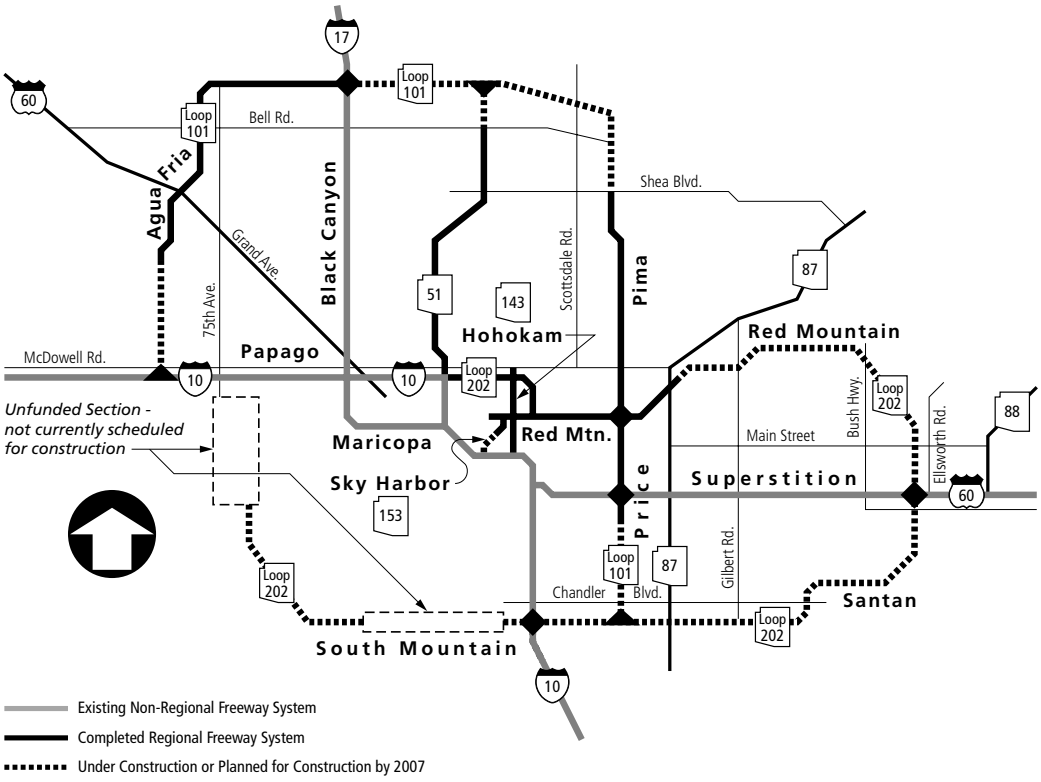

Figure 1. Regional Freeway System

Source: Arizona Department of Transportation, January 2000.

Stakeholders in Maricopa County's Transportation Network

Several entities share responsibility for the Regional Freeway System—ADOT, the Maricopa Association of Governments, the State Transportation Board, the Citizen's Transportation Oversight Committee, and the Regional Public Transportation Authority. While each entity is separate and distinct in its mission and objectives, each organization often has input and involvement on decisions made by the other entities. The desire for these entities to interact in a cooperative and coordinated manner is firmly rooted in federal regulations, state statutes, and local resolutions. Following is a brief description of each entity's mission.

ADOT

The primary role of ADOT is to provide a transportation system that meets the needs of the citizens of Arizona and to manage all state highways throughout the state—including the Regional Freeway System. This includes coordinating and completing design, engineering, right-of-way acquisition, construction, and maintenance activities. While ADOT takes the lead in construction of the Regional Freeway System, it does so with input and involvement from the Maricopa Association of Governments.

Maricopa Association of Governments

Formed in 1967, the Maricopa Association of Governments (MAG) is the regional planning agency for Maricopa County and serves as its metropolitan planning organization. MAG's decision-making body—known as the Regional Council—includes elected officials from 24 incorporated cities and towns, Maricopa County, two Indian communities, the Citizen's Transportation Oversight Committee, and ADOT. Under state statute, MAG establishes criteria and prioritizes transportation projects based on qualitative criteria such as congestion relief, travel demand, and cost effectiveness. Thus, MAG can influence the nature of the State's highway program by removing projects from the regional transportation plan or rejecting projects not conforming to air quality requirements. Once MAG identifies projects for its Five-Year Transportation Improvement Plan, it seeks input and involvement from the other transportation entities and Arizona citizens before it programs funding for individual transportation projects. MAG's power and authority—as with all metropolitan planning organizations throughout the nation—has grown under the federal Clean Air Act Amendments of 1990 and the Transportation Equity Act for the 21st century.

State Transportation Board

The State Transportation Board has statutory authority over the state highway system. It is comprised of a seven-member board appointed by the Governor and represents six geographical regions throughout the state, each member serving a six-year term. The board sets priorities over the highway system, approves the Five-Year Highway Construction Program for statewide projects, and provides final approval of Regional Freeway System projects that have been prioritized by MAG. Additionally, the board has authority to issue bonds that can be used to accelerate the completion of transportation projects.

Citizen's Transportation Oversight Committee

In counties with a population of 1.2 million or more that have approved an additional sales tax to fund transportation projects, state law provides for the establishment of a Citizen's Transportation Oversight Committee. In Maricopa County, the committee consists of seven persons, each serving three-year terms, who function in an advisory capacity on matters relating to the Regional Freeway System such as changes

to freeway priorities and major revisions to transportation plans. Also, the committee consults with the Arizona Auditor General to set parameters for required performance audits of the Regional Freeway System.

Regional Public Transportation Authority

In 1985, the Regional Public Transportation Authority (RPTA) was established along with the passage of the sales tax initiative to fund regional highway and public transportation improvements in Maricopa County. Membership is open to all municipalities in Maricopa County and to the county government. Governed by eight mayors, two council members and one Maricopa County supervisor, the RPTA was created to develop a regional transit plan and operate a regional transit system in the county. ADOT collects the proceeds from the one-half cent sales tax and is required to annually transfer an amount specified in statute to the RPTA for public transportation projects.

Funding of the Regional Freeway System

Although projects on the Regional Freeway System are funded from a variety of sources, nearly 75 percent of the funding comes from the Maricopa County transportation excise tax and the Highway Users Revenue Fund. Innovative funding measures such as the State Infrastructure Bank and Grant Anticipation Notes comprise over 14 percent of available monies.

- **The Maricopa County Transportation Excise Tax** – This is a one-half cent sales tax pursuant to House Bill 2306 and approved by the Maricopa County residents on October 8, 1985, specifically for building the Regional Freeway System. All tax collections flow into the Regional Area Road Fund. The excise tax commenced on January 1, 1986 and will end on December 31, 2005. In 1998, the half-cent sales tax generated over $209 million and in 1999 nearly $230 million.

- **The Highway Users Revenue Fund (HURF)** – Under provisions of Arizona Revised Statutes Title 28, Sections 6538 and 6540 and State Transportation Policy, Maricopa County receives a portion of state revenues generated from motor vehicle taxes and fees for the construction of controlled access freeways in the county. Over the past four years, allocations total approximately $50 million annually.

- **State HURF Revenues** – In addition to HURF funds described above, the 1994 Governor's plan reduced ADOT's administrative budget and allocated $71.5 million of State HURF funds for the Regional Freeway System, to be used during the remaining life of the program to complete the system.

- **Bonds** – The State Transportation Board has the authority to issue bonds backed by a pledge of transportation excise tax revenues or highway user revenues. Because legislation stipulates how much certain types of bonds can be outstanding at any one time, ADOT determines if outstanding bonds are within the legal limits and if new bonds can be issued. The State Transportation Board issues bonds as needed to complete the Regional Freeway System.

  The State Transportation Board also has the authority to issue Grant Anticipation Notes (GANs) which are notes backed by a pledge of future federal funds. This allows the state to use federal funds earlier and in advance of when they are actually earned, and thus allows the state to start projects sooner. This practice of spending money through the use of the GANs is both permissible and encouraged by the Federal Highway Administration. Although Arizona Statutes have allowed the State Transportation Board to issue these notes since 1984, it had not done so because it previously found the related federal regulations were too restrictive. However, with the recent passage of federal legislation, issuing GANs became more feasible and ADOT issued nearly $40 million in GANs on July 1, 2000.

- **Federal Funds** – Both ADOT and MAG receive direct federal assistance monies made up of Surface Transportation Projects funding and Congestion Mitigation of Air Quality funds. ADOT assigns its federal aid directly to eligible projects, while MAG has allotted up to 70 percent of its federal funding to Regional Freeway System projects. Over the last three years, ADOT has received federal funding ranging between $14 and $34 million for regional freeway projects.

- **State Infrastructure Bank (SIB) and Highway Expansion and Extension Loan Program (HELP)** – This innovative process provides the state and its communities with a financing mechanism to accelerate the funding of highway construction. Authorized by Congress in 1995, a SIB operates much like a bank by providing financial assistance in the form of loans or credit enhancement for transportation projects. HELP, Arizona's version of a SIB, was established and became effective August 21, 1998. Initially providing nearly $50 million for the Regional Freeway System, additional funding of $320 million was authorized for HELP under Senate Bill 1201 in 1999. Under current provisions, the State Transportation Board can provide loans through December 31, 2004 from the HELP fund in the following manner: 50 percent of the monies to be expended in Maricopa County, 25 percent in Pima county, and 25 percent in the other 13 counties.

The 1999 legislation also authorized the issuance of Board Funding Obligations, which allows the State Transportation Board, in conjunction with the State Treasurer's Office, to issue up to $300 million of Board Funding Obligations. Recently, the State Transportation Board designated $100 million of this funding for right-of-way purchases on regional freeway projects.

Other legislative action in 1999 appropriated $20 million annually to the HELP Fund from the state's general fund in each of the fiscal years 2001, 2002, and 2003.

- **Miscellaneous Income** – A portion of the Regional Freeway System is also funded by miscellaneous income such as interest income, third party billing, and other minor funding sources. Third party billing refers to payments from other entities for various activities during a project's life cycle such as utility companies' payments to relocate utilities or cities' funds to add enhancements to a specific project.

Figure 2 depicts the Regional Freeway System projects ADOT anticipated funding by each source between 1994 and 2007. As illustrated, the majority of funding—nearly 75 percent—is from a combination of excise tax and highway users fund revenues. A significantly lower portion of the Regional Freeway System is to be funded by "innovative measures" such as SIB loans and GANs.

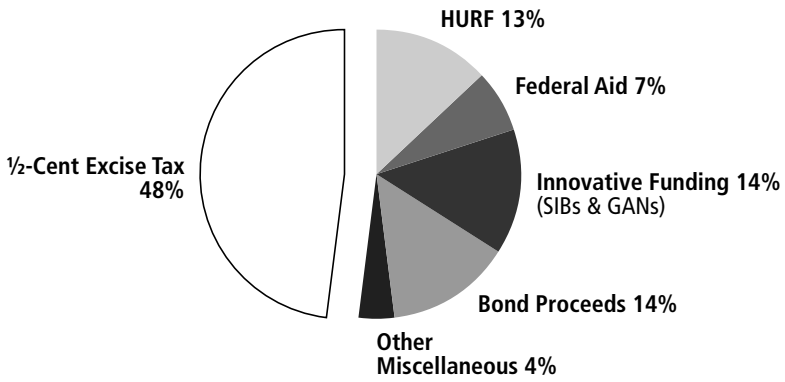

Figure 2. Regional Freeway System Funding (1994-2007)

Source: Arizona Department of Transportation's Cash Flow Forecasts.

Highway Projects: From Project Scope to Maintenance

Within ADOT, the Intermodal Transportation Division is responsible for the majority of the project development process, including all engineering, construction, and administrative functions required to advance a project from conception through design and construction, and finally, into the operation and maintenance of the project. The entire development process is generally comprised of four distinct phases—project scoping, design and pre-construction activities, construction, and operation and maintenance. As shown in Figure 3, these phases are collectively known as the project life cycle.

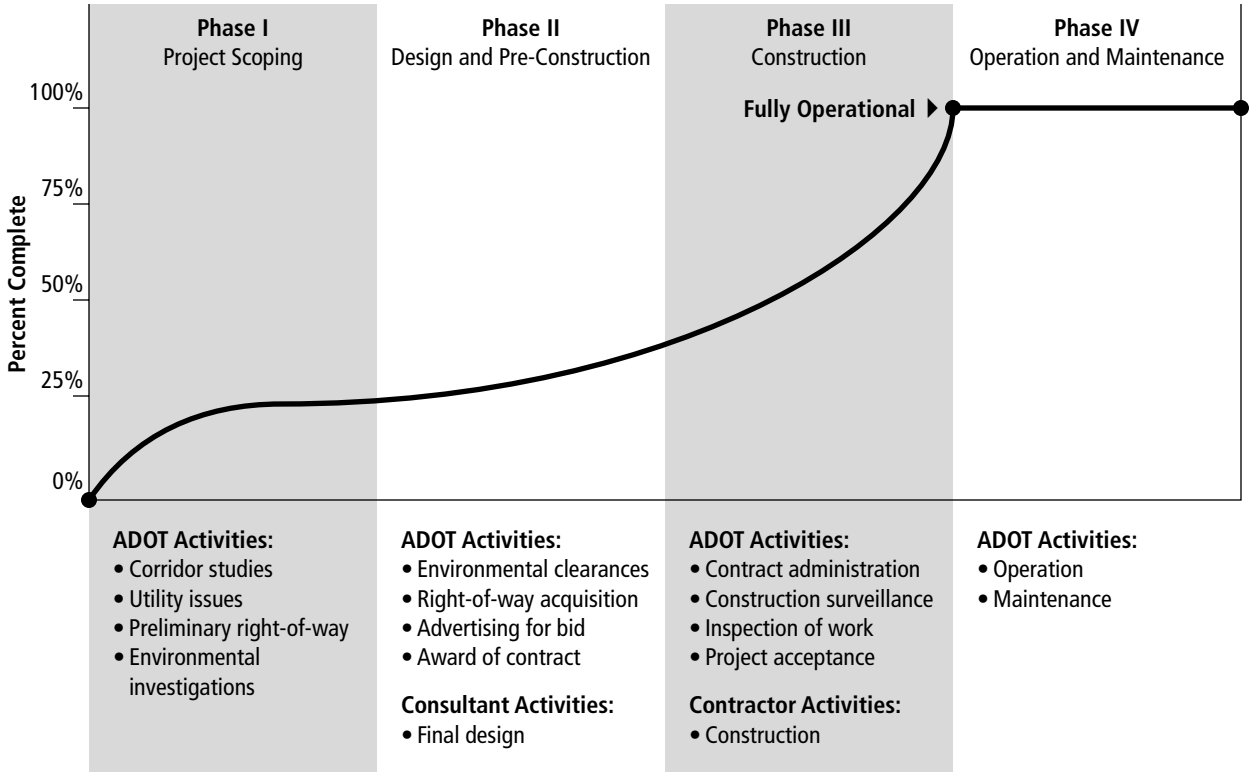

Figure 3. The Four Phases of a Project's Life Cycle

Source: Project Management Institute and Arizona Department of Transportation's Project Development Process Manual.

For the Regional Freeway System, ADOT utilizes multi-disciplinary and multi-divisional team members to guide projects through their life cycles (as depicted in Figure 4 on page 19). Day-to-day management and administrative responsibility for advancing a project through the various development phases lies with ADOT's Valley Project Management group. However, the specific responsibilities for the technical aspects of each project are distributed throughout other ADOT groups reporting to the Intermodal Transportation Division's State Engineer such as Right of Way, Roadway, Bridge, Engineering Technical, Phoenix Construction District, and Phoenix Maintenance District. Specified members of these ADOT groups, along with a project manager from ADOT's Valley Project Management and various external consultants, compose a "project team".

As an extension of its staff, ADOT hired an external general consultant who is involved in the daily issues of project design for all Regional Freeway System projects. The consultant also prepares general plans for regional freeway projects, holds progress meetings with ADOT, updates project schedules and construction cost estimates, generates monthly reports, and reviews and revises costs using recent bid prices. Moreover, ADOT frequently contracts with other external consultants and contractors to provide professional services for more detailed designs, construction activities, or other project tasks. These consultants may also serve as technical leaders and managers on the project team. Finally, once ADOT completes a freeway project and opens the roadway to the public, ADOT staff from the Phoenix Maintenance District monitors operation of the project and identifies areas where adjustments are warranted and communicates these to the design and construction staff.

Scope and Methodology

Arizona Statutes, Title 41, Section 1279.03 requires the Arizona Auditor General to conduct periodic performance audits every three years in counties that have a transportation excise tax in effect. This audit is the third in the series. One primary objective of our audit is to assess ADOT's management over the Regional Freeway System and to recommend ways to improve ADOT's efficiency and effectiveness in fulfilling its overall responsibilities. Another purpose of the audit is to review areas identified by stakeholders and address statutorily mandated issues.

We reviewed federal and state laws and regulations related to transportation, right-of-way acquisition, air quality, financing, and organizational responsibilities. Additionally, we researched existing studies conducted by ADOT, others in Arizona, and entities at the federal level on topics such as alternative transportation, traffic volume and modeling, project management, and air quality.

To understand how ADOT and other key players in Maricopa County's transportation network operate, we conducted individual interviews, focus group meetings, and public forums with a cross-section of relevant parties and interested persons including local government officials, key legislators and staff, ADOT, MAG, State Transportation Board, Regional Public Transportation Authority, Arizona Department of Environmental Quality, Citizen's Transportation Oversight Committee, Arizona trade associations, ADOT's general consultant, and citizen groups. We met with the key managers and decision-makers involved in highway projects as well as garnered the perspective of other stakeholders. Additionally, we developed and distributed over 120 surveys to assess Arizona stakeholders' satisfaction with ADOT's management of the Regional Freeway System.

To establish whether ADOT's management over the Regional Freeway System is efficient and effective, we analyzed a variety of documents including monthly project status and update reports, Life Cycle Certification Reports, and project summary reports. Additionally, we interviewed key ADOT officials and their staff to identify the tools and techniques used to manage the progress of the Regional Freeway System. We attempted to compare all baseline time milestones and cost estimates against completed dates and actual cost data, but because of ADOT's documentation practices, we were unable to fully complete the comparisons. Through interviews and review of monthly performance reports, we assessed the appropriateness and usefulness of ADOT's performance measures used to manage the freeway system. Furthermore, we contracted with Quincy Engineering, a transportation expert, to review and assess the judiciousness of ADOT's practices in areas such as project management, cost estimating, and right-of-way acquisition.

Using our transportation expert, we also ascertained whether ADOT's accelerated timelines are realistic by comparing them to existing engineering practices. Our expert also identified any time-sensitivity vulnerabilities that may exist in the timelines through his examination of design development, right-of-way, and construction schedules including the assumptions inherent within the schedules. To predict ADOT's ability to meet its accelerated schedule and future deadlines, we evaluated ADOT's past performance in meeting timelines and critical milestones. Specifically, we selected a sample of six projects—three projects currently underway and three projects that were recently completed.

To assess ADOT's revenue and expenditure practices and its forecast models, we reviewed audited financial statements, Life Cycle Certification Reports, construction cost estimate reports, revenue forecasts, cash flow calculations, assumptions behind non-traditional funding mechanisms, and various management documents used by ADOT. Additionally, we performed analytical reviews on revenue and cost estimates to evaluate past performance and project future trends. To assess the reasonableness

of cost estimates, we worked cooperatively with our transportation expert to compare ADOT's cost criteria against other state transportation departments. We also captured historical data to assess actual expenditures against estimated expenditures at a summary level. Furthermore, we attempted to evaluate ADOT's ability to meet cost estimates—from an individual project perspective—by comparing actual expenditures against estimated expenditures using our sample of six projects. However, we were unable to do so because cost estimates are revised every six months.

Finally, we were asked to review 36 areas ranging from traffic projections to air quality goals. To examine these areas, we performed a variety of audit techniques and analyzed a variety of documents. Because many of these issues were specific and not necessarily related to our primary reportable issues, we address each area in Appendix A.

Chapter 1

ADOT's Accelerated Plan Appears Realistic, But Tighter Management Controls Over the Regional Freeway System Will Help Ensure Timelines Are Met

Chapter Summary

We found that the timelines and assumptions behind ADOT's accelerated plan to complete the Regional Freeway System by 2007 appear reasonable and realistic, although we cannot predict with certainty that it will meet the deadline. Specifically, ADOT's scheduling assumptions provide adequate time to accomplish the various design, acquisition, and construction activities necessary to complete the Regional Freeway System. However, if the department does not effectively manage and control these tight schedules, delays could occur and significantly affect its ability to meet its deadline.

To improve its ability to meet the accelerated schedule and stay within cost estimates, ADOT should implement more effective project management and increase oversight of the Regional Freeway System. Although project managers have the responsibility of ensuring that a project adheres to scope, schedule, and cost parameters throughout its life cycle, they need greater authority to manage and oversee the multi-disciplinary and multi-divisional team tasked with delivering the project from initial design through construction. Presently, project managers function more as facilitators and coordinators than accountable leaders. Further, while ADOT manages the day-to-day details of a project, it could improve its high-level management oversight.

Also, despite purchasing a sophisticated computerized project management system and training staff in its use, the automated system remains underutilized and the manual system used in its place is less efficient. For example, under its current processes, ADOT does not consistently measure actual to estimated performance for meeting all critical path deadlines; there could be stronger attention to cost containment during the design phase; and there is a general absence of documentation throughout a project's life cycle. As a result, ADOT does not always know the overall program or project status in meeting key milestones with certainty or specificity. In addition, ADOT should more rigorously coordinate records and supporting documentation for assisting development phase decisions and tracking project status.

In practice, we find ADOT relies heavily on institutional knowledge. Their under-utilization of high-level project management tools is troublesome since there are significant vacancies throughout the department. As a result, ADOT may be wasting these resources and duplicating its efforts. We also noted that performance measures could be improved to be more useful and meaningful to the users. While the department's measurement system has positive and useful aspects, ADOT could improve it by instituting explicit follow-up mechanisms and establishing more relevant measures. Furthermore, cost information could provide the detail and specificity needed to better control costs and manage projects. With greater attention to improve controls and to fully utilize management tools, ADOT can better ensure that it monitors costs, uses effective processes, provides public accountability, and meets its promised deadlines.

Finally, although somewhat outside of ADOT's control, federal air quality sanctions could negate much of the department's endeavors to meet its regional freeway deadlines. These future sanctions, if mandated by the federal Environmental Protection Agency, could halt progress on freeway projects entirely.

Although Established Timeframes are Generally Realistic, Some Enhancements May Help Minimize Delays

The entire Regional Freeway System program was intended to be complete within 20 years, but in 1995, the program was extended an additional nine years to 2014. Then, with passage of legislation in 1999 providing innovative financing alternatives, the timeframe was accelerated to a 2007 completion goal realigning the system with the original 20-year plan. After obtaining input from various stakeholders, ADOT established its plan to attain the earlier completion target that is premised on several schedule and financial assumptions. We found these assumptions and the related timelines reasonable and realistic. To achieve its goals, ADOT laid out the following nine schedule assumptions that it deemed critical.

- Improved project delivery system
- Early completion of general plans
- Early acquisition of right-of-way
- Completion of environmental corridor studies
- Availability of consultant and contractor resources
- Maintaining core staff for system delivery
- No major design changes after completion of 30 percent plans
- Support of major stakeholders including cities, county, federal agencies and utility companies
- Availability of design-build contracting

In addition, ADOT developed a generic project schedule that ultimately became the framework behind the accelerated plan that it states is based on ADOT's historical experience in managing projects. To schedule the remaining projects that must be completed to achieve the 2007 delivery date, ADOT placed each into the framework and established general milestones to be met in order to minimize delays. For example, the schedule provides that each project's design process must be developed within 18 months, right-of-way must be acquired within 18 months, and construction must be completed within 24 months. ADOT believes that the framework is flexible enough to fit particular needs of individual projects. Although we agree that the schedule provides room for some delays to occur, too much could negatively impact the timely delivery of the overall Regional Freeway System program.

Together with our engineering consultant, we reviewed the above timelines and compared them against industry practices. Although the generic timelines appear adequate to allow various activities to be accomplished within the time provided, some areas could experience delays if not controlled properly.

To minimize delays, two areas where ADOT can improve the value and usefulness of its timelines are the environmental process and right-of-way acquisitions. The environmental clearance process for individual projects involves a variety of parties and circumstances and can negatively impact the timing of the entire project schedule. Although not specifically addressed in the timelines, ADOT contends that time for environmental processing is embedded in the design phase. Despite its assertion, some of the documents our consultant reviewed indicate that final environmental clearance had not been obtained on the remaining regional freeway projects that had reached the completion of the design phase. In response, ADOT officials indicate that individual project managers have received verbal environmental clearance commitments and that written confirmations are soon to follow. In the event that all approvals have not yet been obtained, the environmental schedules can present obstacles in the critical path and delays in project completion. To ensure that this important component is not overlooked or underestimated, it should be incorporated into the formal schedule.

Another scheduling aspect that is not fully addressed in the process is the acquisition of right-of-ways. While the 18 months provided to reach the 30 percent design stage and identify right-of-way requirements and utility relocations appears adequate, delays can have a profound impact on that project's completion time. The current schedule assumes that ADOT will ensure that the 30 percent design plan will be sufficiently detailed to assure that right-of-way requirements do not change during final design or the schedule will be delayed substantially. Generally, our engineering consultant agreed with this approach.

While normal right-of-way purchases can occur within the allotted 15 months provided for acquisition and relocation plus the initial three months allowed for development, if complex condemnations cases occur, more time might be needed. We compiled historical data and found that it took ADOT an average time of 19.5 months to acquire land for 24 regional freeway projects that we reviewed. While this appears reasonably close to the 18-month timeframe scheduled for right-of-way development and acquisition, on an individual project basis, it took ADOT more than 18 months to acquire land for almost half of the 24 projects. Moreover, acquisition of five of these projects took longer than 26 months and ADOT struggled with one project, taking about three years to finalize right-of-way acquisition. However, in some cases, ADOT can start construction on a project before the acquisition is finalized. Thus, delays in acquisitions may not necessarily cause delays in the overall completion of a project.

Utility relocations are another key project element. Scheduled to be complete within nine months, our transportation expert believes that utility relocation processes can reasonably be accomplished within this timeframe but require ADOT to closely coordinate with utility companies so they can adequately schedule the significant related workload that the freeway system construction places upon them. For several projects reviewed, ADOT has worked with the local utilities during the design phase to discuss relocations.

Finally, the actual construction phase of these projects is typically scheduled for completion within the 24 months. This timeframe is reasonable provided there are no significant staging requirements to assist ADOT in maintaining traffic flow or environmental mitigation. When extraordinary and unforeseeable traffic staging is required, ADOT may need to set up detours or build temporary structures, which could potentially contribute to significant delays in the construction process.

Project Managers Need Greater Authority to Fulfill Their Responsibilities and Ensure Critical Milestones Are Met

Although ADOT has many individuals functioning in oversight capacities and uses a number of processes to manage the daily aspects of projects, it does not operate with a central project leader or manager delegated with high-level responsibility and authority over individual projects. As such, no person serves in a focused “in-charge” position throughout all phases of a project to consistently ensure the attainment of all critical milestones and that each project stays within initial cost estimates. According to management literature, projects and project managers must operate in an environment broader than the project itself—managing the day-to-day activities is necessary, but not sufficient.

ADOT has placed the responsibility for ensuring a project adheres to its schedule, scope, and budget, and the task of monitoring project progress and overall coordination with the individual project manager. According to the job description, the project manager also leads and manages a team in the analysis, design, and preparation of construction plans and represents the project team at all meetings. Moreover, they are charged with "linking all technical units together." Therefore, the many roles ADOT has defined for project managers results in implied responsibility over team members working in other organizational areas, such as Right-of-way and Phoenix Construction District. Figure 4 depicts key organizational areas involved in construction projects.

However, it appears that project managers may not have effective authority to direct, control, and oversee the activities of the other multi-disciplinary and multi-divisional team members. Rather than managing projects from design through construction, project managers focus primarily on controlling and tracking the design milestones.

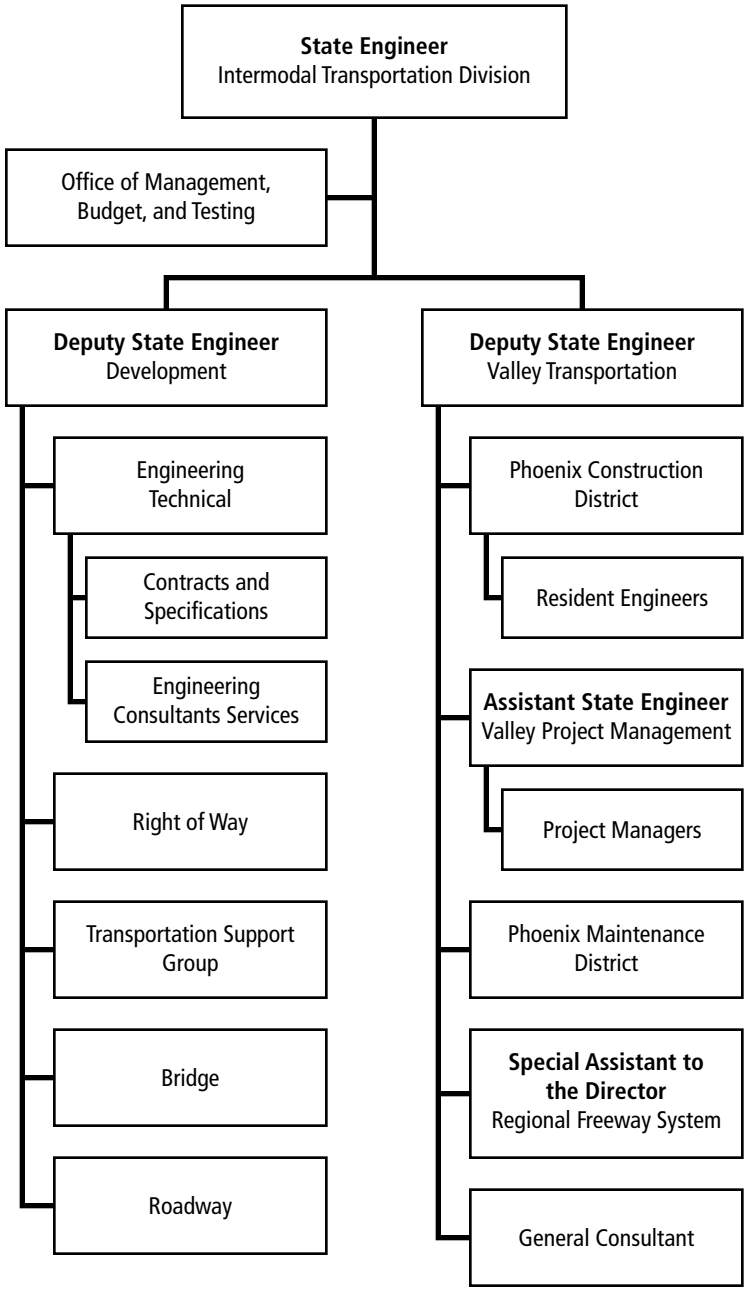

Figure 4. Regional Freeway System Organization Chart

Source: Arizona Department of Transportation.

Control over right-of-way acquisitions and construction resides in other functional areas, but team members within the individual projects coordinate efforts to better ensure their respective project delivery.

As shown in Figure 4, Regional Freeway System project managers are assigned to the Valley Project Management group. They report to that unit's Assistant State Engineer, who in turn reports to the Deputy State Engineer of Valley Transportation. This deputy has responsibility over all Regional Freeway System projects. Similarly, Right-of-way team members are accountable to their divisional supervisor—and a separate Deputy State Engineer of Development. Thus, project managers do not have any true authority over their Right-of-way teammates to ensure that acquisitions stay on schedule and purchases remain within budget. However, they do have the ability to escalate issues to a senior authority as needed.

Similarly, aside from the ability to escalate issues to supervisors, project managers may not have the necessary authority over the activities of team members responsible for the construction phase even though their responsibilities transcend the construction phase. This is because resident engineers in the Phoenix Construction District report to their supervisor who separately reports to the Deputy State Engineer of Valley Transportation. Although the project managers have regular discussions and frequent meetings with colleagues from the various technical and functional areas, there is no central record of specified documents or designated individual responsible for tracking progress through the various stages and memorializing all key decisions made for the project overall.

Moreover, once projects enter the construction phase, resident engineers function as "project manager" and control all day-to-day activities including ensuring the construction of the project stays within the defined schedule, specifications, and budget. Thus, ADOT is working in a team environment to complete its transportation projects—but it is doing so with multiple peer and high-level managers and without designating a central leader in-charge of superintending all project activities.

Although ADOT has established policies holding project managers accountable for projects, it has not accommodated nor enforced the policies by giving its managers the authority needed to carry out their responsibilities. While project managers do have most of the responsibility and authority needed to manage a project through the design phase, given cooperation of their technical team managers, they can only coordinate and facilitate projects during other phases, such as construction. Through the life of a project, under the existing departmental operating structure, project managers lack readily available information to better track or monitor projects through the various

stages because they tend to rely on the contemporaneous status statements of team members and a variety of uncoordinated reports to "manage" their projects. Moreover, ADOT's flat team approach, while having merit, effectively spreads authority too thin across the department's various technical and managerial groups leading to a disjointed coordination of effort. Ultimately, no central point retains complete knowledge of a project or is fully responsible and accountable for ensuring its success.

This issue is not new to ADOT. The 1997 audit of the Regional Freeway System found that ADOT has not fully "institutionalized the practice of project management on every project." The auditors also noted, with little elaboration, "clear accountabilities and responsibilities for delays, missteps, and other execution realities need to be established."

Achieving the proper balance between responsibility, authority, and delegation is not always straightforward, but other transportation departments have recognized the importance of providing the appropriate level of authority along with the assignment of responsibilities. For example, at the California Department of Transportation (Caltrans), top management delegates to project leaders considerable authority to produce intended results, meet schedules, stay within budget, and keep stakeholders satisfied. Project managers retain their authority over the entire life of the project and are the primary points of contact for internal and external stakeholders. According to our transportation expert, Caltrans has struggled over the years with accountability versus the appropriate level of authority. However, over time, Caltrans management realized that the project leaders must have greater authority and be held accountable.

Although It Manages Daily Activities, ADOT Can Improve Project Oversight

In general, project control should occur throughout a project's lifecycle and include regularly measured performance goals identifying variances from the plan. Specific project management or controlling processes include techniques such as coordinating changes across the project; controlling changes to scope, schedule, and budget; ensuring that project results comply with quality standards; reporting on project progress; and responding to changes in risk over the course of the project. Many organizations, including other state departments of transportation, have used these techniques to achieve great successes measured by cost and time savings.

ADOT uses a variety of tools to manage the respective day-to-day details of a project such as frequent team meetings, verbal updates, e-mails, and management reports. For example, project managers regularly speak with design consultants in order to ensure that design plans are submitted on time. Based on these updates, project managers track

completion at the 30, 60, 95 and 100 percent stages of designs. Also, the project team meets monthly to discuss daily progress and troubleshoot issues that impede progress or necessitate design changes. Finally, the Right-of-way section uses a tracking device to monitor elements related to property acquisition such as the parcel number, the date the parcel was acquired, and the anticipated date that the land will be available. Unfortunately, ADOT does not always maintain meeting minutes or develop task lists of action items to follow-up these discussions. For individual group and for day-to-day project management, these meetings and reports enable ADOT to react to barriers that impede progress and respond to events that necessitate changes to the scope of the project. However, this management approach results in decentralized decision-making where project managers act as a central point of contact for the project team; thus functioning as coordinators and facilitators instead of managers and leaders.

While ADOT has several tools to manage projects, it does not fully measure or track a project's ability to meet all estimated critical path milestones throughout a project's life cycle. If ADOT tracked each project from start to finish—or "cradle to grave"—it could proactively manage the schedule and budget and have the knowledge to take actions to better assure it achieves the ambitious deadlines for the entire freeway system. Although in its Project Development Process Manual, ADOT outlines several processes it could use to adequately oversee projects, managers and other team members do not always adhere to the policies described in the manual. From a broad point of view, ADOT cannot easily determine whether it has met critical project milestones or has delivered projects while containing costs. Moreover, ADOT does not compare projects' progress to initial milestones and cost estimates to identify variances.

In 1999, ADOT identified 14 critical path elements as shown in Figure 5 with specific schedules or milestones that must be met in order to meet its accelerated schedule and complete the system by 2007. For example, individual projects each are allotted an initial 18-month timeframe to complete preliminary designs and a second 18-month period for right-of-way acquisitions in order to move into the allotted 24-month construction phase. The overall schedule anticipates roughly a five-year period to complete each project. ADOT contends that all regional freeway projects will be completed within the schedules to meet the 2007 goal.

To determine whether ADOT meets its established milestones throughout a project's lifecycle, we reviewed six Regional Freeway System projects—three projects that have been completed and three projects that are currently underway. Initially, ADOT could not provide concrete evidence or reasonable documentation to show whether it had met

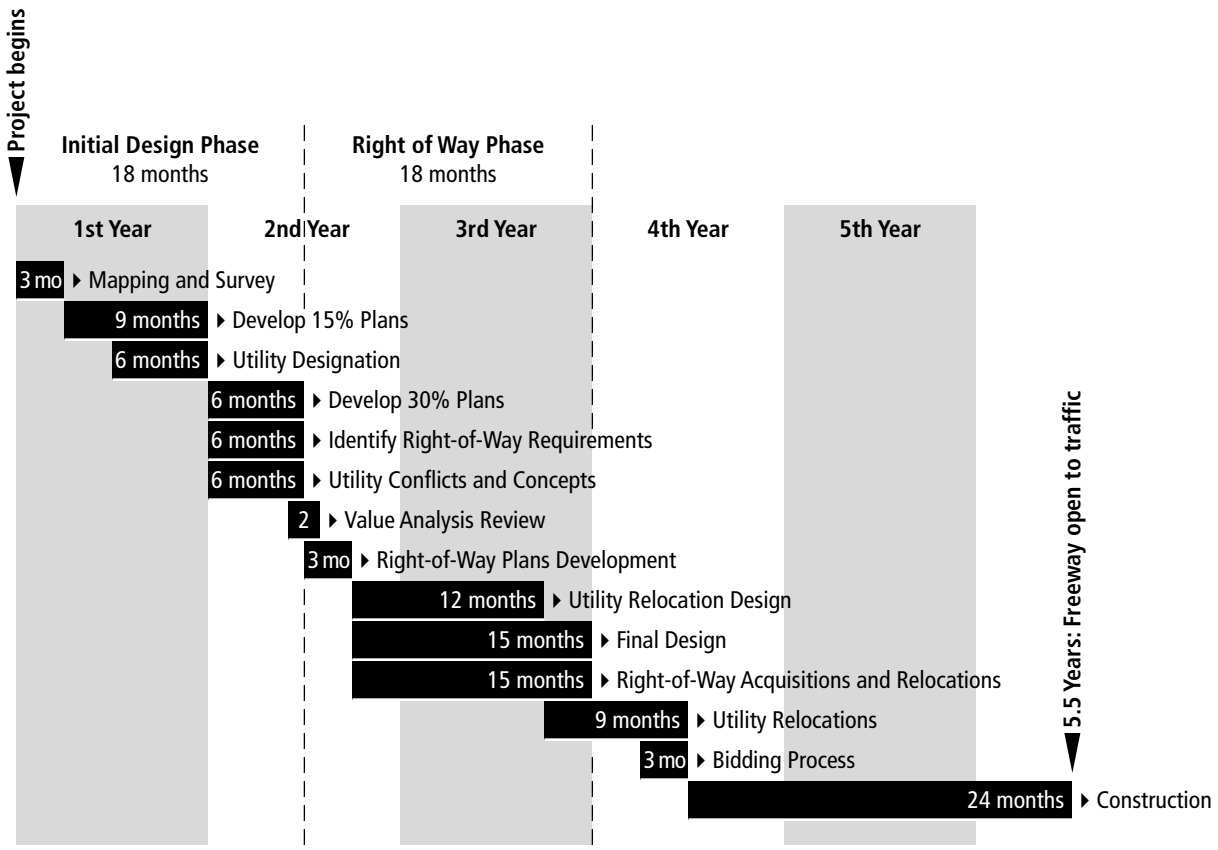

Figure 5. Fourteen Critical Timeline Elements for Accelerated Projects

Source: Arizona Department of Transportation's Generic Project Schedule.

its 14 critical milestones established for any of the projects. However, subsequently, the department was able to provide schedules showing that five of the six projects were on schedule or ahead of schedule in meeting its critical milestones. For the remaining project, ADOT is running 9 months behind its planned timeframe. Additionally, ADOT appears to have met several of its critical milestones for many of its Regional Freeway System projects started since 1995. While the department was eventually able to provide documentation showing it met milestones, some of the information was provided over ten weeks after our initial request. Thus, ADOT could improve its oversight by more rigorously documenting and regularly using this data to proactively manage its accelerated project schedule.

In contrast to the design phase, we found that once projects enter the construction phase, ADOT appears to employ more useful controls to effectively manage. Specifically, resident engineers routinely use several reports to track and measure progress against key timelines. For example, the "Construction Project Updates" report tracks a project's estimated start date, estimated completion date and percent of completion compared to the percent of time that has elapsed. Similarly, for cost, resident engineers regularly use another report, the State Engineer's Report, to compare actual construction costs against initial contract amounts.

We recognize that some project management tools are in place and provide one aspect of effective project control. However, diverse elements such as the construction phase controls, day-to-day task management, and weekly team meetings may be inadequate to ensure the success of an undertaking with the magnitude of the Regional Freeway System. Underutilizing such basic management tools such as measuring to all key milestones and consolidating divisional progress, could leave ADOT at a disadvantage. Without them, ADOT may not be able to assure key project deadlines are being met and proactively manage its projects.

Concerns over these controls were also raised in the 1997 audit, although the issues were not formalized into audit recommendations. In their report, the auditors stated that a control system was not in place at ADOT. Although the auditors noted that ADOT had some automated reporting processes, they did not find examples where the department actually used the system, processes, or tools to change or control project outcomes. Moreover, they also found that the tools were not used on a regular basis and even though ADOT spent a great deal of time and money purchasing software and training staff to employ project management processes, it had not institutionalized the practices.

We found the same to be true three years later. By not using available tools and standardizing and institutionalizing good control and management processes, the execution and delivery of a complex and accelerated project such as the Regional Freeway System is even more difficult. However, during the course of our audit, ADOT has taken steps to improve its oversight efforts during a project's lifecycle. For example, it has developed the "Project Manager Report" which tracks numerous project milestones. On this report, the planned completion date for each milestone is compared to the actual completion date and a variance is calculated. This report also tracks the initial project cost estimate, project cost estimates at various stages during the design process, and the bid award amount. ADOT has also developed another report that will

track unit prices and total construction costs. Provided ADOT uses these reports, they will enable the department to better monitor projects' progress so that it can proactively respond to potential problems, thus minimizing the likelihood of delays.

Better Focus Is Needed On Project Cost Containment

Managing a Regional Freeway System project consists of two parts: program, or the actual process of designing and building, and cost. In the previous section, we discussed the program management aspects. Clearly, cost is also a critical element, not only for each project, but also each aspect within a project. While expenditures for the Regional Freeway System have remained within yearly estimates over the last three years, we believe that ADOT should pay closer attention to the initial cost estimates aspect. Specifically, ADOT revises its cost estimates every six months as part of its Life Cycle Certification Report process. If estimates increase (which they have), the increases are programmed into the Transportation Improvement Plan and, thus, initial programmed dollars, which were based on initial estimates, are increased for each project. Therefore, there is no emphasis on containing project costs to the initial estimate.

As such, no one person is responsible for tracking costs and monitoring them against the initial estimates for the entire project since the estimates are regularly revised. Without this project-wide accountability, there is no real sense for containing costs. Even at project completion, no one conducts a retrospective review to analyze the costs and assess the impact of each project's total costs to the Regional Freeway System budget overall. Doing so would help ADOT more accurately estimate costs for future projects and pinpoint areas that need tighter controls to prevent cost overruns.

Specifically, ADOT does not use initial or formal cost estimates of the project elements as a benchmark for containing costs. Project managers do not compare actual costs to cost estimates during the design phase. Additionally, neither project managers nor Right-of-way coordinators compare actual costs of purchasing property to the initial estimates. Although ADOT's Engineering Consultants Services group tracks design consultants' invoices against contract amounts, no one monitors these charges against the original estimate. Furthermore, each project manager uses different approaches to managing; some maintain only minimal data related to aspects of cost such as increases in the budget, approved additions, or amounts paid to date, while others maintain more.

The prevailing opinion at ADOT is that cost information is not retained centrally because that data can be retrieved from other units within ADOT and compiled as needed. Although a variety of cost elements and reports are maintained by the different

technical groups, we found that the project managers do not regularly seek out the information to monitor and measure costs throughout the life of their project or even when the project is complete. Rather, they solicit the data components if questioned by ADOT management or to respond to inquiries from external stakeholders.

The same is true with respect to right-of-way cost estimates and actual costs. Despite having responsibility for overall management and oversight, project managers do not track or maintain records of right-of-way costs against estimates because they feel Right-of-way staff is responsible for that activity. However, Right-of-way staff does not exercise this control routinely as part of their technical coordination efforts. Rather, they only compare actual costs with current cost estimates of purchasing property and relocation costs. Initial and actual cost information is maintained in Right-of-way's database, which has the capability of analyzing the information; however, division staff do not believe this activity is particularly important because the scope of the acquisition may have changed since the original estimate, and they believe ADOT must pay whatever it takes to purchase the property and relocate its tenants.

During the construction phase the resident engineer takes over project management responsibilities and establishes strong project management controls expected of expensive and complicated projects. ADOT establishes an estimate comprised of the contract amount, and adds nine percent for ADOT's engineering time, plus another five percent for contingencies. Monthly, for each project, the resident engineer reports costs incurred to date compared to the estimate and the contract amount. Additionally, engineers provide project status on a percent of completion basis. Thus, it is evident that this ADOT group understands the responsibility of being accountable for costs and responds with appropriate oversight and reporting.

It is commendable that the resident engineers practice effective and sound cost management. Unfortunately, the use of cost data for managing projects, tracking progress, and containing costs is inconsistent. When we asked, the department did provide us with several analyses related to the construction phases of projects that compared contract amounts to actual costs. These analyses showed that while some contracts exceed the amount per the contract, others came in under the contract amount. However, these analyses included costs only related to construction phase activities and not preliminary engineering, design, or right-of-way phases.

We attempted to assess ADOT's program cost management for the entire Regional Freeway System. The Special Assistant to the Director informed us that ADOT does compare actual costs at the macro-level to cost estimates. However, we only were provided with several analyses related to the construction phase only. To also include

design costs, we performed our own analysis on a macro-level to determine how ADOT's actual costs matched to yearly estimates. We found that over the last three years, expenditures for the Regional Freeway System overall had remained within what was estimated in the previous year.

ADOT Does Not Fully Use Its Project Management System

ADOT asserts that it has extensive communication and reporting processes in place at both the individual project level and the overall regional system level to ensure it meets delivery targets and that it makes appropriate adjustments to minimize delays. However, there was not always adequate documentation showing that critical project milestones, which the accelerated program is premised upon, are being met. Most of ADOT's communication process relies primarily on verbal updates presented during numerous meetings involving management, key team members, and external consultants and contractors. ADOT maintains documentation of these meetings through its external consultants and contractors. This reliance on outsiders may be misguided since the meeting minutes that we reviewed did not summarize how the information discussed impacted ADOT's overall program timelines and milestones. Although on-going verbal updates are an important management tool and cross-functional team meetings are essential in the structure ADOT has established, these meetings alone—without memorializing decisions and progress—may not be adequate to effectively manage projects.

Although ADOT purchased an automated project management system in 1995—Primavera—that would contribute to more effective management, it has not fully utilized this powerful tool despite having trained staff to use it. Primavera has the ability to allow for comprehensive tracking and analysis, resource and cost management, and project reporting and communication. Combining this powerful system with adequately documented update meetings would provide ADOT the tools needed to better manage its projects.

However, various divisions, staff, and groups within ADOT currently issue a multitude of reports for specific reasons and needs. Unfortunately, there is little coordination and no central repository or index to allow for dissemination of data or cross-use of reports. Obtaining key project information entails gathering a variety of reports, extracting relevant data, and compiling it together. This is time-intensive and particularly difficult in that documentation of significant milestones is not always maintained and when it is, data is not always kept in a standardized format or in a uniform level of detail. Therefore, there is no guarantee that the needed information can be generated or that the necessary data is being tracked.

Because project managers rely on verbal status reports and do not require or maintain any sort of checklist or written update to verify necessary activities have been completed or deliverables received, they have little history to fall back on. When asked to provide information related to certain project schedules, ADOT did not initially produce the documents for over two months. Although the department subsequently provided the data, this inability to quickly access all elements of project information within a reasonable period of time demonstrates a need to boost individual and divisional accountability.

Since project managers do not regularly update project data essential to making Primavera a useful tool, the resulting information is incomplete and heavily reliant upon unverified project data submitted by consultants. Reliance on consultants to update the information in Primavera is a concern because project managers do not always review the accuracy of the data that consultants submit.

Moreover, ADOT and its consultants have created a collage of different reports on different systems to track a project's status. Not one of these reports provide a complete picture of the entire project status nor do these reports, generated for specific purposes, work in concert to provide a comprehensive view of a project. Improving controls helps accountability and assists in project management and cost containment. Using Primavera and keeping written documentation could help ADOT retain knowledge on key decisions and foster continuous improvement. Moreover, in today's dynamic job market, it allows for reliable institutional knowledge and background on decisions when projects are passed on to different managers. As discussed more fully later in this chapter, ADOT has fairly high vacancy rates in many of its groups. Reliable reports and supporting documentation are essential to link the critical path stages and to ensure items are acted upon as the project moves through the design and construction stages.

ADOT's struggles with its automated project management system are not unlike environments at other state departments of transportation. According to our transportation expert, the California Department of Transportation has evolved over the last ten years towards using more effective project management tools and capabilities. Ultimately, management forced staff to regularly update data within the automated system and to use the system to manage their project. Thus, the tool allowed effective project management to evolve fairly rapidly. As such, it is important for ADOT to gain optimum benefit of implementing project management by fully utilizing the automated tool ADOT officials selected in 1995.

Likewise, when the Michigan Department of Transportation implemented an automated project management system, department executives found the biggest hurdle was in convincing their staff of the benefits. However, once users grew comfortable with the system, they looked for wider uses and capabilities. The department reports it experienced benefits such as analyzing the impact of decisions in terms of a single project or a program overall. Further, it reduced project managers time to process jobs, improved overall performance in meeting project schedules, and resulted in significant cost savings related to time spent on project management.

ADOT is attempting to remedy our concerns by more fully utilizing Primavera. Currently, it is making refinements to the system that will allow the production of reports comparing estimated to actual milestone dates. These revisions will help inform ADOT technical staff and consultants of current priorities and required completion dates and help ensure a centralized and consistent view of all projects. The improvements are also intended to allow ADOT to produce a report that will replace several existing reports. With these improvements, it becomes more critical that project managers maintain and use this tool, because this system is only as good as the accuracy of the data it contains.

Departmental Vacancies Could Affect Project Oversight and Completion of the Freeway System by 2007

A vital component of adequate project oversight and the ultimate success of the Regional Freeway System is ADOT staff itself. While freeway design and construction are completed by outside consultants and contractors, ADOT uses its staff to oversee these groups and manage projects. However, there are a significant number of vacancies in many key groups. The loss of key staff or vacancies in positions that manage contracts could negatively impact completion of the regional system. Because of the lack of written documentation, any loss in institutional knowledge or absence of oversight due to vacancies can result in duplication of effort, poor quality decisions, delays, cost overruns, and difficulties in completing the projects. However to date, ADOT has not conducted any formal studies to ascertain the staff level essential to complete the Regional Freeway System on time.

Thus, we conducted our own analysis to determine the percentage of vacant positions directly assigned to the Regional Freeway System in five crucial areas: [1] Right-of-way; [2] Contracts and Specifications; [3] Phoenix District Construction; [4] Valley Project Management; and [5] Engineering Consultants Services. As presented on the following page, we found an average vacancy rate throughout these departmental groups of

approximately 28 percent as of November 1999. Several staff in Valley Project Management indicated to us that they could not provide adequate levels of oversight on their regional freeway projects partly because of the many unfilled positions.

Table 1. Significant Vacancies Exist in Critical Department Groups

Department Group	Percent Vacant
Right of Way	30.7%
Contracts and Specification	25.9%
Phoenix Construction District	26.5%
Valley Project Management	35.7%
Engineering Consultants Services	23.1%
Average Vacancies	**28.4%**

ADOT is taking some steps to add additional staff and retain the staff that they have. For instance, it has increased the salary scale for ADOT engineers and technical staff and has requested additional Right-of-way appraisers to fill some vacancies. Notwithstanding the reduced staffing levels, ADOT management and officials are confident that their staff and consultant and construction communities can handle the workload and complete the freeway system by 2007. ADOT uses consultants to supplement its staffing resources that are limited by legislative constraints and believes that adequate funding is available to pay the private sector to meet the demand for the highway construction services. Additionally, the external consultant and construction communities strongly agreed with ADOT's perspective and these communities stated that they have an adequate number of consultants and contractors to complete the Regional Freeway System.

Our engineering expert observed that ADOT's project schedule spreads the delivery of the 30 percent designs by staggering the project start dates and varying the timelines. This allows ADOT's general consultant to match deliverables with its staffing needs, yet there may be little flexibility in the schedules for the other outside final design consultants. While our expert believes that with the normal construction processes the general contractor's schedule would not pose a problem, the sheer size and number of final design contracts required for the remaining segments of the Regional Freeway System may overwhelm Arizona's design consultant industry. However, for construction projects, ADOT's Deputy State Engineer over Valley Transportation cites bidding history

showing that large projects, such as those ADOT is procuring, continue to attract major contractors. For example, Morrison Knudson, a large out of state contractor, recently proposed on a number of ADOT's projects. As competition for work increases, ADOT contends that smaller projects may suffer but regional freeway projects will not.

Regional Freeway System Performance Measures Could Be Improved

To help assess whether it will meet both department-wide and Regional Freeway System goals, ADOT developed a comprehensive strategic plan that sets out its vision, priorities, goals, and objectives (or performance measures). In total, ADOT has outlined 25 agency level performance measures for the department as a whole, five of which are specific to the Regional Freeway System. These measures are also aligned with the Governor's Strategic Plan and direction for state government. Regional system measures include ensuring that 100 percent of the accelerated "2007 Program" construction dollars planned to be awarded in fiscal year 2000 are awarded by the State Transportation Board; achieving targeted cash balance levels at the end of each fiscal year; meeting the established revenue forecasting target ranges; and increasing the travel lane miles to 372 in the accelerated "2007 Program" by June 30, 2000. While the department's measurement system has positive and useful aspects, ADOT could improve it by instituting explicit follow-up mechanisms and establishing more meaningful measures.

According to ADOT, it established a measuring and reporting process to ensure upper management was kept apprised of its efforts and progress towards meeting goals. Monthly, ADOT's Strategic Planning and Budgeting (SP&B) group gathers data from across the department to update and present the status of all performance measures to the Operations Committee consisting of ADOT's Director, Deputy Directors, and other Division Directors within the department. Additionally, it reports the results of certain key performance measures to the Governor's Office.

SP&B is tasked to measure performance using the monthly State Engineer's report and other documents, and to speak with project managers to assist them with project status and developing recommendations for measures falling short of target. Despite these efforts, SP&B is not responsible for ensuring that issues identified are followed up on. General performance measure practices stress that a complete management system includes a performance monitoring feedback loop. However, agreements reached during Operations Committee meetings related to corrective action are not always memorialized to ensure that all participants have a clear understanding as to what action is to be taken, who is responsible for taking action, and when the action is needed.

Currently, for the five performance objectives related to the Regional Freeway System, ADOT's reported measurement data provides only high-level, non-specific information as to why certain targets are behind schedule. In some cases, the monthly presentation provides recommendations for improving future performance, but not always. In practice, if issues identified in one month are not specifically recalled in the subsequent monthly operations committee meeting, then the committee assumes the issues have been resolved. Thus, the current process lacks the necessary feedback loop to provide the committee information as to what happened, why it happened, or how it happened. This may leave the department vulnerable to further delays and missed targets.

In most of its recent monthly Operations Committee meetings, ADOT has identified that it is behind schedule to achieve its objective for ensuring that 100 percent of the Regional Freeways System accelerated "2007 Program" construction dollars planned to be awarded in fiscal year 2000 have been actually awarded. It also identified some of the projects that were planned, but not yet awarded. Despite highlighting these shortfalls, there are no references documented as to who is to take corrective action, what agreements may have been reached, and any follow-up or monitoring efforts intended to assess the situation. Because it is unrealistic to assume that all projects remain 100 percent on schedule, ADOT needs to clearly identify who is responsible for tracking, identifying corrective action, ensuring follow-up, and memorializing feedback to complete the information cycle.

Additionally, to strengthen the value of the performance measure process, ADOT should establish more meaningful measures for several of its key responsibilities. These measures could assist ADOT in better determining whether it is achieving its goals for the Regional Freeway System and its goals department-wide. For example, one of its goals is "to increase the quality, timeliness, and cost effectiveness of products and services." However, the measures the department developed and tracked relate only to its motor vehicles division. None of its measures focus on the quality, timeliness, or cost effectiveness of building highways even though this is a major departmental responsibility. One potential useful measure related to highways could be "to increase the number of intermodal transportation projects that are designed and constructed within original cost and schedule estimates." Another measure should evaluate the timeliness of right-of-way purchases using the number of days over or under the envisioned schedule or timeframe.

For other department-wide and Regional Freeway System goals, the department developed measures that do not directly relate to its goals or do not provide an effective means for measuring the success of those goals. For example, to measure its success in

meeting the goal of "developing and retaining a high-performing successful workforce," ADOT's stated objective is "to reduce the safety incident rate per employee." While this objective itself has merit, it is unlikely to be a primary driver in this goal, unless safety is a reason for turnover. While it is a valuable minor objective, it may not provide a good measure for developing and retaining a high performing successful workforce. Further, the only other objective identified for this goal measures the competencies of certain staff positions. A better objective might be "to reduce turnover rate by XX percent" or "to ensure all staff receive XX hours of training each fiscal year within their area of responsibility." Further, since ADOT has increased the salary scale for engineers and other technical staff in the effort to retain staff, ADOT should consider measuring the effect of the wage increases on retention. In another instance, the department established a goal to optimize the use of all resources, but its objectives only deal with "obtaining" resources not with "optimizing" their use. To effectively measure success in realizing this goal, a more useful objective could be to measure staff's downtime. Or perhaps, ADOT should refine the goal to better target the department's efficiency.

ADOT Could Strengthen Its Post-Construction Reviews to Improve its Processes

ADOT could improve processes to review past problems and record lessons learned during the entire life of a project including design, right-of-way acquisition and other critical path activities. After construction is complete, ADOT conducts retrospective, post-construction assessments; however, these reviews focus on issues related to sound engineering and construction practices such as the proper placement of drainage canals and adequacy of material pits. The value of these assessments is characterized by ADOT as "a factual review of plans and special provision and material sources...(that provide) a valuable tool in future planning, design, and construction." While it is clear that ADOT recognizes the value of these reviews, a broader review would identify successes and mistakes in the management of the project throughout its life cycle, from design through construction. This would allow ADOT to identify best practices and continuously improve their delivery of highway projects.

According to our transportation expert, one of the primary responsibilities of project managers at one state department of transportation is to prepare a final closeout report on the project with recommendations for improvement and provide feedback to the team on lessons learned. Additionally, these project managers are required to ensure that the final product meets the needs of the project customers by discussing results with individuals representing external customers to gauge their level of satisfaction.

Construction Cost Estimates Are Reasonable, But May Be Misleading

Our transportation expert found the process ADOT uses to estimate costs appears reasonable. However, he felt the level of detail could be improved to help ADOT to assure accuracy of estimates when it reviews its consultant's work. It is our expert's experience that when insufficient detail is provided, projects may be underscoped and poorly estimated. If ADOT were to require a modified, more detailed format from the consultants, it could achieve greater success in delivering their projects closer to their estimates. In addition to including a breakdown of unit cost and quantity of roadway items such as earthwork, structural section, drainage, specialty elements, and traffic factors, the modified format could provide an additional breakdown of these roadway items including unit and quantity information on concrete, storm drains, aggregate base, retaining walls, hazardous waste work, equipment passes, and environmental mitigation.

The department's general consultant, who is responsible for the preliminary engineering phase, develops all of the construction cost estimates for the Regional Freeway System. Preliminary engineering and design cost estimates are calculated at a percentage of the construction costs, 3.5 percent and 5.5 percent, respectively. Right-of-way cost estimates are based on market value, comparable real estate sales, and relocation requirements, among other factors. All of the cost estimates are revised every six months for the Life Cycle Certification Reports and are based on current dollars or what it would cost to design and build a project and purchase the right-of-way property today. Thus, under the current practices, cost estimates will likely increase every six months not just because of program changes, but also due to market changes and inflation. Moreover, because ADOT uses these sliding estimates that are updated every six months, according to our transportation expert, it is not always clear why costs increase. Without maintaining adequate historical information and tracking the amount and reasons for cost changes, ADOT cannot identify whether costs are overruns, increases in project scope, due to inflation or other causes beyond its control.

Moreover, our expert found ADOT's practices do not account for escalation of construction costs in a manner similar to others in the industry. Rather than applying an escalation factor to the cost estimates and increasing the estimates in order to account for the effects of inflation, ADOT reduces the revenue estimates to reflect a lower purchasing power of the funds coming into the revenue stream. Although this discounting will result in the same outcome (if the revenue stream actually inflates at the same rate as engineering and construction costs), it is misleading because actual costs will more than likely be higher than what is being reported to the public in the Life Cycle Certification Reports. Further, by not increasing the cost estimates to account for inflation and other

market factors, and not tracking the reasons for other project changes, the cost estimates will increase every six months if only for that reason—making it difficult to monitor or contain costs because of the moving target that is created.

However, for purposes of its Life Cycle Certification Report process, ADOT believes that changing its method of accounting for inflation midstream during the Regional Freeway System program would be more misleading. Thus, the department chooses to maintain the consistency of its current methodology.

Federal Sanctions Related to Air Quality Issues Could Impact the Timely Completion of the Regional Freeway System

Air quality concerns are a significant factor in programming and planning transportation projects. Federal laws, as well as state and local regulations, closely link the attainment of air quality standards with the development of a transportation system and the improvement of public health and quality of life. Portions of Maricopa County are not attaining air quality standards and are designated as being "serious non-attainment" areas for three major transportation related pollutants—ozone, carbon monoxide, and particulate matter. However, the area has recently met federal standards for ozone and carbon monoxide and is now developing maintenance plans to show that the area will continue to meet health standards for the next ten years. If the area fails to meet the standards once again, the threat of possible federal sanctions could become a reality and thus, affect that timely completion of Regional Freeway System projects.

Under 1990 federal legislative requirements, the Environmental Protection Agency (EPA) designated a portion of Maricopa County as a "moderate non-attainment" area when it found that the county did not meet federal air quality standards for particulate pollutants—such as dust. Subsequently, the EPA reclassified the county as a "serious non-attainment" area when it continued to fail to comply with standards. Although significant progress has been made in improving air quality since the 1970s, challenges still remain. For instance, air-monitoring data collected by Maricopa County indicates that levels of particulate pollutants at the edge of a construction site can be as much as three times higher than the allowable standard. Most of the particulate problem is from dust on paved roads that is kicked up by vehicle traffic and windblown dust from construction sites or unpaved areas. According to the EPA, reducing the particulate problem in Phoenix is crucial to public health because particulate matter is associated with increased respiratory symptoms, heart and lung disease, and even premature death.

Partnered with Arizona State University and Maricopa County Environmental Services, ADOT has taken significant strides to complete the development and begin the implementation of an education and outreach program for particulate matter. This program is intended to provide opportunities for ADOT personnel and stakeholders to assist in "achieving performance excellence by going beyond mere compliance" of air quality standards. While ADOT and other regional entities have put forth great effort, public cooperation is essential for ensuring that the Phoenix area remains free from federal sanctions.

When an area violates a health-based standard, the federal law requires that the area be designated as a non-attainment area for that pollutant. Phoenix was originally designated as a moderate area for particulate pollutants and Arizona was required to develop a plan that put into place a basic set of initiatives to control the pollution problem. These initiatives did not adequately reduce pollution and Phoenix continued to experience additional air quality violations. Thus, in 1994, the EPA reclassified the area as a serious non-attainment area requiring the state to develop a stricter plan with more comprehensive control measures. Recent measures to control pollution by the state, Maricopa County, and cities within the county include, but are not limited to, using efficient street sweepers to reduce dust from paved roads, enforcing the "Fugitive Dust Rule" through the provision of additional inspection and enforcement personnel, and paving unpaved road.

Furthermore, because the metropolitan Phoenix region continued to record violations, federal stipulations required the state to develop a "serious" plan for particulate matter and incorporate stricter measures. A plan using computer modeling has demonstrated that region can attain compliance with federal standards in the future. Specifically, Arizona had to prepare this plan and obtain EPA approval within specific timeframes established in federal regulation. Known as the sanction clock, federal regulations provide 18 to 24 months for non-attainment areas, like Maricopa County, to identify strict measures that will help meet federal air quality standards. These measures, through a sophisticated computer model, quantify the possible reduction in air pollution levels. Once complete, a region submits the plan to the EPA for approval and, in essence, avoids the possibility of future sanctions such as the loss of federal funding for construction projects. However, even if the plan is approved, any subsequent air quality violations could ultimately result in federal highway funding sanctions. Such sanctions would affect most new projects of regional significance, such as those of the magnitude for the regional freeway projects and those funded by state and local funds. Thus, ADOT could have to bring construction of certain regional freeway projects to a standstill.

Conclusion

By strengthening its controls, ADOT can better demonstrate that it is protecting public interests by documenting cost-effective decisions by monitoring project progress against established milestones. Given that time is running out and the dedicated funding streams will dry up, it is ADOT's responsibility to have the necessary controls in place to help assure the public that the Regional Freeway System will be delivered as promised. Stronger controls are needed to provide ADOT project managers with more authority and with an 'early warning system' that they can use to control costs and minimize delays. These controls, combined with improvements to its performance measurement system and cost estimate reporting, would allow ADOT to be more accountable to the public and better manage its projects.

Although not entirely within its span of control, possible federal air quality sanctions could impact ADOT's ability to complete the Regional Freeway System on time and within budget. Thus, it is important for ADOT to continue to monitor the impact of these sanctions on its ability to meet critical milestones and budget goals and communicate the possible effects to the public. However, avoiding federal sanctions requires area-wide cooperation from all transportation entities and the public.

Recommendations

To provide greater assurance that the Regional Freeway System is completed by 2007 and to increase accountability to stakeholders, ADOT should:

- Clearly define the roles, responsibilities, and accountabilities of all members of a project team. Specifically, it should designate project managers who have appropriate authority over team members and final accountability for scope, schedule, and budget.

- Identify additional information to be documented during project development and construction and who is or should be maintaining the documentation. At a minimum, documentation should include deliverables and documentation of significant decisions and actions taken during the course of individual projects.

- Monitor project progress throughout the project's life cycle and identify variances from the plan with the intent to proactively alter the course of a project as necessary.

- Use a project management system as a tool to monitor costs as part of project and track overall program status.

- Require all employees to fully utilize the department's automated system, Primavera, since ADOT purchased it to function as its project management system.

- Fully utilize the project management system by inputting the necessary data so that reliable reports can be produced in a timely manner. Evaluate its reports to determine which reports can be eliminated or consolidated with the intent to reduce duplication of efforts and the number of reports.

- Refine its post review process for all projects and apply lessons learned to future projects. Best practices should be communicated to all team members and implemented on all projects.

- Reconsider existing performance measurement systems and develop more useful measures.

- Reconsider revising cost estimates to reflect the estimated effects of inflation, rather than adjusting revenues, in order to provide a more accurate estimate of actual costs. Additionally, a more accurate cost estimate could be used as a benchmark for cost containment.

To address the external environmental threats related to air quality, ADOT should:

- Monitor the impact of future air quality violations or possible federal sanctions on ADOT's ability to meet critical milestones and budget goals.

- Ensure that project managers, personnel, and stakeholders have the opportunity for participation in available air quality educational programs.

- Continue to integrate air quality issues into all transportation plans, programs, and projects to reduce the possibility of federal sanctions.

- Inform the public of the possible effects and impact of future air quality violations and possible sanctions on Regional Freeway System projects.

Chapter 2

ADOT Has Improved Processes Related to the Regional Freeway System

Chapter Summary

Over the years, ADOT has implemented new strategies and policies and has changed some of its processes to improve its efforts over the Regional Freeway System and its image in the eyes of the public. The department has taken the past audit results and recommendations seriously and has implemented most of the recommendations from the 1991 and 1997 audits. For instance, the department hired a consultant to assist them in developing a new revenue-forecasting program in order to better project estimated income. These more accurate revenue estimates allow the department to assess the timing and levels of available funding to plan, initiate, and complete the various Regional Freeway System projects. Further, ADOT's recent meetings with various transportation stakeholders, including metropolitan planning organizations, cities, and counties, are positive steps to reach consensus in a transportation planning process that benefits and involves all the players. As a result, not only are better relationships developing between the department and these external entities, but also the transportation plan for the future is more widely accepted and owned. Finally, the department made inroads towards improving its communication and relationship with its constituents resulting in relatively satisfied taxpayers.

ADOT Has Successfully Implemented Most Prior Audit Recommendations

In addition to an annual fiscal audit of ADOT's financial statements, two performance audits, in 1991 and 1997, were conducted to comply with provisions of state law. The department embraced the results of both performance audits and implemented most of the recommendations. For instance, one of the more significant recommendations included in the 1991 audit report suggested periodically issuing a report as a means of keeping the public informed of progress made on Regional Freeway System's projects. In 1992, ADOT issued the first report named the "Life Cycle Certification" and has issued an updated version every six months since that time. Additionally, ADOT established a new position, the Special Assistant to the Director, to provide assistance to the Citizen's Transportation Oversight Committee, manage the funding and programming of the Regional Freeway System, and disseminate status reports to stakeholders.

The 1997 audit report followed up on the findings of the 1991 report and concluded with 47 recommendations designed to improve the department's management of the freeway system. These recommendations addressed issues such as cost containment, cash management, decision-making, program controls, change management, and project execution. Our follow-up reveals that the department has effectively implemented 85 percent of the recommendations. For example, to respond to a recommendation to obtain better information on the timing of expenditures, ADOT has modified its cash flow forecasting system so that it provides more frequent formalized variance analysis capability. ADOT has also expanded the use of partnering to strengthen its relationship with MAG. This involved drafting a mission statement, holding a partnering session, and making plans for future partnering meetings.

We have summarized each finding from the 1997 performance audit in Appendix B. This comprehensive list shows the status of all prior year recommendations. However, in the following discussion, we highlight some additional operational and management improvements ADOT has accomplished in recent years.

Revenue Forecasting Has Improved

For any entity, public or private, the amount of goods it produces or level of services it provides is dependent on sources of revenue and costs. Likewise, ADOT relies heavily on projected revenue estimates to plan the transportation projects it can build in any given year. Therefore, the accuracy of revenue forecasts is critical to the overall success of the Regional Freeway System. Both the prior audits disclosed the department's difficulty in accurately estimating revenue.

During the early 1990s, Arizona, like most states, experienced a downturn in the economy. As sales and other statutory revenues declined, the department experienced a shortfall in revenue, as estimated funds did not materialize. To compensate, ADOT adjusted its projection techniques to provide more conservative revenue estimates in an attempt to provide more accurate projections. However, as the economy improved, these projection measures did not immediately accommodate the changes, resulting in understated revenues. In recent years, the department has improved its revenue forecasting process to keep estimates more in tune with the economy.

Specifically, in 1996, ADOT hired a consultant to revise its revenue forecasting process and programs. The new model was to incorporate certain economic data generated over the past 10 years and reflect the impact of two laws the Arizona Legislature had passed directly impacting highway revenues. These two measures, changing the

way fees and taxes are generated that flow into the Highway User's Revenue Fund, were expected to be relatively revenue neutral in the short term. Since the existing revenue forecasting models did not reflect those revenue enhancements, the department asked the consultant to provide changes to the forecasting structure to accommodate these legislative and other economic factors. The department subsequently implemented the consultant's improvements and its forecasting measures now appropriately reflect the impact of the amended state fuel tax collection process and the revised vehicle registration fees.

Since the last audit in 1997, actual excise tax revenues have matched or been within 7.5 percent of ADOT's estimates. Figure 6 illustrates the accuracy of ADOT's estimates for the excise tax.

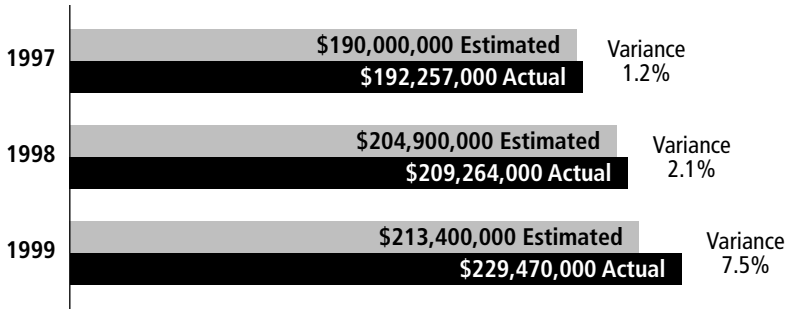

Figure 6. Comparison of Excise Tax Estimates with Actual Revenue

Source: Various Arizona Department of Transportation Cash Flow Forecasts and Maricopa County Transportation Excise Tax Forecasting Process and Results, 1996 through 1999.

In addition to improving its revenue forecasting process, the department now prepares monthly cash flow analyses to more closely track the actual revenue received rather than relying on semi-annual updates as was previously done. These monthly analyses feed into the revenue forecasting process and are an important aspect of the semi-annual Life Cycle Certification reporting process. Moreover, the monthly analyses and revised revenue estimates provide the department with timely information to effectively monitor revenue and provide an early-warning system if the revenues begin to fall short of projections.

Improved Relationships with External Entities

In prior years, the department had been criticized that its planning process did not involve input from the other entities that have some role or responsibility in providing or ensuring the transportation needs of constituents are met. For example, in the past, ADOT developed its statewide Five-Year Transportation Improvement Plan with little input from other transportation planners, such as metropolitan planning organizations, transportation management associations, cities, and the Regional Public Transportation Authority. Likewise, these other transportation planners would develop their own Five-Year Transportation Improvement Plans and in some cases 20-year plans, without ADOT's input. Sometimes these plans were not in alignment. Further, metropolitan planning organizations alerted ADOT to the fact that its planning efforts did not fairly allocate available federal funds to the regional areas. The Maricopa Association of Governments contended that funding allocations should be based on the "fair share" funding concept that revenue originating in specific regions should be allocated back to these areas.

Recently, ADOT took several steps to build more cooperative relationships with these external transportations planners and to involve these entities in its planning process. The most important of these steps occurred just last year. ADOT called a conference in the town of Casa Grande inviting transportation planning entities from around Arizona to examine the statewide transportation planning and programming process and to recommend changes to ensure future cooperation. The result of this effort is the adoption of guiding principals intended to provide a more equitable, rational, and cooperative process for planning and programming transportation projects. The guiding principals link the statewide and individual transportation plans by jointly developing them with the other parties, thus resulting in plans that will be accepted by all and will include more external involvement. The group agreed to seven guiding principles that have become known as the "Casa Grande Resolves." Figure 7 illustrates the programming process based on these resolves.

In addition to developing the new programming process, the group also cooperatively developed funding estimates to be allotted to the various transportation planning entities located in different geographical regions throughout Arizona. The new funding allocations were based on transportation needs. In all, the conference strengthened the relationships between ADOT and the external transportation planners, and because all were involved in making the changes and consensus was reached, the department did not have to "sell" the changes. Each group had a stake in the agreements reached.

Key/Legend

MPO ..... Metropolitan Planning Organization

RPTA ..... Regional Public Transportation Authority

TMA ..... Transportation Management Authority

COG ..... Council of Governments

TIP ..... Transportation Improvement Plan

STIP ..... Statewide Transportation Improvement Plan

FHWA .... Federal Highway Administration

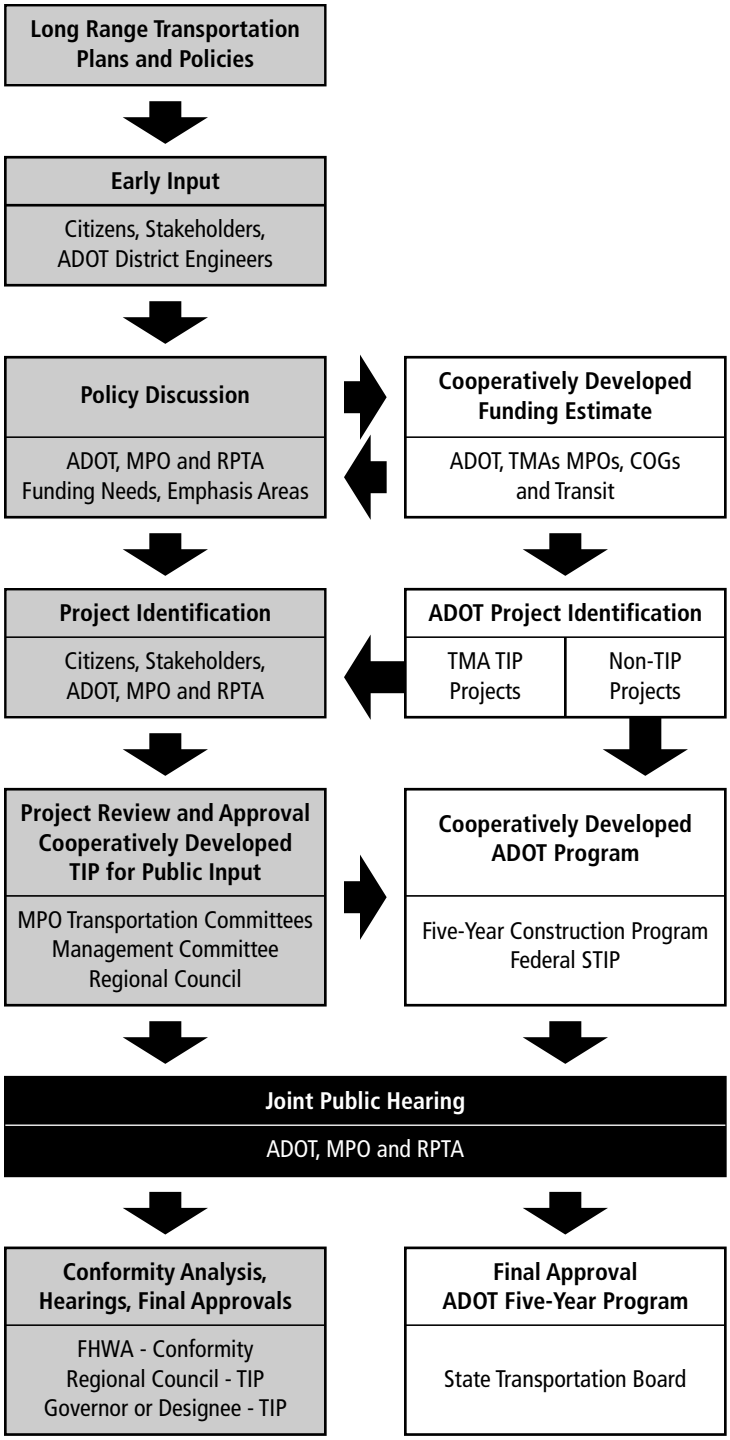

Figure 7. Casa Grande Resolves Programming Process

Source: Maricopa Association of Governments, Annual Report 2000.

ADOT's Stakeholders Are Generally Satisfied

During the early years of the Regional Freeway System, the department was plagued with numerous problems such as poor revenue forecasts, unreliable cost estimates, and inadequate public involvement. To polish its reputation and instill greater public confidence, ADOT has established a strategic plan to be more responsive to stakeholder concerns. Its plan includes objectives to conduct focus group meetings and distribute surveys to obtain public input on local and statewide issues, to engender public support to meet transportation goals, and to improve public education and outreach using tools such as a video program to air on local cable television.

Information from ADOT focus meetings and survey responses show that stakeholders are relatively satisfied. Many felt that there have been improvements in the county's transportation system such as better roadways. Others indicated that there is "too much road construction going on." Of the concerns raised about ADOT, many are specific to individual projects within a taxpayer's local area and, as such, are parochial in nature. For example, some taxpayers are in favor of freeway cable barriers in their area, where others only want open, landscaped medians on the freeways near their homes and businesses. A handful of other comments mentioned displeasure with sound wall placement and the impact of right-of-way acquisitions on senior citizen homes.

To independently assess ADOT's public image, we conducted a formal stakeholder forum and invited members of other transportation agencies, homeowners' associations, city and county governments, trade associations, and the general public. Although there was limited attendance, those stakeholders present indicated that ADOT was successfully fulfilling its management responsibilities over Regional Freeway System projects. While some indicators suggest that external stakeholders were extremely displeased in the past, most believe ADOT has made positive changes. However, participants at the charrette commented that ADOT could make improvements by polishing its long-term planning capabilities, better educating the public, and focusing more on cost containment.

We also garnered stakeholder opinions on ADOT's performance through a mail survey. Specifically, we developed and distributed surveys to over 120 stakeholders throughout Maricopa County. Using this survey, we elicited stakeholders' feedback on ADOT's overall performance relative to the Regional Freeway System. Specific questions elicited opinions about whether ADOT's management of the Regional Freeway System is adequate or inadequate, and whether ADOT's performance has improved, gotten worse, or remained the same over the last five years. We requested views in performance areas such as timely completion of freeway projects, ability to minimize delays, and fairness of treatment during right-of-way acquisition. Finally, we asked ADOT's constituents to rate their current relationship with ADOT as good, fair, poor, or no opinion.

Based on the 27 responses we received, most respondents were neutral towards ADOT's management of the freeway system. Although several individuals stated that ADOT had improved its performance, others cited the need for ADOT to listen to the public and conduct better long-range planning. These varying opinions included beliefs that ADOT has improved its performance while a few respondents stated its performance had worsened. Overall, the ratings indicated that the current relationship between ADOT and those stakeholders responding was "fair". However, consistent with the findings of ADOT sponsored surveys, the overall level of satisfaction appears to have remained relatively constant over the last five years.

The results from our stakeholder satisfaction reviews and those of ADOT suggest most external stakeholders seem moderately content with ADOT's current management of the Regional Freeway System. Indicators suggest that citizens are more satisfied with ADOT now that it has completed sections of the freeway system and improved its external communications. Most of the dissatisfied comments expressed stakeholder frustration about past problems such as ADOT's poor revenue planning and large advance acquisitions of right-of-way properties. While many stakeholders indicate that the department has made major improvements in its management and communication, most agree that ADOT should continue its efforts to increase coordination and improve communication with its stakeholders.

Conclusion

To correct past deficiencies and inspire greater public confidence, ADOT has taken many steps towards improving its efforts to effectively manage the Regional Freeway System. For instance, the department has shown strong levels of commitment and has successfully implemented many recommendations from two prior performance audits. Its efforts have resulted in more cooperative relationships between the department and external transportation entities and a consensus-driven transportation planning process owned by all. Moreover, the department extended the lines of communication with Arizona citizens resulting in better relationships and more satisfied taxpayers.

Appendix A

Response to Stakeholder Issues

As part of our audit, we reviewed 36 specific areas identified by Arizona stakeholders and the Arizona Auditor General. Several of these areas were related to our primary reportable issues discussed in Chapters 1 and 2 of our report. However, we address each of these separate topics below.

1. As required by Arizona Revised Statute Title 41, Section 1279.03 (A)(6)(a), review "past expenditures and future planned expenditures of the transportation excise tax and determine the impact of the expenditures in solving transportation problems within the county."

   ADOT's expenditure of the excise tax revenue for Regional Freeway System projects is just one step towards alleviating traffic congestion and other transportation problems in Maricopa County. By combining past excise tax revenue with other monies, ADOT has built 58 miles of freeway as of January 2000 and plans to spend $1.8 billion to complete the remaining 86 miles by 2007. Based on our analysis and that of our transportation expert, ADOT's estimates of future planned expenditures appear reasonable. However, while ADOT believes that its cost estimates have appropriate support, our expert found that the level of support behind the estimates could be improved. This issue is discussed in greater detail on pages 25 through 27 and pages 34 and 35 in Chapter 1.

2. As required by Arizona Revised Statute Title 41, Section 1279.03 (A)(6)(b), review "projects completed to date and projects to be completed during the remaining years in which the transportation excise tax is in effect."

   Our audit focused on reviewing ADOT's past management of completed regional freeway projects and how its current policies, procedures and management will affect its ability to manage ongoing and future projects. We reviewed completed projects in addition to on-going and future projects and found several areas where ADOT could tighten its project management. This is discussed on pages 18 through 35 in Chapter 1.

3. Compare the distribution of funds to assure they meet the funding formula as outlined in Arizona Revised Statute Title 28, Chapter 18, Article 2 and conclude on compliance.

We found that ADOT correctly calculated and properly distributed Highway User Revenue Funds (HURF) in accordance with state statutes. Specifically, we reviewed the HURF Distribution Summary Reports for Revenues Collected and the Motor Vehicle Division County Distribution Summary Reports for the months of August 1999, November 1999, and January 2000. We recalculated ADOT's distributions and special allocation formulas for payments to the State Highway Fund, to cities with populations over 300,000, incorporated cities and towns, and counties within Arizona.

State statutes require ADOT to distribute HURF monies to ADOT, local cities, and county governments using a legislatively mandated formula that incorporates population data for cities and counties, sales of motor vehicle fuel, and estimated consumption of use fuel. Specifically, the formula specifies that 50.5 percent of total HURF monies must be allocated to the State Highway Fund. Additionally, counties share 19 percent of the HURF collections based on fuel sales and estimated fuel use within each specific county. All incorporated cities split 27.5 percent of the HURF receipts, while those cities with a population greater than 300,000 residents receive an additional allocation of three percent.

4. What is the status of implementing the recommendations contained in the 1997 performance audit?

ADOT has implemented most of the recommendations suggested in the 1997 performance audit of the Regional Freeway System. At that time, the audit included 47 recommendations. Our review of those recommendations reveals that 14 recommendations are no longer appropriate to implement or are not within ADOT's direct influence; thus, ADOT is only responsible for 33 remaining recommendations from the prior audit. Of these, ADOT has successfully implemented 28 of the relevant recommendations, or 85 percent. The prior auditor's recommendations that ADOT has implemented range from ADOT increasing its estimate of Regional Freeway System construction funds by $117 million to ADOT commissioning an independent quality assurance review of contract appraisals and presenting the results to the State Transportation Board.

However, 12 percent—or four of the prior recommendations—have only been partially implemented. These recommendations fall into three categories: decision-making, program controls, and project execution. Decision-making and program controls continue to be challenges for ADOT and current issues in these areas are further addressed on pages 18 through 35 in Chapter 1 of our report; thus, we have new recommendations to replace those previously discussed in the prior audit. To fully implement the prior recommendation related to project execution, ADOT should continue the development and implementation of its resource allocation management plan. This plan will provide a resource-driven schedule for planning and monitoring project progress. Currently, ADOT envisions completing this plan by 2001.

Finally, ADOT has not implemented one audit recommendation at all because its efforts were concentrated on implementing others. This recommendation suggested that ADOT and MAG jointly establish a focused plan for education and outreach for the media. Emphasis should be placed on ensuring that the public fully understands the scope and objectives, the necessity and beneficial impact, and the successes that the planned program hopes to achieve over time. Although this is not one of our primary reportable issues, ADOT should continue to work towards implementing this past recommendation.

While the 47 recommendations with the general subject area addressed are shown in Appendix B, some of the recommendations are also discussed on pages 39 through 43 in Chapter 2 of our report.

5. Are the taxpayers of Maricopa County satisfied with ADOT's performance in regards to the Maricopa County Regional Freeway System?

Overall, the results from our stakeholder satisfaction review suggest that most external stakeholders seem moderately content with ADOT's current management of the Regional Freeway System. We discuss our analysis in greater detail on pages 44 and 45 in Chapter 2.

6. Is sufficient accountability demonstrated by the entities involved in freeway planning and construction and how is this accountability demonstrated?

The responsibility for the Regional Freeway System is shared by several entities—ADOT, Maricopa Association of Governments (MAG), the State Transportation Board, the Citizen's Transportation Oversight Committee, and the Regional Public Transportation Authority. Each of these entities plays a role in planning, executing, administering, and overseeing the Regional Freeway System in accordance with federal regulations, state statutes, and local resolutions. We discuss the role of each on pages 7 and 8 in the Introduction of our report.

Based on our review, we believe that each of the entities involved has clearly defined responsibilities set out by federal regulations, as well as state statutes and local resolutions. Each entity appears to understand its role as documented in annual reports, program reports, and other literature distributed to the public.

Additionally, in 1991, a prior audit reviewed and reported on the roles, responsibilities, and relationship between ADOT and MAG. Specifically, the prior auditor found a number of deficiencies in their relationship, such as significant uncertainty regarding the authority and accountability of ADOT and MAG within various functions and actions. However, with the implementation of the auditor's recommendations, their relationship has improved. We discuss ADOT's strengthened partnerships on page 42 in Chapter 2.

Further, all regional transportation entities appear to be working cooperatively especially during the past year to formulate what is known as the "Casa Grande Resolves." These resolves are described on page 42 and 43 in Chapter 2. Thus, sufficient accountability appears to be demonstrated by the entities involved. However, we highlight some areas that could help ADOT better fulfill its responsibilities on pages 15 through 16 in Chapter 1 of our report.

7. Should there be one person or group accountable and responsible for the Maricopa Regional Freeway System?

The structure used by ADOT for planning and constructing freeways in Maricopa County is similar to that used by transportation departments in other states. Most states share transportation responsibilities amongst a state department, metropolitan planning organizations (like MAG), and various local governments. Further, federal regulations dictate the need for a cooperative effort in transporta-

tion planning between these entities. This system allows each entity to serve as a check and balance for the others that would not be possible if one person or group was accountable or responsible for the Regional Freeway System. Thus, we do not recommend that one entity be given sole responsibility for the Maricopa Regional Freeway System.

8. What impact will the acceleration of the Regional Freeway System have on the various parties involved?

   a. Can ADOT manage and oversee the increase in workload, given the accelerated freeway construction schedule, with existing resources, including but not limited to staff resources?

   b. Will the consulting community be able to handle the increased workload associated with this accelerated freeway construction schedule?

   c. Is the contracting community in a position to handle the increase in workload that will result from the accelerated freeway construction schedule?

   While it has not conducted any formal resource studies, ADOT management asserts that they have the necessary internal and external resources to adequately manage the accelerated regional freeway plan. Those in ADOT's external community also echo these assertions that sufficient external resources exist to handle the increased workload from ADOT's accelerated schedule. However, we found that the department has significant vacancies in several key areas that could affect its ability to complete the freeway as promised. We discuss this area in greater detail on pages 29 through 31 in Chapter 1.

9. Have construction projects and their priority within the system been reconsidered or revisited on a regular basis in order to incorporate revised traffic patterns or increased population growth in certain areas of the valley based on new community developments?

   When MAG initially set the priorities in 1985 for various Regional Freeway System projects, it used traffic patterns based on 20-year population projections. In 1991, in response to a performance audit recommendation, MAG adopted criteria to be used to set Regional Freeway Program priorities. This criteria allowed MAG to prioritize projects according to elements such as travel demand,

congestion relief, air quality improvements, accident reduction, cost effectiveness, joint funding, social and community impact, system continuity and mobility, establishment of a freeway system as rapidly as possible, construction of segments that serve regional needs, and segments that provide continuity.

In 1996, MAG reassessed the revenue available for the Regional Freeway System and established new priorities to complete the freeway by 2014. The plan also advanced projects, added projects, and prioritized previously unfunded freeway projects. In 1999, the 2007 accelerated plan was developed and the MAG Area Life Cycle Construction Program was amended to reflect the acceleration of projects in accordance with the plan.

However, MAG has not reconsidered construction projects or their priority. According to MAG, this is because the Regional Freeway System corridors and construction priorities were planned based on 20-year traffic projections and future needs. Moreover, MAG believes that there is a point in freeway construction planning where the project is too far along to reconsider traffic patterns and increased population growth. Therefore, we agree it is reasonable that priorities not be reconsidered on an ongoing basis if the freeway is to be completed. An exception to this is that localities can fund the acceleration of specific projects. For example, the City of Mesa advanced the completion of one segment of the Red Mountain Freeway using financing from the SIB loan program and local participation. Although the project was accelerated, this freeway segment was already programmed as one of the priority projects set for completion by 2007.

10. What controls are in place for expenditures relating to the Maricopa County Regional Freeway System and are these adequate?

Each year, an independent auditor conducts a fiscal review of ADOT's financial statements as a whole and separately reviews the Maricopa County Regional Area Road Fund. Audit standards require the auditor to review internal controls as part of the audit in order to render an opinion on the financial statements. Because an independent auditor has rendered an unqualified opinion on ADOT's financial statements, we limited our review to evaluating procedures used by ADOT to make payments and record costs. Based on our review, we found that ADOT has adequate controls over expenditures related to the Regional Freeway System.

Specifically, to ensure that costs are recorded accurately and only valid costs are charged, ADOT established project-charging guidelines that outline allowable costs for Regional Freeway System projects. Additionally, staff in the department's contract accounting unit check all invoices for accuracy and ensure that amounts invoiced are within the contract budget. Further, the unit will only pay an invoice if it has been reviewed by either Engineering Consultants Services (for design work) or Field Reports (for construction activities). Additionally, the accounting unit ensures the invoice has not previously been paid by referring to a payment log that it maintains when payments are made.

Finally, the department appears to have adequately segregated duties. Contract accounting is responsible for the recording of expenditures and does not deal with any revenue transactions. A separate unit—the General Ledger group—records revenue and reconciles all ADOT general ledger accounts to various reports.

11. Is the current timetable for completing the Maricopa County Regional Freeway System and the assumptions built into this timetable realistic for completing the system by 2007?

    a. What is needed to make sure the accelerated plan is built within the specific timeframes? For example, what assumptions have been made in regards to right-of-way acquisition, utility relocation timeframes, and design issues?

    b. What checks and balances are in place to ensure the accelerated program stays on schedule?

    c. Do the current timelines established by ADOT for the development process and for right-of way acquisition seem reasonable?

Mostly, the accelerated timelines and assumptions established by ADOT appear reasonable and realistic. However, we believe some controls should be tightened and improvements could be made to help minimize delays and ensure the program stays on schedule. Our recommendations, along with detailed analysis, are presented on pages 18 through 38 in Chapter 1.

12. What factors or conditions might cause ADOT to not meet the 2007 timetable?

    Although some factors that could delay timely completion of the Regional Freeway System are outside of ADOT's control, there are other factors or conditions that ADOT should vigilantly address to avoid missing its 2007 deadline. Throughout Chapter 1 of our report, we discuss these factors and conditions and identify tools that ADOT should implement to help ensure it meets its deadline.

13. How accurate has ADOT been in forecasting when projects will be bid and when those projects will be completed?

    To assess the accuracy of ADOT's forecasting, we selected a sample of six freeway projects—three completed and three currently underway. Based on schedules and documentation provided by ADOT, we found that five of the projects have met planned milestones or are on schedule to meet plans. For the remaining project, ADOT started construction 9 months after the planned start date.

14. Update the program features identified in the 1991 performance audit report.

    See the Regional Freeway System features presented in Appendix C.

15. Review ADOT's performance measures in relation to the Maricopa County Regional Freeway System for the appropriateness of those measures and the accuracy of the performance measure data.

    Of the 25 agency level performance measures that ADOT has adopted, five are specifically designed for the Regional Freeway System. Although its performance measurement process is useful and the data collected appears reasonable, ADOT needs to make improvements to its system to be more valuable to the department in meeting its goals. We discussed this area in greater detail on pages 31 through 33 in Chapter 1 of this report.

16. Could the process used to expedite the median barrier project be applied to Maricopa County Regional Freeway System projects?

Because ADOT recently installed median barriers in what was perceived to be a rather quick process, some stakeholders questioned whether some of the procedures used to install barriers could also be used to expedite Regional Freeway System projects. However, due to differences in the size and nature of these projects, it is not feasible to apply the expedited process used for median barriers to the larger freeway projects.

Specifically, median barriers are substantially smaller in scope than freeway construction projects. Mainly, median barrier projects do not require preliminary design work, do not need an intricate level of design, do not necessitate the purchase of right-of-way property, and do not require utility relocation. Further, the actual construction of median barriers is substantially less onerous than that for roadways and freeways. Thus, the same procedures cannot be applied to the larger Regional Freeway System projects.

17. What impact will completion of the Maricopa County Regional Freeway System have on obtaining air quality goals?

18. How will completion of the Maricopa County Regional Freeway System impact air quality goals if projected reductions in auto emission levels are achieved in the years to come?

Air quality concerns are a significant factor in the planning of transportation projects in Maricopa County. Federal laws, as well as state and local actions, closely link the attainment of air quality standards with the development of a successful transportation system. Thus, the completion of the Maricopa County Regional Freeway System is but one of many tools that will have to be employed to attain, maintain, and sustain air quality goals for the region. Once air quality goals are attained, the county has to sustain its progress through the continued application of existing pollution control measures and alternative transportation projects. However, additional and more strict pollution controls may need to be developed and implemented to ensure that the federal Environmental Protection Agency (EPA) will not reduce federal funding through future sanctions.

All significant projects (such as the Regional Freeway System) programmed over the last five years and included in MAG's Transportation Improvement Plan were found to be in conformity with air quality standards as demonstrated in MAG's conformity analysis; therefore, these projects should not have a negative impact on air quality in the region. Additionally, education and outreach programs, development and implementation of alternative transportation systems, reductions in auto emissions—along with completion of the Regional Freeway System and implementation of pollution control measures—should help the metropolitan Phoenix area attain its air quality goals.

To estimate the effects of regional freeway transportation projects and pollution reduction strategies on future air quality, MAG models various factors in a process known as "conformity analysis." According to MAG, Regional Freeway System projects were considered in its modeling process when the conformity analysis was originally conducted on all significant projects that were included in Maricopa County's transportation plan. This process to determine if the region will conform to federal air quality standards is generally done for all projects included in the transportation program as a whole, but not for individual projects. However, if pollution controls are not implemented and enforced on each individual project, then the possibility exists that project activity could create a subsequent or contribute to an existing air quality violation that would negatively impact the region for several years.

MAG uses several-sophisticated computer models—consistent with those used in the industry and approved by federal agencies—to quantify the reductions in pollutants that are projected to be attained. These models rely upon several factors related to socio-economics (population, land use plans), travel demand (volumes, congestion, projected trips), and air quality (meteorological data, emissions). For instance, MAG's model considers a variety of factors related to emissions such as vehicle miles traveled, fuel modifications, vehicle fleet characteristics, motor vehicle speed and model year, type of paved and unpaved roadway, vehicle registration data, tire wear, traffic volume, gridlock, day of the week, and time of day.

In its most recent modeling, MAG demonstrated that with implementation of certain pollution control measures and programming of all significant transportation projects, the region could meet air quality standards in the future. Further, the conformity analysis showed that air quality would be worse without the additional transportation projects and pollution controls.

19. How effective are HOV lanes? Are the current plans for HOV lanes realistic in terms of their connections and projected use? What effect have HOV lanes had on reducing air pollution and decreasing traffic congestion?

While some researchers question the value of high occupancy vehicles (HOV) lanes, more of the research seems to conclude that HOV lanes are effective and provide many benefits. Because a great deal of debate still exists on their value, most of the literature calls for further research to be conducted on HOV lanes. Notwithstanding any ultimate conclusions, many studies agree that these lanes work best when incorporated as one tool in a traffic management system and when used in combination with other emission reducing alternatives such as transit and light rail systems.

Specifically, researchers disagree on the effectiveness of HOV lanes in reducing air pollution and decreasing traffic congestion. One Texas study concluded that HOV lanes result in a 12 percent reduction in fuel consumption and a 59 percent reduction in carbon monoxide emissions as compared to general-purpose lanes. Further, a representative from the Los Angeles County Metropolitan Transportation Authority gave a presentation in 1994 praising HOV lanes in his area asserting that they have made travel easier and afforded time savings to carpoolers. The representative also stated that everyone benefits from HOV lanes and bus usage through improved air quality, reduced congestion, and energy savings—which, in the long run, would help improve the quality of life in his region. In contrast, at a 1994 conference of the Institute of Transportation Engineers, the Chesapeake Bay Foundation cited a San Diego study that found HOV lanes to be the least cost-effective air quality measure of all those studied. Other research suggests that, in the long run, congestion will not lessen and air pollution would actually worsen with HOV lane construction. The foundation also cited a study done in Sacramento that modeled proposed HOV lane construction and found that carbon monoxide levels would be a little better, but nitrogen oxide levels would actually be worse.

In Maricopa County, we found that only small sections of the Regional Freeway System funded by excise tax monies have incorporated HOV lanes. Specifically, to date, only 9.5 actual miles of HOV lanes have been funded with the excise tax funds at an estimated cost of approximately $39 million. However, it appears that much consideration was given to ensure that the use of the HOV lanes and related HOV connection ramps was realistic at the time construction was planned in the late 1980s.

We found that MAG uses specific criteria for evaluating the feasibility and potential benefits of HOV projects on air quality, safety (in terms of accidents), congestion relief (measured by benefit to cost ratio and current versus future capacity), and use of alternative modes (includes intelligent traffic systems, bike lanes, and bus pull-outs). All projects—including HOV lanes—are "modeled" through sophisticated computer programs that attempt to quantify air quality benefits to be achieved by the projects. However, until the entire freeway system is completed, it is difficult to isolate the effect that HOV lanes, in particular, have on reducing air pollution and decreasing traffic congestion.

20. How much land is left to acquire for planned freeway construction and when is the best time to acquire it?

As of January 31, 2000, ADOT had approximately 3,700 right-of-way acres left to purchase for the Regional Freeway System. If this land were purchased today, ADOT estimates it would cost approximately $405 million. Further, ADOT anticipates completing all remaining right-of-way acquisitions by September 2005.

We consulted with our transportation expert to determine the appropriate timing for acquiring right-of-way land. Based on his expertise and our research, there is little information or proven "best practices" on the best time to acquire land. However, he stated that since right-of-way acquisition is a critical path item in the overall delivery of the program, it should be delivered as early as legally possible to assure there are no delays in the construction schedule. Because the adequacy of the early design plays a key role in the timing of right-of-way acquisition, it is essential to reach an adequate level of design detail to ensure that limited, if any, changes are made to the design structure once right-of-way acquisition has begun. If the lines are established prematurely, there is a possibility that due to changes in final design, more right-of-way may be required. This could result in costly delays in both budgeted time and cost. However, ADOT has taken steps to acquire nearly 870 acres of right-of-way property ahead of schedule using $100 million in Board Funding Obligations, as previously discussed in the Introduction of this report.

21. How effective has the red-letter process been in preventing development in the planned alignment of the Maricopa County Regional Freeway System? If problems exist, what changes should be made to improve the process?

22. What can ADOT do, if anything, to preserve the transportation corridors needed for the Maricopa County Regional Freeway System?

Overall, the red-letter process works well at notifying ADOT of potential developments within the corridor; however, its usefulness in terms of preventing development in the corridor is constrained by the amount of funding available to ADOT to purchase right-of-way at that time. The main devices available to the department to keep development out of the corridor are a well-defined corridor and funds available to the right-of-way group to purchase the land.

The red-letter process is a system to help limit future escalation of right-of-way costs by notifying ADOT of potential developments within or near freeway corridors. Specifically, ADOT receives notices from local municipalities of zoning changes or building permit applications that are within a quarter-mile of established freeway corridors and reviews these notices to determine if there would be a financial benefit to the State by acquiring the property earlier than scheduled.

For the 20 red-letter notifications ADOT received over the past three years related to regional freeway projects, it acquired 11 of the properties or 55 percent prior to their scheduled purchase date. The remaining nine properties, or 45 percent, will be purchased according to the original acquisition schedule.

ADOT has no specific legal authority to prevent local entities from re-zoning or issuing building permits to landowners within the corridor. Therefore, it is up to the local entities to create their own policies regarding corridor permits. The localities understand that they do not have authority to deny permits in the corridor, but some more actively manage the process to discourage private entities from building in the corridor. Specifically, we found the towns of Chandler and Gilbert regularly attempt to negotiate with private entities to build elsewhere within their localities.

23. How effective has ADOT been in coordinating land purchases from the State Land Department?

Charged with administering state trust lands, the State Land Department (SLD) is responsible for assuring the highest and best use of the trust lands on behalf of the trust beneficiaries—the citizens of Arizona. Moreover, both the Federal Enabling Act and State Constitution mandate that the SLD receive fair market value for the sale of all trust lands.

As such, ADOT treats SLD like any other landowner when it purchases right-of-way land. However, unlike its transactions with other landowners, ADOT cannot condemn property owned by the SLD property and cannot sue without the Governor's approval. As a result, ADOT's attempts to negotiate a settlement, at times, can be very lengthy. To partially accommodate the lengthy process, the SLD has allowed ADOT to access its property—even when the final purchase has not taken place, through the use of right of entry. This right allows ADOT to begin construction, even though the acquisition transaction may be delayed. Specifically, the SLD charges ADOT a fee for the right of entry and obtains a down payment towards the purchase price (which is subsequently applied against the final purchase amount) and, in return, allows construction to begin.

According to the SLD, most, if not all, of the right-of-way for the Regional Freeway System has been purchased or is in the process of being purchased for the freeway system. In total, ADOT has purchased less than 2 percent, or $26 million of its $1.3 billion of total right-of-way acquisitions from the SLD. Overall, the coordination between the two entities appears effective.

24. How accurate have excise tax revenue estimates been since the 1997 report and what trend is expected into the future?

ADOT's revenue estimates have proven accurate and useful in its management of the Regional Freeway System. To determine the accuracy of tax revenues, we conducted various interviews, assessed various documents regarding the forecasting process, reviewed material distributed in sessions with economists, examined reports generated to track revenue forecasts against actual revenue receipts, and reviewed cash flow reports.

Revenue forecasting programs were developed in the mid-1980s. Arizona was just coming out of an inflationary period (of about 12 percent) and ADOT used a conservative 10 percent growth rate at the time for its projections. In 1991, a risk analysis concept was introduced in forecasting revenues. This forecasting method is a regression-based model that considers information from economic analysts (one of which is a representative from MAG) obtained during risk analysis sessions that are conducted prior to finalizing forecasts.

The economy improved by 1994, as did the actual revenue. However, as previously discussed on page 40 in Chapter 2 of our report, ADOT continued to use conservative revenue estimates because of the economic downturn it experienced in the early 1990s. When questions arose about ADOT's large cash balances, increases in actual revenue, and extremely conservative revenue forecasts, ADOT contracted with a consultant to revise its revenue forecasting models in 1996 and complete the models by September 1997. Although the revenue forecasts are formally revised annually, ADOT updates estimates internally on a monthly basis using a cash flow analysis.

Since the 1997 audit report, ADOT's forecasting of actual excise tax revenue has met its estimates or has been reasonably close (within 7.5 percent) of the estimates. Over the next six years, ADOT has projected conservatively with anticipated revenue increases ranging from 2.21 through 7.25 percent.

25. How accurate have project cost estimates been since the 1997 report and what trend is expected into the future?

As we explain on pages 34 and 35 in Chapter 1 of our report, overall initial cost estimates since 1997 appear to be fairly close or slightly less than actual costs. Moreover, our transportation expert found the most recent construction cost estimates to be reasonable. However, because of the method used in developing and revising cost estimates and the level of information maintained by project managers for individual projects, we could not conclude whether cost estimates for individual projects were accurate.

Additionally, we found that all cost estimates are prepared using current dollars (rather than taking into account inflation), which may be misleading since actual costs will more than likely be higher if only due to inflation. Further, we found that ADOT does not always monitor actual costs against original cost estimates.

26. Have the Life Cycle Certification Reports produced by ADOT proven reasonably accurate?

Because of the method used by ADOT to produce these reports, it was difficult to test whether its reports have proven reasonably accurate. However, we reviewed the January 31, 2000 Life Cycle Certification Report and found it was reasonably supported. In addition to this report, we reviewed several prior life cycle reports to trend costs over the last three years and found that total cost estimates for the freeway system have grown over 34 percent, from $4.4 billion in January 1997 to $5.9 billion in January 2000. Although some of the growth in cost estimates is due to inflation, projects added to the system and project scope changes have also contributed to the growth.

27. How has the use of State Infrastructure Bank Loans and Grant Anticipation Notes impacted the acceleration of the freeway system and how are they projected to impact the freeway acceleration?

28. Define and conclude on the various assumptions that were built into the State Infrastructure Bank Loans and Grant Anticipation Notes funding mechanisms.

The use of State Infrastructure Bank Loans (SIBs) and Grant Anticipation Notes (GANs) allow the department to accelerate the building of the freeway system by enabling the department to use revenue, that it would typically not receive until later years, sooner. Thus, projects that were originally planned to be built between the years 2007 and 2014 because funding would not be available until then, can now be scheduled for construction before 2007 due to bonding and loan provisions. However, SIBs and GANs comprise only a small amount—approximately 14 percent—of all funding sources that have been used to accelerate Regional Freeway System projects.

The 1995 National Highway System Designation Act established the State Infrastructure Bank (SIB) pilot program. Designed to complement traditional transportation funding programs, SIBs can give states significantly increased flexibility in project selection and financial management. Much like a private bank, a SIB uses seed capitalization funds to get started and offers customers a range of loans and credit enhancement products. Initial funds can be used to finance eligible transportation projects, including both highway construction and transit capital projects. Under a federal SIB pilot program, ten states were authorized to establish SIBs, one of which was Arizona.

ADOT was first authorized to administer a SIB under a cooperative agreement with the Federal Highway Administration in 1996. As a result, the department established its SIB, the Highway Expansion and Extension Loan Program (HELP), in 1998 pursuant to state regulations. The HELP was initially capitalized with grants from federal and state matching funds, but received additional funds in 1999 through state enacted legislation. Refer to pages 8 through 10 in the Introduction of this report for more discussion of these additional funds.

HELP operates similar to a bank, providing financial assistance in the form of loans or credit enhancement for eligible transportation projects across the state. Further, it has established application procedures, application approval process, and repayment structures. HELP operates under the authority of the State Transportation Board and, in accordance with state regulations, a seven-member HELP Advisory Committee. The committee is responsible for reviewing loan applications and other financial assistance requests and making loan recommendations to the State Transportation Board.

The federal government also allows alternative forms of loans, such as grant anticipation notes (GANs) and similar short-term debt instruments, to be issued in anticipation of certain future revenues, including future federal reimbursement of state transportation expenditures and state appropriations. GANs can be issued to provide financing in advance of conventional funding flows. Since 1985, the State Transportation Board has had the authority to issue GANs, but had not done so because of certain restrictions that were recently lifted. ADOT issued its first GANs on July 1, 2000.

GANs, together with the HELP funds, will enable certain freeway projects to start sooner by using diverse sources of funds to acquire necessary right-of-way land and to design and construct eligible projects.

29. Review the transportation excise tax monies received by the Regional Public Transportation Authority and identify to what extent these funds are applied regionally as opposed to locally.

Over a four-year period between fiscal years 1995-96 and 1998-99, the Regional Public Transportation Authority (RPTA) has spent the majority of its excise tax allocation—an average of $6.8 million annually—on regional projects such as bus service, vanpools, and dial-a-ride vehicles.

According to Arizona Revised Statute, Title 28, Section 6305, ADOT is required to transfer $5 million each fiscal year to the public transportation fund and adjust the monies distributed by the annual percent change for the previous calendar year in the gross domestic product price deflator as defined in Arizona Revised Statute, Title 48, Section 5103. In fiscal year 1998-99, ADOT transferred over $7 million to RPTA. To fulfill its key mission, RPTA develops and promotes alternate travel modes that encompass a wide range of projects such as transit bus service, vanpools, dial-a-rides, park and rides, bike lanes, and pedestrian projects. Additionally, alternative modes can include trip reduction programs such as telecommuting and flextime.

While RPTA allocated most of the excise tax funds to fixed-route bus service throughout the Maricopa County region, it also provided nearly one million dollars—or approximately 15 percent of its annual allocation—to local transit departments for local projects. For instance, the city of Phoenix receives about $450,000 of excise tax funds for dial-a-ride and reserve-a-ride programs that benefit low-income and senior citizens.

Finally, RPTA spent the remaining excise tax money on local transit projects such as dial-a-ride services in Tempe, Scottsdale, Mesa, and Chandler and para-transit services in Paradise Valley. Between fiscal years 1995-96 and 1998-99, RPTA spent between 2.5 and 4 percent of its annual excise tax allocation on these local projects. Specifically, the allocation has been approximately $175,000 to $250,000 annually.

30. What percent or amount of the ½ cent sales tax has gone for funding alternative modes of transportation and what specifically the money has funded?

Over the last four years, RPTA allocated more than $27 million of excise tax revenues, or 3.34 percent of the total excise tax revenues received that period, to alternative modes of transportation such as bus service, vanpools, dial-a-rides, and studies on light rail systems. Additionally, over the entire life of the Regional Freeway System program, ADOT spent or plans to spend over $71 million on alternative projects such as high occupancy vehicle lanes and ramps, toll roads, and intelligent traffic systems.

31. Could Intelligent Traffic Systems play a role in relieving freeway congestion? Consider the effect redesigning local intersections to loosen up traffic flow will have on traffic congestion.

According to many studies analyzing its benefits, Intelligent Traffic Systems (ITS) can relieve freeway congestion, increase the efficiency of freeways and public safety, and minimize environmental impacts. Common ITS tools used to relieve traffic congestion include:

- Metered freeway on-ramps
- Synchronization of traffic lights
- Traveler information centers such as kiosks
- Real time control of traffic signals
- High occupancy vehicle and reversible lanes
- Electronic toll and fare systems
- Railroad grade crossing warning systems

Both ADOT and MAG recognize the role ITS can play in relieving freeway and road congestion and have taken steps to ensure that there is a plan for the implementation of ITS in Maricopa County. According to ADOT, all Regional Freeway System segments built in the last two years and planned in future years have been funded to incorporate fiber optic cables (infrastructure) and loop detectors in the pavement every one-third mile to connect the ITS system. However, while some of the infrastructure has been installed, many elements remain unfunded.

While some ITS projects relate to statewide freeways others are more local in nature. For example, redesigning local intersections could have a positive effect on traffic congestion by improving vehicle flow and capacity. However, Regional Freeway System excise tax funds are not used to fund local improvements and must be spent on controlled access freeway projects. Thus, MAG funds local ITS projects through other funding sources, such as federal Congestion Mitigation of Air Quality funds. To ease congestion, alert drivers to delays, and improve public transit operations, several regional transportation entities including ADOT, Maricopa County Department of Transportation, and cities and private industry within the county have joined to form AZTech, a partnership to employ ITS technologies. Through this partnership, ADOT and local entities have installed traffic sensors, cameras, and synchronized traffic signals on streets called “smart corridors,” and used variable message boards and kiosks to inform travelers of traffic conditions throughout the region. While positive results have been reported by AZTech, the impact of ITS on the Regional Freeway System can not easily be measured.

32. Compare traffic projections from 1985, and subsequent revisions to those projections, to current traffic volumes. For example, in 1985, what traffic volumes were projected for the year 2000? If significant variances exist between what was projected and what is reality, review projection model(s) used and make recommendations for improvements. Note the impact of traffic projections on freeway planning.

Although we were asked to compare 1985 projects to actual, MAG did not present calculations for that time period. Therefore, we compared MAG's 1979 projections for year 2000 to the actual traffic volumes of 1998 and our review found that noticeable variances exist between traffic projected and actual traffic volumes that had materialized. Many of the variances result because some of the key assumptions underlying the 1979 model have significantly changed. For example, some of the initial projections were developed for segments of freeway that were never built. Yet, other corridors have changed paths since the initial projections in order to accommodate growth.

To estimate vehicle miles traveled throughout Maricopa County, MAG uses a sophisticated travel demand model that analyzes data based on demographic and socioeconomic projections of population and employment. MAG currently uses the resulting model's traffic projections for freeway planning and as criterion for prioritizing transportation projects. For example, MAG uses the projections to estimate delays and congestion, test high occupancy vehicle lane use, and assess alternative land use patterns. In general, when MAG prioritizes projects, those freeway segments projected to have heavy traffic demand are usually given a higher priority.

Although the predictions made 20 years ago did not completely materialize, we do not believe it is necessary to recommend improvements to the projection model. Over the years, MAG has changed its traffic projection model and its design and accuracy appear reasonable. Moreover, it considers the constant updates to its model important to accommodate the variety of changes impacting traffic volumes on a regular basis.

33. Review the latest 20-year traffic projection and the viability and appropriateness of the model used.

To assess the viability of MAG's 20-year projection model, we compared the model against federal guidelines. Based on this review, MAG's current traffic projection model and related projections for the year 2020 are viable and appropriate.

Specifically, MAG's model is based on a standard four-step travel demand forecasting method and includes the majority of data suggested by the federal Bureau of Transportation Statistics. Further, a model's validity is based on its ability to replicate current traffic conditions and MAG's current model replicates today's traffic conditions within an acceptable measure of error. In addition, MAG continuously updates the data within its model in order to ensure that it remains viable.

However, Federal Highway Administration literature cites the limitations of the four-step model and encourages the use of expanded transportation planning tools. Along these lines, MAG has indicated its desire to participate in the implementation of TRANSIMS, a sophisticated traffic projection model currently under development by the Federal Highway Administration.

34. Are traffic projections models used by ADOT adequately identifying where sound walls are needed?

It appears that appropriate models are used to assess noise levels and identify the future location of sound walls. For each freeway project, ADOT hires an external consultant to assess noise levels. The consultant gathers data, inputs the data into the Federal Highway Administrations' noise abatement model or one based on that model, provides a report to ADOT on the noise conditions, and suggests any noise abatement it feels is appropriate.

However, federal guidelines allow the department a great deal of latitude to make changes to sound wall specifications subsequent to the completion of noise studies. Specifically, ADOT's site engineers can make slight changes to the location of sound walls without approval or additional noise studies. Furthermore, should the engineer deem substantive changes are necessary, the proposed modifications would be subject to review and approval by ADOT management.

35. What impact will video conferencing, telecommuting and other methods have on traffic and have these been considered in current traffic projections?

36. What impact will Internet shopping have on traffic congestion and has this been considered in traffic projections?

According to MAG, both e-commerce and telecommuting are considered in its current model to the extent that these issues impact today's traffic patterns. MAG inputs current traffic flow data into its projection model to predict future traffic projections. Therefore, indirectly, these issues are included in projections as changes actually occur in current traffic patterns and volume. Moreover, we found MAG's current model to be viable and appropriate.

According to MAG, the use of e-commerce and telecommuting is difficult to predict and too recent to have a traceable impact. Therefore, it has not tried to augment the traffic projections for future highway planning and development to accommodate any potential change in e-commerce or telecommuting because it would not be able to predict the popularity or true effects on traffic with any degree of certainty. However, MAG is confident that its current method of traffic projections will capture the future effects of telecommuting and e-commerce on traffic flow.

Appendix B

Status of 1997 Performance Audit Recommendations

Recommendation	Fully Implemented	Partially Implemented	Not Implemented	No Longer Appropriate
Audit Response 1.1, 1.2, 1.3	●			
Costs and Estimates 2.1, 2.2, 2.3	●			
Program Reporting 3.1, 3.2 3.3, 3.4	●			●
Cost Containment 4.1	●			
Cash Management 5.1 5.2, 5.3, 5.4, 5.5	●			●
Governance 6.1 6.2	●		●	
Decision Making 7.1, 7.2, 7.3 7.4	●	●		
Program Controls 8.1, 8.4 8.2, 8.3, 8.5 8.6, 8.8	●	●		●
Project Execution 9.1, 9.4 9.2 9.5	●	●		●
Change Management 10.1, 10.2, 10.3	●			
Right of Way 11.1, 11.2	●			
Alternative Funding 12.1, 12.2, 12.3, 12.4a, 12.4b 12.5	●			●
HURF Compliance 13.1, 13.2, 13.3				●

Source: Performance Audit Report on the Maricopa County Regional Freeway System, David M. Griffith & Associates, July 1997.

Appendix C

Regional Freeway System Program Features

Features	1985	1991	2000
Right-of-way acres	8,500	12,947	9,360*
Total lane-miles	1,171	1,333	962†
Expressway lane-miles	250	22	44
Freeway lane-miles	921	1,311	883
Traffic interchanges	127	156	125
Fully directional interchanges	0	14	10
Miles of depressed freeways	13	56	43

Source: KPMG Performance Audit of the Arizona Department of Transportation's urban Highways Program for Maricopa County, KPMG Peat Marwick, August 1991.
DMJM general plans and 30 percent design plans.

Note: As freeway construction progresses through the 30 percent, 60 percent, 95 percent, and final phases of design plan completion, the program features are more precisely defined. Because projects on the Regional Freeway System are currently at various stages of design completion, these program features in the table above could change once again before the Regional Freeway System is completed in 2007.

*As of November 1999—5,638 right-of-way acres have been purchased and 3,722 remain to be acquired. This results in roughly $1.4 billion of right-of-way land purchased and $405 million remaining to be purchased.

†As of the end of February 2000—455 lane-miles have been completed and 507 lane-miles are in progress or scheduled for completion by the end of 2007. In actual miles, ADOT has completed 58 miles of the Regional Freeway System funded by excise tax funds and has 86 miles left to complete for a system total of 144 actual miles.

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July 19, 2000

Debbie Davenport, Auditor General
Office of the Auditor General
2910 N. 44th Street, Suite 410
Phoenix, AZ 85012

Dear Ms. Davenport:

A review of the 2000 Performance Audit of the Regional Freeway System final report has been completed. The Arizona Department of Transportation's response to the audit findings and recommendations is enclosed. Although we can not fully agree on every point, many of the recommendations will help us improve the management of the Regional Freeway System.

The audit team from Sjoberg Evashenk Consulting and the Auditor General's staffs have been very accommodating during the course of the audit and their efforts are appreciated.

Sincerely,

Victor M. Mendez
Deputy Director

Enclosure

Arizona Department Of Transportation

Response To The:

2000 PERFORMANCE AUDIT REPORT

Maricopa County Regional Freeway System

July 19, 2000

ADOT RESPONSE TO THE: ***07/20/00***
2000 PERFORMANCE AUDIT REPORT
MARICOPA COUNTY REGIONAL FREEWAY SYSTEM

EXECUTIVE SUMMARY

The successful, accelerated completion of the Regional Freeway System (RFS) by 2007, some seven years sooner than recently planned, is a priority for the Arizona Department of Transportation (ADOT). As always, the Department seeks to continuously improve performance, and the timely completion of each project that comprises the Regional Freeway System. The Performance Audit conducted by the Office of the Auditor General every three years is an important part of our process. Previous audits have provided valuable insight and resulted in recommendations, which have strengthened ADOT capabilities, improved performance and enhanced public support. The 2000 Performance Audit has been thoroughly reviewed. It provides a comprehensive and insightful basis to assist the Department in addressing areas needing improvement. A plan for implementation of the recommendations will be developed, similar to the 1997 audit.

The audit has correctly concluded that for ADOT to implement the program to complete the Regional Freeway System by 2007, sound project management is vital. Delivery of a program of this magnitude involves many stakeholders, consultants, contractors, suppliers and the public. The work involved and complexity of coordination with all the participants makes for a monumental task. ADOT strives to use sound project management practices and is open to continuous improvement of our capabilities.

The audit identified a number of constructive recommendations, many of which focus an tightening project management controls. ADOT agrees that projects need to be closely monitored to ensure that schedules continue to be met and costs contained. We also agree that documentation of our progress can be improved and that we can optimize the use of management tools. To that end, ADOT has already initiated efforts to identify the improvements that are needed to ensure success.

ADOT is appreciative of the positive audit conclusion that the timelines and assumptions underlying the freeway acceleration plan are reasonable and realistic. The Department had previously conducted its own examination of key issues before determining that construction of the freeways on a faster track was possible. Our assumptions were found to adequately address the critical steps needed to deliver the Regional Freeway System on time The audit found other positive aspects that are noteworthy:

1) The majority of the 1997 audit recommendations were implemented.

2) The accuracy of revenue estimates has increased.

3) Partnerships and communication with stakeholders have been strengthened.

As noted by the audit team, great strides have been made in managing and delivering the Phoenix area freeway system. Hard work has resulted in the completion of 29 miles of freeways since 1996. ADOT and its contractors have added three major interchanges linking Loop 101 with 1-17, Loop 202 and US60, providing motorists with direct freeway to freeway movements. Key segments of "interim" freeways and frontage roads are already carrying traffic. Most importantly, 30 more miles of freeways currently under construction are scheduled for completion by the end of next year (2001).

ADOT and the Regional Freeway System are headed in the right direction. We appreciate the input provided by this audit. The following is a point discussion addressing many of the findings and recommendations:

CHAPTER 1 ADOT's Accelerated Plan Appears Realistic, But Tighter Management Controls Over the Regional Freeway System Will Help Ensure Timelines Are Met

Most of the findings and recommendations focus on providing better project management and tightening management controls over the development and construction of projects. The audit findings have identified some sound recommendations that will help ADOT improve its project management processes. It is encouraging that the auditors concluded that the plan to complete the Regional Freeway System by the end of 2007 "appear reasonable and realistic." ADOT is confident that this goal is achievable, barring unforeseen circumstances beyond our control. These findings have helped identify some issues, which will be thoroughly evaluated. The audit recommendations will be considered for implementation.

The audit team carried out their audit tasks in a professional manner. However, due to the audit teams limited exposure to a complex program, it must be recognized that some the conclusions reached by the auditors may not be based on a full understanding of the myriad of processes and procedures used to manage the Regional Freeway Program. To enhance the understanding in future audits, it is recommended that the audit team's technical expert participate in the interviews and discussions with ADOT staff to ensure a fuller understanding and comprehensive grasp of technical issues, processes and oversight controls.

The following is a point discussion addressing key findings and recommendations:

Project Managers Need Greater Authority to Fulfill Their Responsibilities

ADOT consciously selected the project management process currently in use. Project Managers (PMs) are given sufficient levels of authority for the leadership and direction of the development phase with upper management oversight. The auditor's findings are based on the premise that that a central project leader or manager would function more effectively, which may or may not have merit. ADOT project management philosophy embraces a team concept within a partnering environment. Our philosophy recognizes that the sum of the parts is greater than the whole and that technical experts are better positioned to make technical decisions. Work is accomplished with a cooperative approach where technical leaders participate under the PM's leadership and guidance, rather than one individual retaining all authority. A team concept leads to buy-in and acceptance by all partners.

ADOT's team approach is consistent with similar approaches used in many other states. The audit made a differing comparison between ADOT and CalTrans. Contact with CalTrans reflected that, while our counterparts in California define their PMs as "one hat" PMs, they actually function in a similar capacity to ADOT's PMs. The team concept cannot be understood by observing our organization chart, rather, it is important to analyze the entire project development process to determine how the team-approach functions day to day. It is the State Engineer's responsibility, with the assistance of the Deputy State Engineers to see that each team member understands their roll, decision-making authority and responsibility to support the PM's efforts to deliver the projects on time and within budget. The auditors may have understood our project team approach more fully, had they interviewed the State Engineer and the Deputy State Engineer responsible for project development.

ADOT will review, consider and confirm the appropriate levels of authority and responsibility that PMs need to effectively manage the projects assigned to them. There is merit to ensure the roles, responsibilities and accountability of each member of the project team are clearly defined and understood. It is also prudent to confirm that our PMs have appropriate levels of responsibility and authority throughout the project life cycle to ensure their projects are completed on schedule and within budget.

Although It Manages Daily Activities, ADOT Can Improve Project Oversight

ADOT currently uses most of the project management and control processes identified in this section, including the control of project scope, schedule and cost changes. ADOT has processes that ensure quality control of projects and timely reporting of

project progress. ADOT has a well-documented change management process that clearly defines parameters for scope, schedule and budget change approval. Even though many of these project control processes are documented, ADOT recognizes that there is a need to improve documentation and data management. Additionally ADOT will look to improve meeting minutes in a manner that ensures key decisions and followup action items are effectively organized and documented.

Another concern raised in this section referenced the need to measure and track staffs ability to meet all estimated critical path milestones throughout the project life cycle. ADOT concurs that it is important to monitor the project development progress to ensure schedules and budgets are met. ADOT has been tracking and monitoring, key milestones, which include, design start, project advertisement and bid and construction completion. Better measurement and documentation of related key milestones would enhance project control. However, ADOT has been able to deliver its accelerated program due to continuous oversight by PMs and management to ensure all phases are completed to meet overall scheduled completion goals.

ADOT incorporates considerable high-level management oversight at all levels within the organization. For example, Regional Freeway System status meetings held every two weeks involves all high level managers who report, interact, address issues and recommend solutions. The meeting includes the Director, Deputy Director, Chief Financial Officer, State Engineer, Deputy State Engineer, Right of Way Manager, District Engineers, Valley Project management leaders, and the Director of Community Relations. The Maricopa Association of Governments and the Federal Highway Administration also have representatives attending this meeting. Additional high-level management oversight is provided as part of the process for approving material changes to scope, schedule and budget for projects under development. This action item includes approvals by the Project Review Board (PRB), the Priority Planning Advisory Committee (PPAC) and ultimately the Transportation Board. For "material changes" in scope, schedule and cost, an additional approval is required by MAG. Changes are reviewed and approved by the MAG Transportation Review Committee, Management Committee and Regional Council. The auditors were invited to attend these meetings but were unable to attend. Additionally, the Deputy State Engineer for Valley Transportation provides daily project oversight with his involvement in critical project issues throughout all phases of project development and construction.

It is agreed that ADOT will reinforce the importance for project managers to adhere to processes outlined in the Project Development Process Manual. We agree that better progress reporting of project milestones will ensure that completion target dates are met and projects continue on schedule.

ADOT has proactively begun to address the recommended improvements to project oversight by developing new and improved reporting documents. A new Project Managers Report is being developed that will track completion of project milestones and

project cost estimates to ensure and document the control of project schedules and costs.

Regarding the need for PMs to track and maintain records of right of way cost, ADOT maintains that the responsibility for right of way cost containment is best handled by the ADOT Right of Way Group who have the technical expertise. However, PMs do monitor the right of way costs to ensure that the project costs are within current budgets, and make change requests when additional funds are needed to complete the right of way acquisition for a project. ADOT will evaluate methods to provide accurate and timely right of way data to be accessible to the PMs and involved project team members.

Better Focus Is Needed On Project Cost Containment

Initial project cost estimates are established before any of the design work is completed and are based on preliminary cost estimates prepared as part of design concepts. It is impossible to identify all costs in the early stages of project development due to the many changes that occur over time. These changes are readily apparent upon review of the Audit Report Introduction that includes an overview of the history of the Regional Freeway System. For example, due to funding limitations in 1995, the program was scaled back, by deleting several freeway corridors and design features. Since that time many of the design features previously deleted have been restored to the program, as additional funds became available. Due to the dynamics of the program, it has been difficult to maintain a consistent cost basis for comparative purposes. Additionally, there are circumstances beyond ADOT's control that impact costs. Legislation was recently passed regarding ADOT interactions with utility companies resulting in higher relocation costs. Costs are refined throughout the project development phases based on updated and changing design information. PMs recognize that design changes or additions are predicated upon a cashflow analysis which confirms funding availability. Comparing current project costs to previous projections isn't necessarily an effective measurement of ADOT's performance in the area of cost containment. This is why ADOT focuses on balancing the program in total, and biannually comparing the latest costs to the most recent revenue forecasts.

PMs are responsible for monitoring and maintaining costs within budget constraints prior to recommending material changes. Cost adjustments are approved, if the increase can be accommodated within the overall funding limitations of the program for the year(s) in which the project is scheduled. Project managers monitor project estimates with the support of the General Consultant. The General Consultant continually maintains up-to-date unit cost data and reviews project estimates submitted by the project managers to ensure that costs are estimated accurately. Secondly, PMs oversee the consultant design of projects to ensure that designs meet ADOT quality standards and are maintained within scope and budget. When design changes result in a justified need to increase the cost of the project beyond the estimated project budget,

PMs initiate and justify a "material change" to the project. Once the material change has been approved and funding is verified, the project estimate can be changed.

4 As part of ADOT's Life Cycle Program management, project costs are adjusted for inflation. The Life Cycle process includes semi-annual reviews of the project costs and an update of revenue projections. The program cashflow includes a discount factor (inflation factor) that represents a projection of cost growth trends by bid item and a review of the projected changes in land use. The growth trends for design, construction and right of way are based on a programmatic review of market factors and expert opinions presented through a Risk Analysis process. Program revenues are reserved to account for the annual adjustments to project costs, based on the discount factor. The semi-annual Life Cycle reviews provide regular confirmation that the revenues available to the program can reasonably cover program costs.

ADOT agrees that improvements can be made in the area of cost containment. However, as acknowledged by the audit, the cost of the over all program has been contained within previous estimates. As a result of the audit finding, ADOT will review processes that ensure program cost control to determine if they can be enhanced to accurately provide effective cost containment at the project level.

ADOT Does Not Fully Use Its Project Management System

Project teams maintain a high level of communication in addressing and ensuring that project milestones are met. Project managers and consultants document key design decisions during the development process. However, documentation is not always consistent and is sometimes difficult to retrieve. The audit has identified some areas where project management tools could be incorporated to document and communicate important decisions and progress.

ADOT has implemented the use of Primavera, an automated management system, and provided training for all project managers and technical leaders. However, its use has been inconsistent, and better utilization is achievable, which will help to more efficiently manage projects. As recognized by the auditors, ADOT is working to remedy concerns by more fully utilizing Primavera.

ADOT agrees that PMs need to provide regular updates, before the system can be used and relied upon to provide an accurate assessment of the project status. ADOT will work toward better utilization of this management tool. Additionally, ADOT will investigate how Primavera could be used to consolidate other tracking databases and spreadsheets to provide a more comprehensive, centrally located, source of project information that is readily available. The outcome of these efforts is expected to provide better reporting and monitoring of progress.

Departmental Vacancies Could Affect Project Oversight and Completion of the Freeway System by 2007

ADOT agrees that attracting and maintaining experienced staff to manage and oversee project development and construction are critical to successful implementation of the Regional Freeway System. ADOT is hopeful, the recent adjustments to the salaries of engineers and technical staff will result in vacancy rates declining. However, with the high levels of work in our industry, there is a continual draw from other governmental agencies and the private sector for qualified staff. ADOT will continue to make every effort to improve staff retention and reduce vacancies.

ADOT relies on consultants to provide additional services needed to deliver the Regional Freeway Program. ADOT works with many well-qualified firms that have consistently provided both quality and timely service. The Arizona Consulting Engineers Association (ACEA) has assured ADOT that the engineering consulting community is capable of providing the necessary services to succeed in delivering the Regional Freeway System.

Likewise, the highway construction contractors have delivered quality projects thus far in the program and are continuing to provide competitive bids and consistently meet or exceed estimated construction schedules.

Performance Measures Could Be Improved

The audit has identified some positive recommendations that will support and improve the successful implementation of ADOT breakthrough strategies. ADOT's "Breakthrough Strategies" include:

- Develop and employ a measurement system that provides information for securing and allocating resources and improving performance.
- Allocate resources according to mandates, planned priorities, customer requirements and return on investment.
- Align workforce development with priorities and business needs; design and implement necessary training programs and delivery systems.

ADOT will review and consider the implementation of more meaningful measurements that effectively support our goals, objectives and strategies. Our strategic planning process will be reviewed to identify a methodology that will ensure there is a feedback loop for communications and actions.

The auditors were critical that ADOT had not documented responsible parties for corrective action and follow-up For all those who work on the Regional Freeway

System it is clearly defined who is responsible for follow-up. The Valley Transportation Group is organized with specific staff identified to deal with issues that arise on the various freeway corridors. Additionally, the Valley Transportation leadership team has direct, day to day involvement to resolve issues quickly and to ensure that our completion targets are met. Weekly, Valley Transportation staff meetings are held with key staff to review and identify problems early and to initiate corrective action. Unfortunately**,** the audit team was unable to attend any of these meetings to witness how issues are addressed. Additionally, ADOT executive management, including many members of the Operations Committee attend bi-weekly Regional Freeway System meetings where the status of all aspects are reported and issues discussed to ensure that everyone is current on Regional Freeway issues. Minutes are taken at all Regional Freeway System meetings where status and identification of issues are documented. The audit team was also unable to attend any of these meetings. ADOT will review its internal processes and procedures dealing with issue resolution to ensure that those responsible for corrective action and follow through activities are clearly identified. 5

ADOT should conduct Post Construction Reviews to Improve its Processes

ADOT recognizes the importance of post-construction reviews. Post construction critique of a project by the project manager, designers, resident engineers and contractors, including subcontractors, is accomplished as part of the partnering closeout conference. The Value Engineering office distributes lessons learned. ADOT will evaluate and consider the audit recommendation to broaden the post-construction reviews to consider the success of the project management process from design through construction. The suggestion that project managers should prepare a final closeout report, that include recommendations for improvement of the project management process will also be considered.

Construction Cost Estimates Are Reasonable

ADOT has a sound documented method for preparation of estimates at all key milestones. These estimates are consistent with the level of detail in the design at the major milestones. Consultants are required to submit the appropriate detail in a format that allows for comparisons to previous estimates. Estimates based upon submittal of 30, 60, 95 and 100 % plans are detailed by bid item and do include a breakdown of unit costs and estimated quantities for additional items such as concrete, storm drains, aggregate base, retaining walls, hazardous waste containment or removal and environmental mitigation. Our recent bidding history reflects that the estimates are base on accurate cost data and the Departments grasp of construction practices. For example, the fourteen Regional Freeway Projects bid in FY 1999, the total bid amounts plus 14% for construction engineering and contingencies were within 3% of the total programmed amounts.

ADOT has reviewed the estimating methodology provided by the auditors and found it to be very similar to ADOT's methodology. The method expands the subcategories into more specific details. Some of the more specific details are not available in the early development stages, such as pipe lengths and sizes or pavement design thickness and other materials. However, inclusion of more specific details appear to be appropriate such as separating Freeway Management System items from traffic items and separating sound walls from retaining walls. ADOT will review and consider implementation of additional estimate detail where appropriate.

The audit implies that ADOT does not maintain adequate historical cost records. Records prior to 1992 are limited, but since 1992 project estimates and scope changes have been identified as estimates have been updated. Major scope changes are documented through cost estimate documentation and the approval of material changes. Minor scope changes are considered as design issues and accommodated in cost estimate contingencies. ADOT's General Consultant provided the auditors with examples of the historical detail that has been accurately maintained. ADOT will review and improve its estimate documentation to ensure that sufficient information is identified to determine reasons for cost changes.

The audit is critical of ADOT's methodology to address inflation factors. In response to a similar item in the 1997 audit, ADOT concluded that it would be misleading to alter its method of accounting for inflation midstream in program development. There is no single, correct method for estimating the future impact of inflation on the long-term estimated revenues of the MAG Life cycle program. Each approach has specific positive and negative attributes. ADOT believes that comparing revenues to costs at present day values is more easily understood than trying to predict the future and comparing future values. Because there are positive and negatives to each alternative, the Department chooses to maintain consistency of its current methodology. Secondly, there appears to be a misunderstanding as to how the discount (inflation) factor is determined and how it is applied to the projection of revenues. The factor used is determined from Risk Analysis of construction and right of way costs to determine growth escalation and inflation. Based on expert reviews of trends in construction cost growth by major bid item and right of way by land use, factors for each are identified and quantified. Therefore revenues are discounted at a rate consistent with a projection of inflation and growth trends for right of way and construction, and with federal and local market indicators.

Federal Sanctions Related to Air Quality Issues Could Impact the Timely Completion of the Regional Freeway System

ADOT is cognizant of the concerns expressed in the audit relative to air quality. ADOT will continue to cooperate and partner with MAG to address federal and state air quality issues. ADOT agrees with the recommendations concerning staff participating in air quality education programs and to assist in providing information to the public. Finally, as is our practice, addressing air quality issues will continue to be a part of all transportation plans, programs and projects.

RECOMMENDATIONS

ADOT finds the recommendations to be reasonable, with one exception, and implementation will provide an opportunity for ADOT to continue improving its successful delivery of the Regional Freeway Program. Review and implementation of many of the recommendations has already begun. The Regional Freeway Life Cycle Office will identify responsible parties for the implementation of each recommendation and implementation progress will be monitored quarterly.

The only recommendation that ADOT takes exception to is "*Reconsider revising cost estimates to reflect the estimated effects of inflation rather than adjusting revenues…*" As previously explained, this issue was thoroughly reviewed and considered following the 1997 performance audit. ADOT continues to selectively choose to maintain the consistency of its current methodology. ADOT believes that comparing revenues to costs at present day values is more easily understood than trying to predict the future by comparing at the future values, which are subject to effects of changing market conditions and the uncertainty of national and local trends. Therefore, ADOT does not agree with this recommendation and does not plan to implement it.

CHAPTER 2 ADOT HAS IMPROVED PROCESSES RELATED TO THE- REGIONAL FREEWAY SYSTEM

Prior performance audits of the Regional Freeway System have assisted ADOT in identifying continuous improvement opportunities. As recognized by the audit, ADOT has successfully implemented a number of recommendations from previous audits that have resulted in the implementation of new strategies and processes.

Another area that ADOT continues to emphasize is building good relationships with our stakeholders, customers and the public. Efforts to develop a continuous, comprehensive and cooperative statewide programming process including extensive public involvement are noteworthy. The involvement of stakeholders has increased in all phases of project development The finding that stakeholders are generally satisfied is encouraging. ADOT intends to continue to improve its stakeholder and public involvement efforts.

CONCLUDING REMARKS

ADOT is appreciative of the auditor's efforts to constructively comment on the delivery of the Regional Freeway System. The magnitude of constructing a $ 6 billion, 147-mile freeway system in the nation's sixth largest metropolitan area is challenging. Even more difficult to assess are the complex internal processes necessary to keep freeway construction on schedule and within budget.

To accomplish the many tasks associated with this endeavor, ADOT has assigned key management personnel to lead its engineering and technical staff in completing this task. To date, ADOT has been very successful in delivering the Regional Freeway construction program on schedule and is confident in the delivery of the accelerated completion of the remaining freeway segments by the end of 2007.

ADOT believes this new completion date is only achievable by a total commitment of staff and maximum utilization of the consulting and contracting communities. ADOT will evaluate and consider all audit recommendations prior to implementation, as management supports the concept of continuous improvement at all levels in the organization. Although there may be preferential differences of opinion regarding the audit findings, ADOT supports the audit process as it seeks new methodologies to assist in improving our ability to successfully deliver our commitment to the Regional Freeway System.

Sjoberg Evashenk Consulting Comments on the Response from the Arizona Department of Transportation

To provide clarity and perspective, we are commenting on the Arizona Department of Transportation's (ADOT) response to our audit report. The numbers correspond with the numbers we have placed in the response.

❶ = As part *of* our audit effort, we spent over 2000 audit staff hours reviewing the complexities of the Regional Freeway System program administered by the ADOT. Additionally, we spent nearly 50 audit staff days in Arizona.

❷ = To garner a full understanding of ADOT's project management efforts, we interviewed and held meetings with the Deputy State Engineer of Valley Transportation on many occasions in addition to obtaining information through telephone conversations and written electronic communications. Additionally, in the initial phases of our audit, we met with the State Engineer who stated that he focused mainly on the many other state highway projects separate from the Regional Freeway System. These interviews, along with many other staff interviews, were just one of many aspects *of* our audit approaches designed to obtain a complete understanding of the department s project team approach. Our interviews and additional analysis revealed that no central person consistently ensures that all critical milestones are met and that projects stay within initial cost estimates.

❸ = We have not stated that such meetings do not occur. Our review of minutes from these meetings revealed that key issues such as delays and changes were not always memorialized. Therefore, ADOT is not able to assure that agreements reached are accomplished.

❹ =

This statement is misleading. While ADOT updates its cost estimates every six months as part of its Life Cycle Certification, the estimates are merely revised to reflect current cost information. Thus, costs for projects that are scheduled to be constructed in future years are reported at present day values rather than shown adjusted for inflation Also, refer to Sjoberg Evaslienk Consulting's comment. ❻

❺ =

Our review of minutes from these meetings revealed that key performance information tied to the measurement system was not always documented. Therefore, as we state on pages 31 and 32, ADOT is not able to complete the feedback loop necessary in well-functioning performance measurement system. All issues needing follow-up should be memorialized so that all responsible persons are clear on the expectation of corrective action. This is especially critical given ADOT's staff turnover and high level of vacancies.

❻ =

As we have discussed with ADOT on several occasions, we do not misunderstand ADOT's method for determining its expenditure discount (inflation) factor or how it is applied to the projection *of* revenues. As stated on page 34, although ADOT's method of determining the inflation factor is reasonable, it is misleading to apply air expenditure inflationary factor to discount its revenues. While we understand that ADOT does not want to change its public reporting method at this stage of the Regional Freeway System Lifecycle we believe that ADOT should change its method for future freeway projects.