

State of Arizona
Office
of the
Auditor General

PERFORMANCE AUDIT

**ARIZONA
DEPARTMENT
OF
TRANSPORTATION
A + B BIDDING**

Report to the Arizona Legislature
By Debra K. Davenport
Auditor General
November 1999
Report No. 99-22

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DEBRA K. DAVENPORT, CPA
AUDITOR GENERAL

**STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL**

November 22, 1999

Members of the Legislature

The Honorable Jane Dee Hull, Governor

Ms. Mary Peters, Director
Arizona Department of Transportation

Transmitted herewith is a report of the Auditor General, A Performance Audit of the Arizona Department of Transportation—A+B Bidding. This report was completed pursuant to the provisions of Laws 1998, Chapter 278, Section 4.

This report focuses on the Department's use of A+B bidding, an alternative contracting method for highway construction projects. A+B bidding differs from traditional contracting in that it considers the time to complete a highway construction project in addition to a project's cost. This bidding method is particularly advantageous if completing a project quickly is desirable or project construction is anticipated to seriously impact and cause inconvenience to road users and the surrounding community. Under legislative authorization, the Department and Transportation Board issued 6 A+B contracts, 3 of which have been completed. Even with this limited experience, A+B bidding has shown to significantly reduce construction times and construction-related impacts. For example, the reconstruction of the Bethany Home bridge over Interstate 17 in Phoenix was completed 110 days ahead of the Department's time estimate and 35 days ahead of the contractor's time estimate. Additionally, in states with more A+B experience than Arizona, A+B bidding results are generally favorable, particularly with regard to shortened construction times.

The experience of Arizona and other states suggests that A+B bidding offers an effective bidding alternative for highway construction projects, especially where accelerated construction and reduced public impact is desired. Therefore, the Legislature should consider amending statute to allow the Department and Transportation Board to use A+B bidding for appropriate state highway construction projects.

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This report also addresses Department compliance with statutory limits for changes to highway construction contracts and the increasing costs for these changes. According to statute, these changes (commonly referred to as supplemental agreements), cannot exceed 10 percent of the contract amount, or \$50,000, whichever is greater. Based on a review of over 1,300 supplemental agreements, the Department generally complies with these statutory limits. Fewer than 3 percent of the supplemental agreements exceeded these limits. However, the cost for these changes has increased from 2.9 percent over original contract amounts in 1993 to 9.7 percent for the first 6 months of 1999. Based on the Department's current rate of completion for highway construction projects, each 1 percent of cost increase could add over \$3 million annually to final construction costs. In an effort to reduce its need for supplemental agreements and reduce cost increases, the Department should continue to analyze supplemental agreement data and make appropriate changes to its highway construction projects.

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

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

This report will be released to the public on November 23, 1999.

Sincerely,

A handwritten signature in black ink that reads "Debbie Davenport". The signature is written in a cursive style with a prominent flourish at the end of the last name.

Debbie Davenport
Auditor General

Enclosure

SUMMARY

The Office of the Auditor General has conducted a performance audit of the Arizona Department of Transportation (Department). This audit was completed pursuant to the provisions of Laws 1998, Chapter 278, Section 4, which required the Office to review two issues: (1) implementation of a new bidding alternative for highway construction projects; and (2) the Department's compliance with statutory limits for changes to highway construction contracts. As part of the second issue, the Office also conducted follow-up work on a 1997 performance audit examining cost increases in highway construction projects.

A+B bidding provides an alternative method of contracting for and completing highway construction projects. Currently used by many other states, it is designed to address situations in which completing a project quickly is desirable. Instead of relying solely on project cost estimates as a basis for awarding a highway construction contract, A+B bidding requires prospective contractors to also submit time completion estimates. Both a contractor's project cost and time completion estimate then serve as the basis for project award. The Legislature authorized the Department and Transportation Board to pilot A+B bidding for up to 20 highway construction contracts between October 1, 1997, and October 1, 1999.

Also beginning October 1, 1997, the Legislature set parameters for changes (commonly referred to as supplemental agreements), to construction contracts. These changes cannot exceed 10 percent of the contract amount, or \$50,000, whichever is greater.

A+B Bidding Presents Beneficial Alternative to Traditional Bidding (See pages 9 through 20)

Arizona's experience with A+B bidding, while limited, indicates that this approach can accelerate highway construction and reduce construction impacts and costs to road users and the surrounding communities. These impacts cause inconvenience to

motorists and may cause loss of revenue for abutting businesses. The Department used A+B bidding on 6 projects, 3 of which have been completed.¹ Even with this limited experience, A+B bidding has been shown to substantially reduce construction times and construction-related impacts on road users by reducing traffic delays and associated inconveniences. For example, the public was saved more than 100 days of construction-related traffic delays when the Bethany Home bridge reconstruction over Interstate 17 in Phoenix was completed 110 days ahead of the Department's time estimate and 35 days ahead of the contractor's estimate. Department officials have found the quality of work under the compressed time schedules to be acceptable, and contractors have cited additional benefits of using the approach, such as the opportunity to use equipment more efficiently.

In states with more A+B experience than Arizona, results are generally favorable, particularly with regard to shortened construction times. Reviews of 13 separate studies on A+B bidding show that relative to traditional contracting, A+B accelerates construction and reduces construction impacts on road users. Despite these benefits, current research remains inconclusive as to the impact of A+B bidding on project cost and quality. Specifically, the Texas Transportation Institute (Institute) reports that bids received for the cost portion (A) of A+B were usually 2 to 5 percent higher than traditionally bid contracts, but in almost all cases, lower than the state's cost estimate. However, the Institute further indicates that A+B project data must continue to be collected and tracked to determine the effect of A+B bidding on project costs. Additionally, project quality could potentially suffer as a result of the increased pressure to meet a shortened time schedule. However, other states report that quality is better since contractors want to construct projects properly the first time to avoid delays and not incur disincentives for late completion.

¹ The Transportation Board issued a seventh A+B contract for reconstruction of a segment of U.S. Highway 191 between Clifton and Morenci. While bids on this project were opened and the low bidder announced to the public on September 30, 1999, the Transportation Board did not make its determination of lowest responsible bidder and award the project until October 15, 1999. As the Department and Transportation Board's authority to use A+B bidding expired on October 1, 1999, and under advice from the Attorney General, the Department rescinded the contract on October 28, 1999.

The combined experience of Arizona and other states indicates that A+B bidding can be an effective tool, especially for projects where completion time and public impact are major factors. Because of the benefits offered by A+B bidding, the Legislature should consider amending statute to allow the Department and Transportation Board to use A+B bidding for appropriate state highway construction projects. However, while the Department is still learning how to effectively use A+B bidding, a review of the Department's procedures showed that additional actions are needed if A+B bidding is to be used effectively. For example, the Department currently lacks formal guidelines for selecting projects appropriate for A+B bidding, and as a result, it has missed opportunities to use A+B bidding for several projects. In addition, Department staff express uncertainty about using the method, and no process is in place for assessing the results of A+B bidding. To ensure that the Department appropriately uses and takes full advantage of this contracting method, it needs to develop and implement guidelines to identify appropriate A+B projects, enhance its efforts to educate Department personnel about A+B bidding, and develop a written process for assessing the results of A+B bidding.

Department Complies with Statute for Supplemental Agreements, but Needs to Assess Reasons for Cost Increases (See pages 21 through 26)

The Department generally complies with new statutory limits on changes to construction projects made through the use of supplemental agreements. Based on a review of the 1,309 supplemental agreements the Department entered into between January 1, 1998, and May 21, 1999, only 32 agreements (or 2.44 percent) surpassed the contract amount by more than 10 percent. A majority of the 32 agreements that exceeded the 10 percent requirement were entered into to correct project design oversights or omissions that should have been in the original plans, or to perform extra work deemed desirable for satisfactory completion of the project.

While the Department generally adheres to supplemental agreement requirements, it could potentially reduce its need for

these agreements through additional analysis of the reasons for construction cost increases. Follow-up analysis of state engineer reports that document completed highway construction contracts revealed that while completed highway construction projects exceeded their original contract amounts by 2.9 percent annually in 1993, contract overruns have increased to 9.7 percent for the first 6 months of 1999. Based on the Department completing close to \$340 million and \$185 million in highway construction projects for 1998 and the first 6 months of 1999, each 1 percent of cost increase could add over \$3 million annually to final construction costs. The Department has so far been unable to overcome past problems that kept it from adequately capturing and analyzing information about construction cost increases. While the Department is now taking steps to do so, it should ensure that it implements all appropriate measures to collect and assess supplemental agreement data to improve the design and construction of future Arizona highway construction projects.

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INTRODUCTION AND BACKGROUND

The Office of the Auditor General (Office) has conducted a performance audit of the Arizona Department of Transportation (Department). This audit was completed pursuant to the provisions of Laws 1998, Chapter 278, Section 4, which required the Office of the Auditor General to review two issues: (1) implementation of a new bidding alternative for highway construction projects, and (2) the Department’s compliance with statutory limits for changes to highway construction contracts. As part of the second issue, the Office also conducted follow-up work on a 1997 performance audit examining cost increases in highway construction projects.

Legislature Authorized Test of New Bidding Method and Set New Requirements for Contract Changes

The Department’s Intermodal Transportation Division is responsible for building and maintaining Arizona’s highway transportation system. Highway construction represents a substantial expenditure. During fiscal years 1998 and 1999, the Department completed 287 highway construction projects at a cost of almost \$600 million. The design, project management, and construction administration of highway projects is carried out by the Statewide Project Management Group, Valley Project Management Construction Group, and District offices, units within the Department’s Intermodal Transportation Division.

The Department has typically employed a traditional contracting system that focuses on project construction costs. Once Statewide or Valley Project Management develops and designs a highway construction project, the Department advertises the project and invites contractors to bid on it. Contractors estimate the cost to build that project and then submit sealed bids to the Department. The Department then forwards the bids along with an award recommendation to the Transportation Board, which awards the

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construction project to the lowest responsive bidder who meets specific conditions of responsibility as outlined in the contract.

Effective October 1, 1997, the Legislature authorized the Department and Transportation Board (Board) to pilot an innovative highway construction contracting method commonly referred to as A+B bidding. A+B bidding differs from traditional contracting in that the bid takes

The Legislature authorized the Department and Board to pilot the A+B contracting method for highway construction projects, a method that requires contractors to estimate both the project cost and construction time.

into account not only the project's construction cost, but also the time required to complete the project. This authorization, contained in A.R.S. §28-6923(I), permits the Department and Board to issue up to 20 highway construction contracts under A+B by October 1, 1999, if the Department and the Transportation Board determined that this contracting method best served the public interest. After October 1, 1999, the Department and Board have no further statutory authority to use this method.

Also beginning October 1, 1997, the Legislature set new parameters for changes (commonly referred to as supplemental agreements), to construction contracts. Specifically, statute allows the Department to make a change to a construction contract by means of a supplemental agreement under the following conditions:

- For changes falling within the existing scope of work under the contract, if the cost of the change does not exceed 10 percent of the contract amount, or \$50,000, whichever is greater.
- For changes that alter the scope of work on a construction contract, if the cost of the change does not exceed 10 percent of the contract amount or \$50,000, whichever is greater, and the amount of the changed work is within 20 percent of the total project length.

A+B Bidding

The use of A+B bidding by state highway administrations was initiated by the Federal Highway Administration (FHWA), which is part of the U.S. Department of Transportation. In February 1990, the FHWA approved the A+B bidding method for use by state highway administrations. After a trial period, the FHWA declared A+B operational in May 1995 and over 38 states have since employed this contracting method.

The A+B bidding method consists of two components. In the first part, **A**, the contractor bids prices similar to the traditional contracting system. If the contractor is awarded the project, its prices will serve as the basis for cost reimbursement. In the second part, **B**, the contractor estimates the total number of days required to complete the project and multiplies this estimate by a “daily road user cost” figure that is included in the bid documents.

Daily road user cost is a Department-calculated amount that attempts to capture the daily “cost” of traffic delays through a highway construction project to the traveling public, businesses, and surrounding community; and serves as a cost basis for determining any savings that result from reduced construction time.

When determining the daily road user cost, the Department may consider such items as traffic speed; the number of lanes open before, during, and after a highway construction project; the number of commercial and non-commercial vehicles passing through a construction area; the number of individuals riding in those vehicles; and the value of these people’s time.

To determine the lowest cost bid for an A+B project award, the Department requires prospective contractors to submit both project cost and time completion estimates. The time estimate is then multiplied by the Department’s road user cost calculation and added to the bidder’s cost estimate to arrive at the bidder’s estimate. For example, if the prospective contractor bids a project cost of \$13,000,000 and a project completion time of 350 days, and the Department calculates an \$8,000 daily road user cost, the bid would equal \$15,800,000. However, the submitted project cost of \$13 million would serve as the basis for contractor payment.

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In addition, if the Department advertises a project as A+B, it can include an incentive/disincentive (I/D) provision for early or late completion. This allows the Department to compensate a contractor for each day that the project is completed ahead of schedule, and penalize a contractor for each day work exceeds the contract time.

The Department calculates the Incentive (up to the cap)/Disincentive by:

Daily Road User Costs of Project	X	Number of Days Contractor Is Ahead/Behind Contract Time Schedule
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A+B bidding can include monetary rewards for completing a construction project early.

For instance, on a contract recently completed using A+B bidding, the contractor completed the project 35 days early. This project had an I/D provision attached that allowed the contractor to earn \$20,000 for every day the project was completed ahead of the time estimate, up to a maximum of \$600,000.¹ Of the 6 A+B projects awarded by the Department and Board, 4 have an I/D provision, while 2 have a provision related only to disincentives.

Supplemental Agreements

A supplemental agreement is a written agreement made between the Department and a contractor covering work not otherwise provided for in the contract, or for adjustments to the contract time. These agreements address revisions in, or amendments to, the terms of the contract or conditions specifically prescribed in the contract. The Department's supplemental agreements fall into three categories:

¹ For 3 of the 4 A+B projects awarded with an incentive provision, the Department capped the incentive at 20 percent of the contractor's time estimate for the project, which is then multiplied by the daily value to arrive at the maximum incentive. However, this formula for maximizing the incentive did not provide sufficient incentive to entice potential contractors for the Bethany Home bridge project, and the Department had to increase the maximum incentive to \$600,000.

1. **Change orders**—A contract modification in which the Department and the contractor agree to an amount to complete the modification.
2. **Force accounts**—Contract alteration is needed, but the Department and the contractor cannot agree on a price for the new items of work. As a result, the contractor maintains daily records of the labor, materials, and equipment used to perform the additional work and submits these records and invoices to the Department for review, approval, and payment. Payment is then based on pre-approved hourly rates and material costs.
3. **Letter agreements**—A contract change under \$5,000.

Audit Scope and Methodology

This audit focused primarily on the Department's implementation of statutory mandates as they relate to A+B bidding and supplemental agreements.

The methodologies used to conduct this audit included:

- Reviewing the bid results, including project cost and time estimates; final completion costs and construction time; and the daily road user costs for the six A+B contracts awarded by the Department and Transportation Board between October 1, 1997, and October 1, 1999, and a seventh A+B contract awarded on October 15, 1999, but rescinded by the Department on October 28, 1999;
- Analyzing 1,309 supplemental agreements pertaining to 271 highway construction contracts received by the Department's Field Reports section between January 1, 1998, and May 21, 1999, to assess the Department's adherence to statutory mandate;
- Reviewing State Engineer Reports from fiscal years 1998 and 1999 that document 287 completed construction projects to

assess the Department's management of construction cost increases;

- Reviewing 13 separate studies on the merits of A+B bidding (see Appendix, page a-i through a-ii, for listing of studies);
- Interviewing the following to assess their knowledge and use of A+B bidding and to obtain their perspectives on the benefits and drawbacks of its use: the Arizona Transportation Board Chairman, two highway construction contractors awarded A+B contracts by the Department, two contractors that bid A+B projects but were not the low bidder, officials from the Federal Highway Administration (FHWA), the American Association of State Highway Transportation Officials (AASHTO), the Association of General Contractors (AGC), and the Utah Technology Transfer Center at Utah State University; and
- Contacting seven state highway administrations that have had significant experience using A+B bidding to compare and contrast the Department's implementation efforts.¹

This report presents findings and recommendations in two areas:

- The Legislature should consider reauthorizing the use of A+B bidding for highway construction projects; and to ensure that A+B bidding is used appropriately and effectively, the Department should establish guidelines for applying A+B, educate Department personnel about its use, and evaluate its results.
- The Department needs to evaluate causes for cost increases on construction contracts and use this information to minimize future construction cost increases and the need for supplemental agreements.

¹ State highway administrations in Missouri, New York, North Carolina, and Texas were contacted because of their significant experience using A+B bidding. In addition, state highway administrations in California, Colorado, and Utah were contacted because of their proximity to Arizona.

Introduction and Background

This audit was conducted in accordance with government auditing standards.

The Auditor General and staff express appreciation to the Director and staff of the Department of Transportation and members of Arizona's Transportation Board for their cooperation and assistance throughout the audit.

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FINDING I

A+B BIDDING PRESENTS BENEFICIAL ALTERNATIVE TO TRADITIONAL BIDDING

A+B bidding can accelerate highway construction and reduce construction-related impacts and costs to road users.

Arizona's experience with A+B bidding, while limited, indicates this approach can accelerate highway construction and reduce construction impacts and costs to road users and the surrounding community. States with more A+B experience likewise report that it shortens construction time and reduces the negative impact on the public. Although A+B's effect on project cost and quality is still inconclusive, on balance the results suggest that the Legislature should consider renewing the Department and Transportation Board's ability to use it as a bidding alternative. However, to ensure that A+B bidding is used appropriately, the Department needs to develop guidelines to identify appropriate A+B projects, enhance its efforts to educate Department personnel on A+B bidding, and develop a process to assess the results of this innovative contracting method.

Arizona's Limited Experience with A+B Bidding Has Been Generally Positive

The Department's experience with A+B bidding has been limited to six projects, three of which have been completed. However, even with this limited experience, the A+B approach has been shown to substantially trim the length of construction-related traffic delays. Much less is known about A+B's effect on project costs. Department inspectors have found the quality of work under the compressed schedules to be acceptable, and contractors have cited additional benefits of using the approach, such as the opportunity to use equipment more efficiently.

Six projects conducted under A+B bidding—The Legislature authorized the Department and Transportation Board (Board) to issue a maximum of 20 contracts under A+B bidding between

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Although the Legislature authorized the Department and Board to issue 20 A+B projects, they issued only 6.

October 1, 1997, and October 1, 1999. The Department and Board issued six contracts using A+B during that time, a much smaller number than authorized.¹ According to various Department officials, three reasons contributed to the low number of A+B projects awarded: unfamiliarity with the A+B bidding process, an inefficient method for identifying appropriate projects for A+B, and a three-month period in 1998 when ADOT management put A+B bidding on hold to focus on awarding several traditionally bid projects. Three of the six contracts have been completed and three A+B projects are currently under construction. Table 1 illustrates the six projects, including location, bid

Table 1

**Arizona Department of Transportation
A+B Projects Awarded
As of November 1, 1999
(Unaudited)**

Project Description	Project Cost A	Total Days B	Daily Road User Cost C	Bid Estimate A+(B x C)	Days Early	Maximum Incentive
I-17 (Phoenix) Bethany Home Bridge (Phoenix)	\$79,729,000	609	\$16,000	\$89,473,000	NA ¹	No incentive ²
I-40 (Holbrook)	11,465,728	225	20,000	15,965,728	35	\$600,000
S.R. 89A (Cottonwood)	5,272,000	385	1,300	5,772,500	77	100,100
S.R. 143 (Phoenix)	4,494,190	200	4,800	5,454,190	NA ¹	192,000
I-8 (Yuma)	3,031,785	120	2,700	3,355,785	0	No Incentive ²
	1,447,079	60	3,000	1,627,079	NA ¹	36,000

¹ Under construction.

² Disincentive only with no maximum.

Source: Arizona Department of Transportation list of A+B highway construction projects awarded.

¹ The Transportation Board awarded a seventh A+B contract for reconstruction of a segment of U.S. Highway 191 between Clifton and Morenci. While bids on this project were opened and the low bidder announced to the public on September 30, 1999, the Transportation Board did not make its determination of lowest responsible bidder and award the project until October 15, 1999. As the Department and Transportation Board's authority to use A+B bidding expired on October 1, 1999, and under advice from the Attorney General, the Department rescinded the contract on October 28, 1999.

amount, possible incentive award, and status as of November 1, 1999.

A+B bidding's effect on construction time, project cost, and project quality differs—Although the Department and Board have awarded only six A+B projects and completed three of these projects to date, the State has seen a decrease in project duration and a savings in road user costs, while maintaining project quality. However, A+B's effect on project costs is inconclusive at this time. Specifically:

- **Construction times and impact on public reduced**—Current results demonstrate A+B's potential to reduce construction time and minimize effects on road users. The clearest illustration is the completed Bethany Bridge Project over Interstate 17 in Phoenix. The Department bid the Bethany Home project A+B to ensure that the reconstruction of the bridge was completed prior to the Department's expansion of Interstate 17. While the Department estimated that this project would take 300 days to complete, the contractor who had been awarded this project completed the Bethany Home construction in 190 days, 110 days ahead of the Department's estimate, and 35 days ahead of the contractor's own bid. By using A+B bidding in this instance, the Department saved the public more than 100 days of construction-related traffic delays. Additionally, the contractor for the Holbrook Interstate 40 construction project recently completed the project 77 days ahead of its and the State's estimate of 385 days, saving the public many more days in traffic delays. The other completed A+B project, a pavement replacement project on State Route 143 in Phoenix, was bid and completed at the State's estimate of 120 days. Finally, for the remaining 3 A+B projects under construction, the contractor's time estimate for project completion is a combined 351 days less than the Department's contract time estimate, potentially saving road users hundreds of days in construction-related traffic delays.

Using A+B on the Bethany Home bridge reconstruction saved the public more than 100 days of construction-related traffic delays and associated costs.

Although a contractor is not deterred from completing projects as quickly as possible under traditional contracting approaches, A+B's advantage in this respect is that it builds time competition into the contract. Under the "B" portion of the A+B formula, a contractor's bid must include a time estimate for completing the project. Keeping that time as low as possible is part of what determines the winning bid. Traditional contracting approaches do not take this factor into account as part of the competitive bidding process.

■ **Impact on project costs not yet determined**—The Department has not engaged in a sufficient number of A+B projects to determine its impact on project costs. With only six projects awarded and two completed, A+B's impact on project costs is inconclusive at this time. Additionally, the Department has not attempted to estimate what the cost of the completed projects would have been if traditionally bid, and then compared that estimate to the project's final cost. However, there is some evidence suggesting that the traveling public may accept higher costs if projects are completed sooner. This subject was covered at a focus group of the traveling public that the Department convened in July 1999. This group indicated that it would rather pay a little more in tax dollars for highway construction projects if these projects could be completed more quickly in order to decrease traffic delays and driving inconveniences.

■ **Project quality judged acceptable by the Department**—One concern voiced about A+B contracting is that project quality could suffer as a result of the increased pressure to meet a shortened time schedule. However, according to Department officials, the quality of work on A+B projects has so far met construction standards. Additionally, a Department engineer noted that the recently completed Bethany Home Bridge A+B project met all quality standards.

Contractors cite other potential benefits—Arizona contractors reported several other potential benefits of using the A+B approach. Those who commented favorably included a representative of a contracting association and individual contractors involved with A+B contracting. They cited the following benefits:

- **Better use of resources**—One Arizona contractor noted that A+B allows contractors to be creative in scheduling projects and thus better utilize their resources. Another contractor indicated that contractors might rent highway construction equipment for eight-hour-day fees, but operate two shifts of construction workers and use the rental equipment 24 hours per day.
- **Improved relationships with the public**—The incoming President of the Arizona Association of General Contractors indicated that A+B allows the contractor to show to the road user and surrounding community how the State and the contractor are working on their behalf to reduce the impact of construction projects.

One contractor with a current A+B contract remained very positive about this approach even though there are some difficulties on the current project. The contractor indicated that he would like the Department to continue using A+B bidding and would anticipate bidding on future A+B projects.

Experience of Other States Also Points to the Benefit of Using A+B Bidding

In states with more A+B bidding experience than Arizona, results have been generally favorable, particularly with regard to shortening construction times. Because Arizona's experience with A+B bidding was limited, Auditor General staff contacted other states, research institutes, and others who had more experience with the approach. Reviews of 13 separate studies of A+B contracting showed that relative to traditional contracting approaches, the A+B approach accelerates construction. Results are more mixed with regard to cost and quality.

Studies indicate that A+B bidding can reduce construction-related inconveniences to the community.

Construction times are accelerated, reducing traffic delays—Based on a review of 13 separate studies of A+B bidding, this method allows state highway administrations to accelerate highway construction times, which in turn reduces traffic delays and associated inconveniences for road users (see Appendix, pages a-i through a-ii for listing of studies). For example, a 1999

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study by the Federal Highway Administration (FHWA) found that states had positive results with A+B bidding because:

- 1) Highway construction times are accelerated as compared to traditionally bid contracts; and
- 2) In most instances, contractors complete the work ahead of schedule.

As a result of accelerated construction times, the impact of highway construction on the public and the surrounding community is reduced. Both a 1997 FHWA study and a 1998 Virginia Transportation Research Council study agree that A+B bidding reduces construction impacts and costs to road users by reducing traffic delays and inconveniences to the surrounding community, including local businesses. The Virginia study also agrees that costs to motorists are reduced in these major areas: travel cost times, vehicle operating cost, and accident cost, as compared to traditionally bid contracts.

States report the following benefits from using A+B bidding:

- **New York** reports that it has saved 5,900 contract days for the 54 A+B projects it has completed. New York also estimates that this reduction in contract time has saved the traveling public \$59.3 million in costs associated with construction-related delays.
- In an A+B study completed by Zohar Herbsman and published in the *Journal of Construction Engineering and Management*, **California** reports using A+B bidding to quickly rebuild part of the freeway system in 1994 following the earthquake in Northridge. The contractor was able to complete the highway construction 74 days earlier than the state's estimate, saving the public millions in construction-related delays. For instance, the California Trucking Association reported that commercial truck operators saved \$500,000 for each day the freeway was opened early.

Because states report mixed results, A+B's impact on project cost and quality is inconclusive.

Costs results are mixed—Despite these benefits, current research remains inconclusive as to the impact of A+B bidding on project cost. For example, an April 1999 draft final report by the Texas

Transportation Institute indicates that bids received for the cost portion (A) of A+B contracts were usually 2 to 5 percent higher than traditionally bid contracts, but in almost all cases, lower than the state's cost estimate.¹ Yet, the report states that A+B project data must continue to be collected and tracked to determine the effect of A+B bidding on project costs as compared to traditionally bid contracts. Additionally, New York reported that for the 94 A+B projects it has awarded, the contractor's bid estimates were \$25 million less than the state's cost estimate. Finally, an operations manager at the Utah Technology Transfer Center, which is conducting research on A+B bidding practices, likewise indicated that although data is being gathered from states and highway construction groups, no conclusionary research has been developed to determine whether A+B bidding reduces or increases highway construction costs.

Effect on project quality is also mixed—The Texas Transportation Institute report indicates that quality of work, according to the majority of states interviewed, is either the same or worse when compared to that of a traditionally bid project. In some cases, state highway administrations must accept minimum or lower quality work or face costly time delays. However, the opinion of other states is that quality is better, since the contractor wants to do the construction properly the first time and not incur disincentives for late completion of the project, which might result from poor quality construction.

Department Can Enhance Use of A+B Bidding

Taken together, the experience of Arizona and other states indicates that A+B bidding can be an effective contracting tool, particularly for projects in which completion time and public impact are major factors. However, the Department needs to take sev-

¹ The Texas Transportation Institute, a state agency which is part of the Texas A&M University System, engages in research pertaining to all forms of transportation. The Texas Transportation Institute conducts interdisciplinary and multi-modal research extending into the planning, design, construction, operation, maintenance, enforcement, economic, environmental, and social aspects of transportation.

eral steps if it is to maximize the effective use of A+B bidding. Specifically, the Department needs to:

- 1) Develop guidelines to assist with the timely and appropriate identification of highway construction projects for A+B bidding;
- 2) Enhance efforts to educate its design, contracting, and construction personnel regarding A+B bidding; and
- 3) Develop a process for assessing the results of A+B bidding.

Department should develop formal guidelines to identify projects appropriate for A+B bidding—The Department currently has no formal guidelines to select projects that may be appropriate for A+B bidding. Instead, the Department has relied primarily on two individuals within the Construction Group, with assistance from District Engineers (these engineers help identify and supervise highway construction projects) to select A+B projects just prior to the bid process. As a result, the Department has potentially missed opportunities to use A+B bidding or has not ensured the appropriateness of a project for A+B through thorough project planning and design. For example, Department officials indicate that several projects that would have been appropriate for A+B were not identified as such because the Department lacked a defined process for identifying and selecting these projects. Additionally, the Department identified and issued one project that appeared appropriate for A+B, but a significant project design error and subcontractor problems have put this project behind schedule and may negate any time savings the Department hoped to realize.

Other state highway administrations and the Texas Transportation Institute have created written guidelines to assist with the identification and selection of projects suitable for A+B bidding. Specifically:

- **Texas and New York guidelines**—Both Texas and New York have adopted guidelines for A+B project selection. The Texas Department of Transportation’s guidelines specify the types of highway construction projects that are best suited for A+B bidding, including projects that add driving lanes, proj-

ects that expect to have an economic impact on local communities and businesses, or projects located in high-traffic areas. Additionally, the New York State Department of Transportation's guidelines indicate that it is essential that a project's suitability for A+B bidding be identified during the early stages of project development to allow for proper planning, design, and coordination.

- **Texas Transportation Institute recommends guidelines—** The Texas Transportation Institute formally recommended the use of guidelines as a means for starting or formalizing a state highway administration's A+B selection process. In addition to those items identified by Texas and New York, the Texas Transportation Institute recommends that guidelines include provisions for considering third-party influences, especially utilities relocation and right-of-way issues, which can potentially delay highway construction; and for providing for the safety of the traveling public and highway construction workers.

The Department needs to develop and implement formal guidelines for A+E bidding.

These existing guidelines can serve as a starting point for Arizona's efforts. The Department should develop formal guidelines to assist with the identification and selection of appropriate A+B projects. These guidelines should incorporate the Texas Transportation Institute's selection criteria as well as any guidelines specific to Arizona's highways. In fact, Department personnel believe such guidelines should be developed with input from its design, contract, and construction groups.

Department should enhance A+B education efforts—In addition to developing guidelines, the Department needs to better educate its construction, design, and contracting personnel on A+B bidding. After A+B was approved for use in 1997, the Department's Construction group compiled an A+B educational packet and distributed this packet to its nine District Engineers (DE) for their review. These District Engineers help identify future highway construction projects, as well as supervise current highway construction projects in their respective regions throughout Arizona. Despite this educational packet, a recent survey of all nine DEs indicated that the majority of them were uncertain as to the appropriateness of designating a highway construction project for A+B bidding. One DE mentioned that experiences on current

Finding I

A+B projects are not shared in any formal manner with other DEs. Another indicated that he would like to see more education on A+B as there is a “fear factor” among district engineers regarding its use. As a result, many engineers do not know when it is appropriate to suggest potential projects within their regions for A+B bidding. In addition, officials indicate that design and contracting staff also have a limited understanding of A+B bidding and how it relates to their respective responsibilities, which therefore may affect their ability to appropriately plan and design A+B projects or appropriately prepare project bid requests and contracts.

The Department needs to educate its staff on how to best apply A+B bidding.

To further maximize its use of A+B bidding, the Department should develop an ongoing education program to ensure personnel from its design, contracts and specifications, and construction sections understand this bidding method. This education effort should inform Department personnel about such items as what types of highway construction projects are candidates for A+B bidding, when in the design process projects should be identified as A+B, and how the Department determines the low bidder using this method. Additionally, Department personnel should be trained on how to watch for and manage the potential pitfalls of A+B bidding. This effort follows the Texas Transportation Institute’s suggestion that state highway administrations must have agency personnel with appropriate levels of A+B bidding skills and expertise.

Department should develop a process for assessing A+B bidding—While the Department has taken some initial steps to track A+B project results, it should develop a more comprehensive written process for assessing the results of A+B bidding. Developing such a process will allow the Department to evaluate what succeeded or failed with its A+B projects and apply this knowledge to future projects. To encourage states to evaluate A+B bidding, the Texas Transportation Institute provides guidelines to help state highway administrations examine the differences between the A+B bidding method and the traditional method of contracting. Specifically, the Texas Transportation Institute’s report suggests that state highway administrations consider the following assessment parameters when evaluating A+B projects:

- **Compatibility with the low bid system**—Was the lowest responsible bidder awarded the contract?
- **Reduction of project bid cost**—Was the amount of the contractor bid lower than, or equal to, the state’s estimate of cost?
- **Impact on open competition**—Was equal opportunity provided to all bidders?
- **Reduction of project completion time**—Was the time required to complete the project reduced as compared to the state highway administration’s time estimate and the contractor’s time bid?
- **Shifting of risk from agency to contractor in terms of cost, time, and quality**—Did the contractor assume increased responsibility for control of cost, time, and quality? Did the contractor maintain a high standard of quality and prevent workers from taking shortcuts on project construction? Did the contractor meet the construction schedule?
- **Ease of implementation with respect to agency resources, data, systems, and expertise**—Did the state highway administration have the resources necessary to properly plan, design, and administer the contract without causing counterproductive situations, such as stretched manpower, overtime needs, or cutbacks on state highway administration inspections of construction projects?

**Legislature Should Consider
Renewing Department and Board’s
Ability to Use A+B Bidding**

Because of the benefits associated with A+B bidding, the Legislature should consider amending statute to allow the Department and Transportation Board to continue using A+B bidding for appropriate highway construction projects. Since A.R.S. §28-6923(I) authorized the Department and Transportation Board to award 20 A+B contracts only through October 1, 1999, new leg-

isolation would be required to extend their authority to engage in A+B bidding.

Recommendations

1. The Legislature should consider amending A.R.S. §28-6923(I) to adopt A+B bidding as a permanent contracting method for state highway construction.
2. The Department should develop and implement written guidelines, similar to those created by the Texas Department of Transportation, the New York State Department of Transportation, and the Texas Transportation Institute, to assist with the identification and selection of appropriate highway construction projects for A+B bidding.
3. The Department should develop and implement an ongoing education program about A+B bidding for its design, contracts and specifications, and construction personnel.
4. The Department should develop and implement a written process for assessing the impacts of A+B bidding on highway construction projects.

FINDING II

DEPARTMENT COMPLIES WITH STATUTE FOR SUPPLEMENTAL AGREEMENTS, BUT NEEDS TO FURTHER ASSESS REASONS FOR COST INCREASES

The Department has generally adhered to the new statutory requirements that limit the size of supplemental agreements, but it could potentially reduce its need for such agreements through additional analysis of the reasons for construction cost increases. Although nearly all supplemental agreements fall within the new limits, the extent to which final contract costs exceed original estimates has continued to rise. The Department can minimize future construction cost increases and the need for supplemental agreements by analyzing factors that cause these increases and using this information to improve the design and construction of future projects.

Few Supplemental Agreements Exceed Statutory Thresholds

According to legislative changes that took effect on October 1, 1997, changes to construction contracts are now limited to the following:

- For changes falling within the existing scope of the contract plans and specifications, the cost of the change cannot exceed \$50,000, or 10 percent of the contract amount, whichever is greater.
- For changes that alter the scope of work in the contract plans and specifications, the cost of the changes cannot exceed \$50,000, or 10 percent of the contract amount, whichever is greater, and the amount of the changed work must be within 20 percent of the total project length.

Should a contract change exceed these statutory requirements, the Department must solicit competitive bids for the change in the scope of work.

Only a small percentage of supplemental agreements reflecting changes to construction contracts exceed statutory thresholds.

Since this legislation took effect in 1997, slightly over 2 percent of the supplemental agreements the Department has entered into have exceeded these monetary thresholds. Based on a review of 1,309 supplemental agreements the Department received between January 1, 1998, and May 21, 1999, 32 (or 2.44 percent) surpassed the contract amount by more than 10 percent. These 32 supplemental agreements exceeded their original contract amounts by a median of 15.7 percent, ranging from a low of 10.8 percent to a high of 70 percent of their original contract amounts.

Most of the 32 agreements that exceeded the 10 percent requirement were entered into due to errors of omission on the project plans or specifications, extra project work, or changed site conditions. For example:

- Two agreements that exceeded their original project amounts by 56 and 70 percent (reflecting dollar increases of \$300,000 and \$57,095, respectively, over original contract amounts), were entered into to correct project design oversights or omissions that should have been in the original plans.
- Three agreements that exceeded their original contract amounts by 20, 25, and 47 percent (reflecting increases of \$46,101, \$382,302, and \$134,057 respectively, over original contract amounts), were entered into to perform extra work deemed desirable for satisfactory completion of these projects, but not provided for in their original scope.

Final Contract Costs Continue to Exceed Original Contract Bid Amounts

In a 1997 performance audit report (Report No. 97-17), the Auditor General examined a closely related issue: cost overruns on highway construction projects. Since this issue closely relates to statutory requirements governing supplemental agreements, a review of the Department's progress in reducing cost overruns

was performed. This review found that final costs on highway construction projects continue to exceed their original contract amounts at an increasing rate. Incomplete and poorly classified project information impedes the Department's ability to understand and evaluate the factors impacting cost increases. While the Department is taking steps to better collect and assess supplemental agreement information, it needs to take additional action to ensure these plans are implemented.

Final highway construction costs continue to increase as compared to original contract amounts.

Final construction costs continue to increase—Since the Auditor General's 1997 audit, construction cost overruns have not only continued, but have increased. The 1997 report found that completed highway construction projects exceeded their original contract amounts by 7.6 percent annually as of June 1997, more than double the 2.9 percent figure for 1993. Based on a review of state engineer reports documenting 287 highway construction projects completed between July 1997 and June 1999, the Department's contract overruns have increased. As illustrated in Table 2 (see page 24), final contract amounts exceeded original contract amounts by 8.5 percent for the construction projects completed during 1998. Similarly, for the first 6 months of 1999, final contract amounts exceeded original contract amounts by 9.7 percent for the construction projects completed during that time. Based on the Department completing close to \$340 million and \$185 million in highway construction projects for 1998 and the first 6 months of 1999, respectively, each 1 percent of cost increase could equate to more than \$3 million annually.

Final construction costs have continued to increase beyond original contract amounts despite a Department goal to limit cost changes to construction contracts to 5 percent of the contract amount. As outlined in its construction manual, the Department attempts to limit cost changes to 5 percent of the contract amount, realizing that unavoidable cost increases or changes can occur on highway construction projects. Additionally, to help ensure that project cost increases are limited to 5 percent, the Department adopted a process in May 1998 that requires the State Construction Engineer to approve supplemental agreements to construction projects if the agreement causes the cumulative cost of contract changes to exceed 2 percent. To its credit, the Department's 5 percent target differs from the standards of the industry or other states. According to the Arizona

Finding II

Association of General Contractors and other states, a standard of 10 percent for project increases is used, as it allows more flexibility to accommodate and account for unanticipated and/or unavoidable project cost increases or changes. However, Department officials view their 5 percent target as a management tool to retain control over cost changes to construction contracts and prevent these changes from becoming excessive.

Table 2
Arizona Department of Transportation
Completed Construction Projects
Years Ended or Ending December 31, 1993 through 1999
(Unaudited)

Year	Number of Projects	Original Contract Amount	Final Amount Paid	Dollar Increase	Percentage Increase
1999 ^a	83	\$ 168,591,050	\$ 184,903,177	\$ 16,312,127	9.7%
1998	146	311,679,642	338,254,487	26,574,845	8.5
1997	134	219,822,952	236,190,156	16,367,204	7.5
1996	151	248,765,709	262,608,295	13,842,586	5.6
1995	131	262,261,453	278,579,773	16,318,320	6.2
1994	97	178,015,778	188,531,146	10,515,368	5.9
1993	115	324,429,088	333,880,371	9,451,283	2.9
Total	<u>857</u>	<u>\$1,713,565,672</u>	<u>\$1,822,947,405</u>	<u>\$109,381,733</u>	

^a Only projects completed in January through June 1999 are included.

Source: Auditor General Performance Audit of the Arizona Department of Transportation, Construction Management Function (Report No. 97-17) and Auditor General staff summary of data presented in Arizona Department of Transportation State Engineer Reports for July 1997 through June 1999.

Deficient information about supplemental agreements hinders analysis—Similar to the 1997 performance audit, inadequate supplemental agreement information and analysis prohibit the Department from identifying trends to make construction process changes. The 1997 audit found that the Department relied on very broad categories to classify the reason for supplemental agreements, which limited the Department’s ability to measure trends in contract changes. In addition, the 1997 audit found that

incomplete and poorly classified supplemental agreement information impeded the Department's ability to fully understand and evaluate the factors impacting construction cost increases.

These same problems persist. For instance, many supplemental agreements reviewed during the audit were not categorized, or included multiple classifications. Specifically, of the 1,309 supplemental agreements reviewed by auditors, 344 (or 26.3 percent) of the agreements either failed to identify a reason for the change or contained multiple classifications. An additional 160 agreements were categorized as "other," which effectively reduces the quality of this data for analysis. As a result, for nearly 40 percent of its supplemental agreements, the Department does not have the data it would need to assess reasons for these agreements and institute appropriate changes to reduce the use of these agreements. The Department's analysis of construction cost increases resulting from supplemental agreements is also still limited. While the Department did attempt to group reasons for supplemental agreements, the Department has not conducted further analysis of this information or instituted any corrective actions.

Department making changes to remedy deficiencies—The Department has recently taken steps to improve its management of construction cost increases. For instance, the Department has modified its classification of supplemental agreements into fewer, better-defined categories. Implemented into the Department's supplemental agreement database on July 1, 1999, these better-defined categories for supplemental agreements should help the Department better track and determine trends for highway construction cost overruns. In addition, the Department has further stressed to its Resident Engineers the need to classify every supplemental agreement and use only one classification category per agreement.

In addition to creating more measurable and complete data, the Department has taken steps to better ensure supplemental agreement information is analyzed. Specifically, the Department's Construction and Statewide Project Management (design) sections are developing systems to collect and evaluate supplemental agreements in an effort to identify trends in changes to original contracts. With this information, the Department intends

Finding II

to identify problem areas in the design, planning, or construction of highway projects and institute corrective action. However, these process changes are not finalized and the Department should take measures to ensure such information is indeed collected and analyzed. As noted in the 1997 audit, patterns may emerge that suggest the need for review or closer scrutiny in future projects.

Recommendation

1. The Department should ensure that it collects and evaluates supplemental agreement information to identify trends in changes to original contracts and to determine if it needs to make changes to improve the design and construction of future Arizona highway construction projects.

APPENDIX

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APPENDIX

National Studies on A+B Bidding

1. American Association of State Highway and Transportation Officials. *Primer on Contracting 2000: A Report of the Contract Administration Task Force of the AASHTO, Subcommittee on Construction of the AASHTO Standing Committee on Highways*, Sept. 1997.
2. American Association of State Highway and Transportation Officials. *Primer on Contracting 2000: A Report of the Contract Administration Task Force of the AASHTO Subcommittee on Construction of the AASHTO Standing Committee on Highways*, Second Edition, Oct. 1998.
3. Anderson, Stuart D. and Jeffery S. Russell. Texas Transportation Institute, *NCHRP 10-49 Improved Contracting Methods For Highway Construction Projects Draft Final Report*. The Texas A&M University System: April 1999.
4. Anderson, Stuart D. and Jeffery S. Russell. Texas Transportation Institute, *NCHRP 10-49 Implementation Guidelines for Warranty, Multi-Parameter, and Best Value Contracting Preliminary Draft*. The Texas A&M University System: April 1999.
5. Ellis, Ralph D. and Zohar J. Herbsman. *Cost-Time Bidding Concept: An Innovative Approach*. Transportation Research Record 1282. 1990.
6. Federal Highway Association. *Contract Management Techniques for Improving Construction Quality*, FHWA-RD-97-067. July 1997.
7. Federal Highway Association. *FHWA Initiatives to Encourage Quality Through Innovative Contracting Practices Special Experimental Projects No. 14-(Sep-14)*. July 1999.
8. Federal Highway Administration. *1998 National Strategic Plan*. 1998.
9. Federal Highway Association. *Road User Cost Determination Methods In Use for Innovative Contracting Projects*, March 4, 1996.
10. Herbsman, Zohar J. A+B Bidding Method-Hidden Success Story For Highway Construction. *Journal of Construction Engineering and Management, ASCE, Vol. 121, No. 4*. December 1995.

APPENDIX (Concl'd)

11. Herbsman, Zohar J., Wei tong Chen, and William C. Epstein. Time is Money: Innovative Contracting Methods in Highway Construction. *Journal of Construction Engineering and Management*, ASCE, Vol.121, No. 3. Sept. 1995.
12. Utah Technology Transfer Center, Utah State University. Executive Summary on A+B Bidding. 2 July, 1999.
< www.utaht2.usu.edu/projects/InnovativeContracting/Bestpractices/A.../A+Bbidding>
13. Virginia Transportation Research Council. *Estimating User Costs as a Basis for Incentive/Disincentive Amounts in Highway Construction Contracts*, VTRC 98-R12. Feb. 1998.

AGENCY RESPONSE

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November 16, 1999

Debbie Davenport
Auditor General
Office of the Auditor General
2910 N 44th St
Phoenix Arizona, 85018

Re: Response to the A+B Contracting Audit

Dear Ms. Davenport:

We are pleased to respond to the above audit dated November 1, 1999. The response is in the format of 1) Response to Recommendations, and 2) General Comments.

RESPONSE TO RECOMMENDATIONS: PAGE 20

- 1. The Legislature should consider amending A.R.S. No. 28-6923(1) to adopt A+B bidding as a permanent contracting method for state highway construction.** Proposed legislation has been prepared for the legislature to consider in accomplishing this action. (See applicable attachment in hard copy version of report)
- 2. The Department should develop and implement written guidelines similar to those created by the Texas Department of Transportation, the New York State Department of Transportation, and the Texas Transportation Institute, to assist with the identification and selection of appropriate highway construction projects for A+B bidding.** The finding is agreed to and the audit recommendation will be implemented. All three documents referred to in the recommendation will be reviewed and ADOT is developing appropriate similar guidelines. (See Attachment 1)

3. **The Department should develop and implement an ongoing education about A+B bidding for its design, contracts and specifications, and construction personnel.** The finding is agreed to and the audit recommendation will be implemented. The appropriate guidelines developed in Recommendation #2 will be conveyed, reviewed and discussed with Design, Contract and Specifications and construction personnel at their respective staff meetings and through special training sessions.
4. **The Department should develop and implement a written process for assessing the impacts of A+B bidding on highway construction projects.** The finding is agreed to and the audit recommendation will be implemented. This process is already being developed.

RESPONSE TO RECOMMENDATIONS: PAGE 26

1. **The Department should ensure that it collects and evaluates supplemental agreement information to identify trends in changes to original contracts and to determine if it needs to make changes to improve the design and construction of future Arizona highway construction projects.** The finding is agreed to and the audit recommendation will be implemented. A new process is being implemented at the present time. The Department is currently tracking time, incentive/disincentive earned and user savings on the 6 projects that have been bid using “a+b” specifications. (Attachment 2). Additional data stated in pages 18 and 19 of this report will also be incorporated in our new reporting system, as it becomes available.

GENERAL COMMENTS:

Footnote 1 on page ii and page 10 refers to a U.S. 191 project between Clifton and Morenci. This “a+b” project never was started and is not pertinent to the purpose of the audit, which was to evaluate effectiveness of “a+b” contracting. The project bid was opened by ADOT on September 30, 1999 and awarded by the Transportation Board on October 15, 1999. As contract approval activities occurred before and after October 1, based upon legal advice from the Attorney General, the contract was rescinded.

Related to the 1st paragraph on page iii: The guidelines presented in “Primer on Contracting 2000” prepared by American Association of State Highway & Transportation Officials, were used to develop our initial program.

Comments on page 21, **Few Supplemental Agreements Exceed Statutory Thresholds.**

Page 22 of the report refers to five supplemental agreements that exceeded the 10 per cent allowable variance. These agreements all occurred for special reasons as detailed below:

Change Order No. 1, Project F-026-1-525, Globe Show Low Highway, had a value of \$300,000 creating a 56 per cent overrun. This was a rock slope stabilization project. When the planned design slope ratio was obtained, another geologic fault was discovered and a very large amount of unstable rock slipped out onto the roadway requiring clean up. This supplemental agreement is classed as an emergency, changed condition, which could not be anticipated. Contract Value \$ 540,896

Change Order No. 1, Project No. I-8-1-518, Mohawk Canal Overpass, Yuma Casa Grande Highway, had a value of \$57,095, creating a 70 per cent overrun. This was a bridge structural steel repair project. Field conditions and measurements did not match plans dimensions and an additional six cracks were found requiring additional welding. The costs were incurred to pay for the additional work required in repairing the bridge. The construction contract was not changed. Contract Value \$81,594

Change Order No. 1, Project No. S 315-511, SR. 286 had a value of \$46,101 and added 1.3 miles to an asphalt roadway overlay creating a 20 per cent overrun. Maintenance funds were used to take advantage of the economic availability of asphalt in this remote area. This change Order should not have been counted as a construction contract overrun. Contract Value \$225,670

Change Order No.6, Project No. IM 40-1(84), Topock Kingman Highway, had a value of \$382,302 creating a 25 per cent and was needed to pay the cost of emergency repairs when a new pavement failed upon opening to traffic. This contract contained new specifications, new materials, and new processes and a fair and equitable repair cost in the above amount was reached with the contractor by ADOT. Contract Value \$1,499,716.

Change Order No. 4, Project No. TEA-WKL-0 (1)P, Winkleman, Gila River Bridge had a value of \$134,057 which created a 47 per cent overrun. These costs were caused by additional, sidewalk, depressed curbs, needed to meet American Disabilities Act requirements which were not known at time of design. Some additional landscape items included in the Change Order were paid out of local enhancement funds and should not have been counted as construction contract changes. Contract Value \$285,954.

In all cases the scope of work in the contract was not changed and the work was required to complete the contract and provide a safe usable facility.

Comments on **Final Contract Costs Continue to Exceed Original Contract Bid Amounts Page 22**

Beginning in 1997 the Department began paying incentives to contractors for superior quality and workmanship. These incentives are paid in the area of materials quality control, asphalt pavement smoothness, asphalt mix consistency, concrete pavement smoothness and concrete pavement pavement thickness. This program is resulting in longer pavement life and lower maintenance costs. Arizona is gaining national recognition as having the smoothest pavement in the nation. One of the customers (the motorists) major requests is also to have smoother pavements and their needs are being met.

The current emphasis in the transportation construction industry is to lessen motorist inconvenience. ADOT now uses incentive payments for early completion of contract work. These incentives are resulting in 3-4 % increase in cost over the original contract bid amounts. The bidding process is being re-evaluated at this time with the consideration of including this cost due to incentive payments in the estimated contract bid amounts.

Additionally the new Supplemental Agreement Process (Attachment No. 3) currently being implemented will allow ADOT to determine the areas causing cost increases and establish methods and procedures to improve plans and document quality and cost overruns should decrease.

A letter from the Attorney General is attached to this report explaining their legal opinion on the "a+b" decision and their interpretation on contract changes.

We appreciate the opportunity to review this report and are pleased your findings show we are complying with established requirements. We furthermore appreciate the recommendations which upon implementation will allow us to provide improved service to our customers, the motorists of Arizona

Sincerely,

Mary E. Peters
Director

Attachments

ATTACHMENT 1

A+B Project Selection Guidelines - DRAFT

1. Type of Project

The following type of projects can be ruled out:

Projects where most of work is limited to outside the shoulder (landscape, fencing, signing, etc).

2. Project should meet at least one of the following criteria:

- Time Restraint:

Weather limitations

Upcoming major event

- Current level of service below "C"

- Major bridge or roadway out of service

- Large impact to local businesses

- Safety Considerations:

School zone in project

Impairment of emergency vehicles (hospital, police or fire)

High accident area

Heavy pedestrian usage

- Road User Cost for duration of project exceeds \$3000

3. Resource Availability

Although the number of man-hours for an A+B project is about the same as one bid conventionally the district needs to be aware that the contractor will likely work longer hours. This will require an increase in ADOT man-hours per day; overtime, weekend work, multi-shifts should be expected.

4. Project Restrictions

- It is important the contractor be creative in how he goes about constructing the project. A+B bidding lends itself to new ideas and methods and therefore restrictions of the contractor should be kept to a minimum.

- In order to accelerate the work the contractor may want to work at night and during weekends in addition to his normal daytime work. Weekend and nighttime restrictions established in the contract will defeat the purpose.

- When possible minimize traffic control restraints. (It may be necessary to include a traffic control plan in the contract to demonstrate one possible method to construct the project.)

- Restrictions are sometimes necessary and should not necessarily deter us from using A+B bidding. However it is critical that whatever restrictions are required, that they be clearly defined in the contract.

ATTACHMENT 2

A+B PROJECTS, DETAILS & RESULTS

PROJECT NO.	DESCRIPTION	DAILY VALUE	ADT	STATE ESTIMATE				BID AMOUNT				DAYS EARLY	INCENTIVE EARNED	MAX. POSSIBLE INCENTIVE
				"a"	days	"b"	"a+b"	"a"	days	"b"	"a+b"			
H304601C	Holbrook TI	\$1,300.00	SR77=10,800 I-40=14,200	\$4,994,000.00	385	\$500,500.00	\$5,494,500.00	\$5,272,000.00	385	\$500,500.00	\$5,772,500.00	77	\$100,100	\$100,100
H391201C	Hohokam	\$2,700.00	47,000	\$2,005,002.00	120	\$324,000.00	\$2,329,002.00	\$3,031,785.00	120	\$324,000.00	\$3,355,785.00	0	\$0	N/A*
H461801C	Bethany TI	\$20,000.00	Beth=39,000 I-17=184,600	\$11,061,300.00	300	\$6,000,000.00	\$17,061,300.00	\$11,465,727.50	225	\$4,500,000.00	\$15,965,727.50	35	\$600,000	\$600,000
H447801C	I-17 Design Bld.	\$16,000.00	Glen=43,000 Camel=48,000 I-17=185,000	\$64,749,450.00	910	\$14,560,000.00	\$79,309,450.00	\$79,729,000.00	609	\$9,744,000.00	\$89,473,000.00		\$0	N/A*
H441301C	I-8B, Ave 3E to 7E	\$3,000.00	10,000	\$1,350,000.00	100	\$300,000.00	\$1,650,000.00	\$1,447,079.00	60	\$180,000.00	\$1,627,079.00		NOT COMPLETE	\$36,000
H274101C	Cottonwood	\$4,800.00	22,000	\$4,417,910.44	210	\$1,008,000.00	\$5,425,910.44	\$4,494,190.12	200	\$960,000.00	\$5,454,190.12		NOT COMPLETE	\$192,000

* no incentive specified

ATTACHMENT 2

A+B PROJECTS, USER SAVINGS

PROJECT NO.	DESCRIPTION	COMPLETION TIME			DAYS AHEAD OF ESTIMATE	USER SAVINGS
		STATE ESTIMATE	BID	ACTUAL		
H304601C	Holbrook TI	385	385	308	77	\$100,100
H391201C	Hohokam	120	120	120	0	\$0
H461801C	Bethany TI	300	225	190	110	\$2,200,000
H447801C	I-17 Design Bld.	910	609	NOT COMPLETE		
H441301C	I-8B, Ave 3E to 7E	100	60	NOT COMPLETE		
H274101C	Cottonwood	210	200	NOT COMPLETE		

A NEW SUPPLEMENTAL AGREEMENT PROCESS

The following changes are proposed for the Supplemental Agreement process. The Supplemental Agreement Cover Sheet described in the Construction Manual will be eliminated and replaced with an electronic template form. The RE's will use the electronic template form to prepare and submit a Prior Approval Letter. The form will make the prior approval process more consistent, easier, and more defined. It should be E-Mailed to Field Reports where the input fields will be downloaded to an Excel spreadsheet automatically. Analysis of the data may allow us to control and understand some of the overrun that we are experiencing.

The Prior Approval Letterform is now being tested in some orgs. After testing and final approval of the new Supplemental Agreement Process, the Construction Manual will be updated so that all orgs will have the same information and documentation. The new Change order types are already approved and the orgs can use the new types when classifying new Supplemental Agreements.

The following pages include drafts of the new change order types, a flow diagram for choosing change order types, the verbal approval instructions, and the prior approval letter.

General Change Order Types

I. Changed Condition: Std. Spec. 104.02

Use this reason when an unusual and unknown condition occurs on the project after award of the contract.

Examples: Unknown utility conflicts or other subsurface conditions, unknown or unusual material characteristics, unusual acts of nature, vandalism.

Comment: This type is a hidden condition that could not be known at contract award. This change cannot be controlled, estimated, or decreased. This category will allow us to explain that a certain percentage of our construction budget must be spent to fix construction conditions that cannot be predicted.

II. Value Engineering: Std. Spec. 104.13

Use this reason when a Value Engineering proposal is accepted.

Comment: These changes should be examined so that future designs include the Value Engineering improvements.

III. Quantity Omissions: Std. Spec. 104.02 D(4) and 101.42

Use this reason when an item was shown on the plans, but was not included on the bid tab or when a major item quantity is increased or decreased more than 25 percent of the plan quantity.

Comment: These changes should be examined to determine if improvements could be made to the estimating process.

IV. Plans Revisions and Oversights: Std. Spec. 104.02

Use this reason when the plans did not accommodate existing visible field conditions, at the time of construction, and a change to the design is desirable.

Examples: Obvious design oversight or omissions.

Comment: These changes are within the original scope and should have been on the original plans. These changes should be examined to determine if improvements could be made to the design process.

V. Penalties-Bonus: Std. Spec. 104.02 (D) (1)

Use this reason when paying for items where construction quality or time was modified and the change was not included in the contract documents.

Examples: ADOT chooses to accept a substandard product at a reduced price or wants to accelerate the contractors schedule with a bonus, or accepts a different product at a penalty or bonus when the plans materials are unavailable.

ATTACHMENT 3

VI. Additional or Extra Work out of Scope: Std. Spec. 104.02 D(4)

Work for which a price is not included in the original contract, but where the work is deemed necessary or desirable for satisfactory completion of the contract.

A. ADOT funded

B. Other Jurisdiction funding.

Examples: Visual walls, sound walls, additional landscaping, and intergovernmental agreements are some of the items that can be extra work.

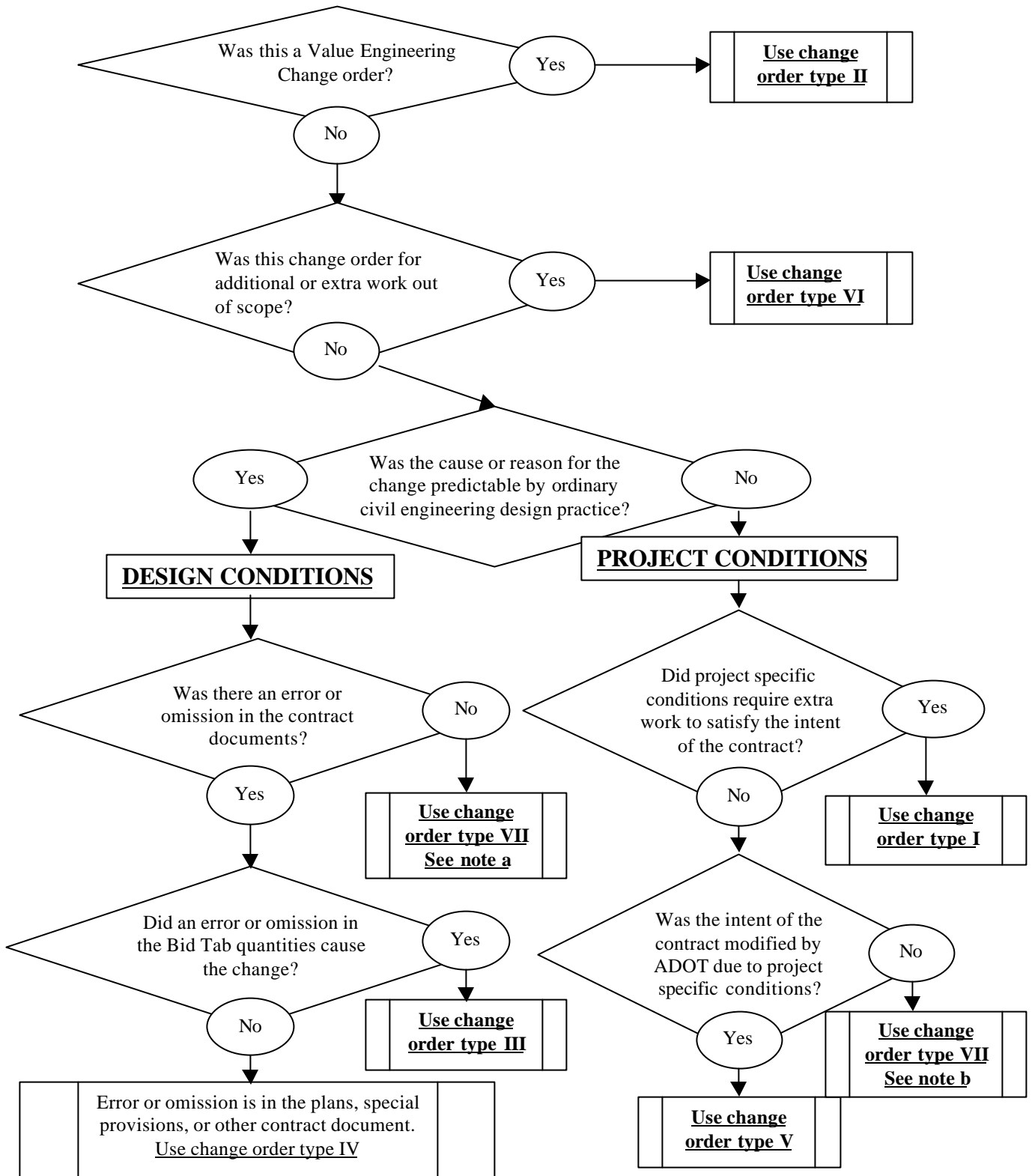
VII. Other:

Write in any items not included in the above categories and explain in detail.

Examples: Negotiated settlements should be included in any of the above categories that the change order fits if there is agreement that a contract change has occurred and the price is being negotiated. When a contract change is debated and a settlement is reached, the change order should be included in this category and the negotiated settlement should be explained in detail.

COMMENTS: Each of the change order types defined above can better define and categorize the reason for overruns. With any system, overlap and redundancy may occur so the supplied flow diagram for choosing the change order type should be used. The Resident Engineer should make a conscious effort to not lump types of contract changes within one change order.

Flow Diagram for Choosing a Change Order Type



Note a: An example of type VII (Other) here would be when the Resident Engineer changes the design because he or she feels that the change would improve their project. These changes should be approved by the responsible ADOT authority and fully explained in the comments.
 Note b: An example of type VII (Other) here is when ADOT feels the contract did not need to be modified, but the contractor did and a negotiated settlement is reached. These changes should be fully explained in the comments.

Draft Verbal Approval Instructions

The following draft (Exhibit 1) is a new description of the prior approval process and will replace the current description of the prior approval process in the Construction Manual.

Exhibit 1

Verbal Approval Requirements for Supplemental Agreements (Prior Approval Letters)

The purpose of Prior Approval Letters is to provide a written document that details ADOT verbal approvals and Contractor acceptance of contract changes. This document shall be prepared and distributed within 48 hours of a verbal authorization to proceed with a contract change. The contractor can not start work on a contract change without an authorized verbal contract. The Prior Approval Letter is important because it documents that authorized approvals for contract changes have been obtained so that work and payment can proceed before a detailed Supplemental Agreement is signed as the official contract document. In cases where exact costs cannot be determined, the contractor and the Resident Engineer shall prepare a cost estimate for the Prior Approval Letter and the Resident Engineer shall document the work as if it were a force account until an exact cost can be agreed upon. A completed formal detailed Supplemental Agreement with exact cost shall be submitted within 45 calendar days following the date of verbal authorization.

The Resident Engineer shall use the Microsoft Word template form that was provided to prepare the prior approval letter. The following contacts will be made.

1. The person authorizing the change. (See “Authorization Levels” above)
2. The Assistant State Engineer – Construction and the Project Manager if the Supplemental Agreement cost warrants. (See “Authorization Levels” above)
3. If the design was modified, the name of the registrant that was contacted as specified under “Sealing Change Orders”.
4. The person contacted within the appropriate ADOT technical section if ADOT Standard Specifications, Special Provisions, or Standard Drawings were altered. (See “Technical Contacts for Supplemental Agreements” above)
5. Contractor’s Agent.
6. Federal Highway Administration and local government contacts.

The original will be filed with the District Engineer, with additional copies distributed to the:

1. Contractor
2. Field Reports
3. Local Government and/or FHWA as applicable (FHWA must be contacted for Interstate projects > 1 Million)
4. All other contacts specified in the Prior Approval Letter.

Draft Prior Approval Template

ARIZONA DEPARTMENT OF TRANSPORTATION

Prior Approval Letter

11/22/99

TO: **DE Engineer**
District Engineer

FROM: **RE Engineer**
Resident Engineer

Signature: _____

Signature: _____

When changed the project Info is changed

When contract amount is entered the contingency is automatically calculated

Tracs Number	Project Number	Project Name	
HC00101C	FA3124301C	MY Project	
Contractor		Contract Amount \$	Contingency
My contractor		\$4,000,000.00	\$200,000.00
Supplemental Agreement Amount \$ / %		Accumulated Amount \$ / %	
\$19,000.00	0.47%	\$338,000.00	8.45%

Will be added to accumulated amount and percentages are calculated.

1. Change Order
2. Force Account
3. Letter of Agreement

SUPPLEMENTAL AGREEMENT TYPE: **Change Order** NUMBER 1
 DESCRIPTION: The subgrade was unstable and had to be replaced with stable material.

Dropdown listboxes

1. Changed Condition
2. Value Engineering
3. Quantity Omissions
4. Plans Revisions and Oversights
5. Penalties – Bonus
- 6A. Additional or Extra Work (ADOT)
- 6B. Additional or Extra Work (Other Jurisdiction)
7. Other (Explain in comments)

REASON: 1. Changed Condition

COMMENTS OR PROCESS IMPROVEMENT SUGGESTION
 This item could not have been anticipated.

Enter one paragraph for the description and comments

Project information is saved.

CHECK BOX FOR PROJECT MEMORY SAVE

Spellcheck is done.

CHECK BOX FOR SPELL CHECK

DOWNLOAD TO EXCEL

Project info is downloaded to an Excel spreadsheet.

NAME	TITLE	DATE	COMMENTS
	Resident Engineer		ADOT's Authorizing Agent
			Contractor's Agent
	Asst. State Eng.(Const)		
	Project Manager		

Contacts are automatically inserted based on the Supplemental Agreement and Accumulated amounts and percentages.

Other Performance Audit Reports Issued Within the Last 12 Months

<p>99-2 Arizona Air Pollution Control Hearing Board</p> <p>99-3 Home Health Care Regulation</p> <p>99-4 Adult Probation</p> <p>99-5 Department of Gaming</p> <p>99-6 Department of Health Services— Emergency Medical Services</p> <p>99-7 Arizona Drug and Gang Policy Council</p> <p>99-8 Department of Water Resources</p> <p>99-9 Department of Health Services— Arizona State Hospital</p> <p>99-10 Residential Utility Consumer Office/Residential Utility Consumer Board</p> <p>99-11 Department of Economic Security— Child Support Enforcement</p> <p>99-12 Department of Health Services— Division of Behavioral Health Services</p>	<p>99-13 Board of Psychologist Examiners</p> <p>99-14 Arizona Council for the Hearing Impaired</p> <p>99-15 Arizona Board of Dental Examiners</p> <p>99-16 Department of Building and Fire Safety</p> <p>99-17 Department of Health Services’ Tobacco Education and Prevention Program</p> <p>99-18 Department of Health Services— Bureau of Epidemiology and Disease Control Services</p> <p>99-19 Department of Health Services— Sunset Factors</p> <p>99-20 Arizona State Board of Accountancy</p> <p>99-21 Department of Environmental Quality—Aquifer Protection Permit Program, Water Quality Assurance Revolving Fund Program, and Underground Storage Tank Program</p>
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Future Performance Audit Reports

Department of Health Services—Behavioral Health Services Coordination
Healthy Families Program