REPORT NO. 95-30

STATE OF FLORIDA

OFFICE OF PROGRAM POLICY ANALYSIS AND GOVERNMENT ACCOUNTABILITY

REVIEW OF THE

FLORIDA DEPARTMENT OF TRANSPORTATION'S PERFORMANCE IN CONTROLLING COST OVERRUNS AND DELAYS WHEN BUILDING ROADS AND BRIDGES

January 11, 1996

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- Whether a program is operating within current revenue resources;
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State of Florida

OFFICE OF PROGRAM POLICY ANALYSIS AND GOVERNMENT ACCOUNTABILITY

January 11, 1996

The President of the Senate,
the Speaker of the House of Representatives,
and the Legislative Auditing Committee

I have directed that a review be made of the Florida Department of Transportation's performance in controlling cost overruns and delays when building roads and bridges. The results of the review are presented to you in this report. This review was conducted at the request of the Joint Legislative Auditing Committee. This review was conducted by Mr. Douglas Isabelle under the supervision of Mr. Gary VanLandingham.

We wish to express our appreciation to the staff of the Florida Department of Transportation for their cooperation during this review.

Respectfully yours,

James L. Carpenter
Interim Director

111 WEST MADISON STREET ■ ROOM 312 ■ POST OFFICE BOX 1735 ■ TALLAHASSEE, FLORIDA 32302
904/488-0021 ■ SUNCOM 278-0021 ■ FAX 904/487-3804

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Purpose

This review examines the Department of Transportation's (FDOT) performance in minimizing cost overruns and time delays. Our review was requested by the Joint Legislative Auditing Committee and addresses three questions:

- How prevalent are construction cost overruns and delays in FDOT construction projects?
- What factors contribute to cost overruns and delays in transportation construction projects? and
- What additional actions could FDOT take to minimize construction cost overruns and delays?

Conclusions and Recommendations

Cost Overruns and Project Delays Are Worsening

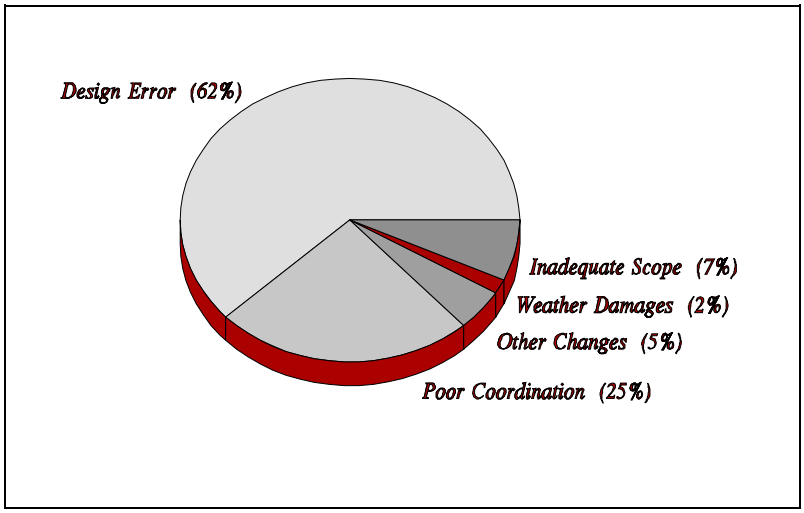
Completing transportation projects on time and within budget has been a chronic problem for FDOT and the problem is worsening. Cost overruns on FDOT transportation projects have increased from an average of less than 2% during fiscal years 1980-81 through 1984-85 to an average of 15% by fiscal year 1994-95. Similarly, projects have taken longer to complete than planned. Projects completed during fiscal year 1994-95 took an average of 2.5 months longer to complete than planned and had cost overruns that averaged $450,000.

Most Overruns and Delays Are Due to Design Errors and Omissions

There are complex and interrelated reasons why FDOT experiences cost overruns and delays in constructing transportation projects. Almost two-thirds of the cost overruns and delays in the projects we reviewed were attributed to errors and omissions in project design plans (see table that follows). The remaining cost overruns and delays were attributed to breakdowns in project coordination between FDOT and other entities such as local governments and utility companies; problems in defining the scope of work required to carry out a project; changes to project specifications after design plans are complete;

and damages to construction sites due to extreme weather conditions.

FDOT's Construction Contract Cost Overruns: Review of 448 Supplemental Agreements



Source: Office of Program Policy Analysis and Government Accountability analysis of the Florida Department of Transportation's construction contract documents.

Emphasis on Meeting Schedules Leads to More Design Errors

Some of these factors are within FDOT's control and are likely due in part to the increased volume of construction FDOT has initiated in recent years and its strong emphasis on meeting production schedules. These cost overruns and delays could be reduced with better project management. Notably, due to pressures to meet production schedules, FDOT staff do not always carefully review design plans to identify and resolve errors and omissions before projects are let for bid. Other cost increases reflect expenses to resolve unforeseen site conditions. FDOT likely would have incurred these costs for many projects in any event. Some of these expenses probably could have been lower if FDOT had detected these conditions before construction had begun. FDOT faces trade-offs when managing transportation projects. Funds spent to collect additional data on site conditions may be a good investment if the data identifies problems that would significantly affect construction. Similarly, FDOT could identify and resolve more design errors if it performed more detailed plan reviews. However, it can be criticized for not meeting its

Work Program commitments if this additional work causes FDOT to miss planned project bid dates.

FDOT Taking Actions to Address Some Problems

FDOT is taking steps to address cost and delays. For example, several districts are expanding their reviews of design plans to try to identify and resolve errors and omissions prior to bid letting. These actions include hiring staff to perform "constructability reviews" that examine whether projects can be readily built as designed. FDOT has also increased its efforts to identify underground utilities that would be affected by projects. This should help to avoid some cost overruns and delays that occur when contractors encounter a utility line that must be moved before construction can proceed. Additionally, FDOT is providing training to consultants in construction standards and to its staff in contract management. FDOT is also drafting specifications and procedures for innovative contracting procedures such as design/build contracts, lane rentals, and warranties. The impact of these efforts may not be known for several years as projects take several years to proceed through the planning and construction cycle.

Recommendations

We believe that FDOT could take additional steps to help minimize cost overruns and delays in transportation construction projects. Specifically, we recommend that the Department:

- Improve the quality of its review of project design plans to resolve errors and omissions prior to letting contracts for bid. Specifically, FDOT should strategically focus its review efforts on the types of projects—new construction and reconstruction. In addition, FDOT should focus on areas of design plans—earthwork and drainage—that have been particularly problematic in the past.

- Carefully review design plans that it adopts that have been developed by other entities such as transportation authorities. These plans have not been subject to FDOT's normal plan development process. Many of the projects we examined that had significant

design errors and cost overruns had been developed by outside entities.

- Conduct additional preliminary research to better identify site conditions before design plans are developed. This should be done for certain types of projects that have a high risk of cost overruns due to project conditions being different than those assumed by the design plans, particularly bridge rehabilitation projects.

- Increase its efforts to coordinate projects with local governments, other state agencies, and utility companies to minimize construction conflicts.

- Develop formal goals for minimizing cost overruns and delays in transportation projects, and monitor district performance in these areas. This will help balance the current emphasis that is placed on meeting production schedules and help ensure that districts do not shortcut project development and review activities.

- Continue developing specifications for innovative contracting methods.

We also recommend that the Legislature:

- Amend Ch. 337, F.S., to expand FDOT's authority to use design/build contracting. FDOT should be authorized to use design/build contracting whenever it determines that this process could save time or money in constructing transportation projects.

- Amend Ch. 337, F.S., to authorize FDOT to award transportation construction contracts based on both cost and construction time. This "A + B" bid method has reduced construction time in other states. FDOT should work with the construction industry to develop the criteria to be used in the selection process; and

- Authorize FDOT to use a percentage of its appropriations to experiment with other innovative

contracting methods. The Department should be required to report the results of these experiments to the Legislature.

Agency Response

The Secretary of the Department of Transportation agreed with the findings identified by our review and agreed to implement our recommendations to reduce costs in time and money.

Review of Construction Cost Overruns and Delays

CHAPTER I Introduction

Scope

This report reviews the Florida Department of Transportation's (FDOT) performance in controlling cost overruns and delays when building roads and bridges. Our review was requested by the Joint Legislative Auditing Committee and addresses three questions:

- How prevalent are construction cost overruns and delays in FDOT construction projects?
- What factors contribute to cost overruns and delays in FDOT construction projects? and
- What additional actions could the FDOT take to minimize construction cost overruns and delays?

Our review was made in accordance with generally accepted government auditing standards and accordingly included appropriate performance auditing and evaluation methods. Our fieldwork was conducted during May through November 1995. A detailed discussion of our methodology is provided in Appendix A.

Background

Chapter 334, F.S., provides that FDOT has the authority and responsibility for constructing and maintaining the State Highway System in the most efficient and cost-effective manner. The State Highway System consists of about 12,000 centerline miles of roads that carry about two-thirds of the total vehicle miles traveled in Florida. [1]

FDOT follows a multi-step process in constructing transportation projects. FDOT, through a cooperative

[1] As defined by s. 334.03, F.S., the State Highway System includes the interstate highways and urban and rural roads that provide service that is relatively high traffic volume, long average trip length, high operating speed, and high mobility importance. Centerline miles are the length of a road measured along the center of the road right-of-way regardless of the number of lanes.

planning process that involves state, regional, and local government officials and the public, identifies transportation needs and develops a Five-Year Work Program that is updated annually. The Work Program identifies the transportation projects that will be undertaken during the five-year period and the estimated costs of these projects. FDOT next conducts engineering research (e.g., to identify soil and environmental conditions in the area) and develops design plans for the projects.

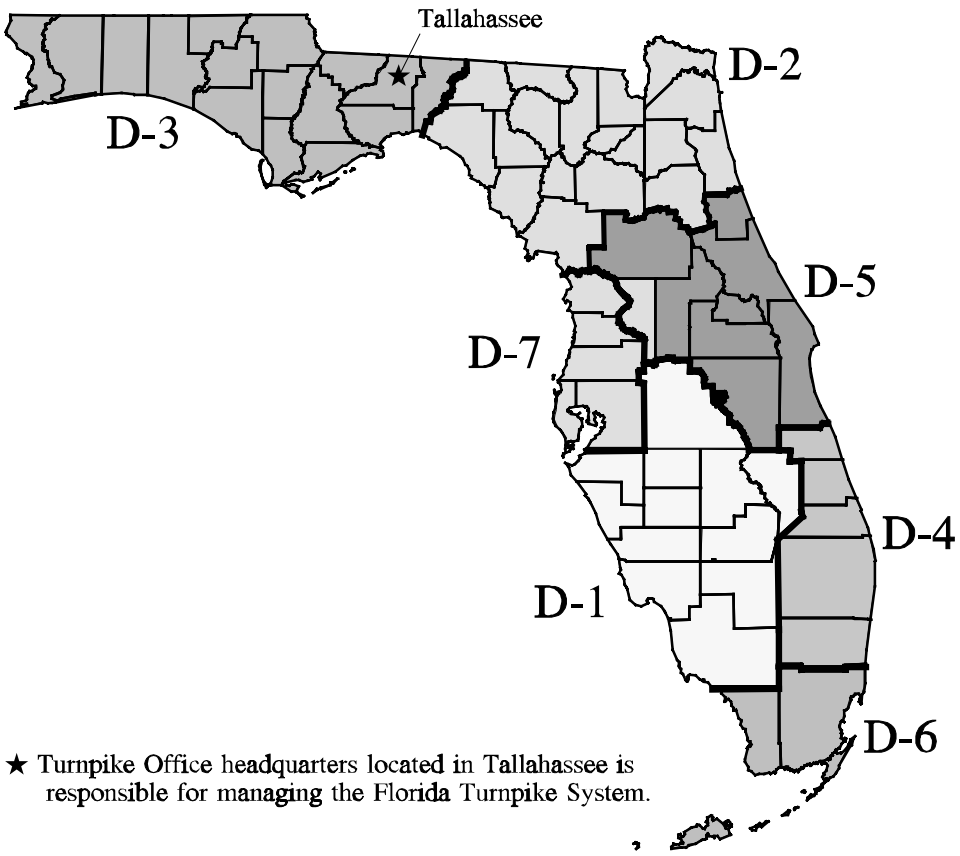
Florida statutes require FDOT to ensure that design plans and descriptions are complete and accurate prior to bidding. These plans contain blueprints to be followed during construction, specify the materials needed for the job (types and quantities), and establish a schedule for construction steps to be followed in carrying out the project. The plans may be developed either by in-house FDOT staff or by private consultants. FDOT reviews the plans at various stages of completion to ensure accuracy. Depending on available funds and project complexity, the project design stage may take several years to complete. During this time period FDOT will also purchase any needed right-of-way through negotiations, eminent domain, or condemnation proceedings. In addition, FDOT coordinates the project with local governments, holds public hearings, and acquires necessary permits. Once these steps are completed, FDOT advertises the project for competitive bid and awards the job to the lowest responsible bidder. FDOT then performs materials testing and construction engineering inspections to monitor the contractor's performance during the construction period.

Although construction contracts specify the price to be paid and the amount of time allowed for a project to be completed, FDOT may agree to changes in contract provisions. These may be required due to errors or omissions in the design plans, changes in project specifications (e.g., adding an additional driveway access), and/or unfavorable weather conditions. These changes are generally made through supplemental agreements to the contract and through time extensions.

FDOT Organization

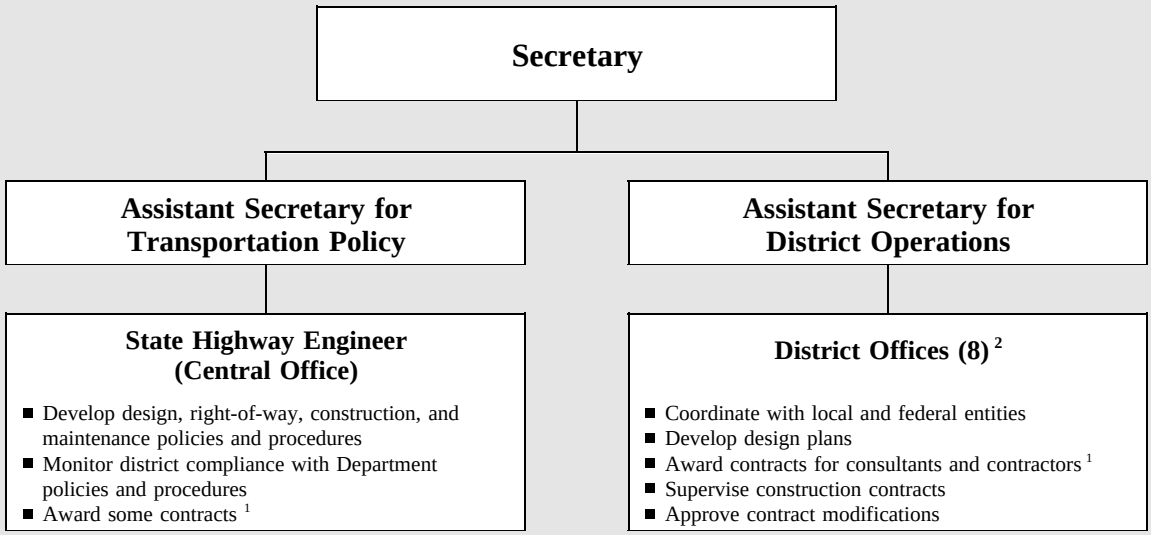
FDOT is organized on a decentralized basis, with a Central Office responsible for establishing statewide policies and procedures and seven district offices and the Turnpike office responsible for carrying out program operations (see Exhibit 1 for a map of the Department's districts). The head of FDOT is the Secretary, who is appointed by the Governor and confirmed by the Senate. The current Secretary is Ben G. Watts, who was appointed as Secretary on December 18, 1989. Each district office is headed by a District Secretary who is appointed by the Secretary. Exhibit 2 shows the program responsibilities of the Central Office and district offices.

Exhibit 1: Florida Department of Transportation Districts



Source: Florida Department of Transportation, Office of Policy Planning, effective July 1, 1994.

Exhibit 2: Functional Responsibilities for Managing Construction Contracts



[1] While districts are generally responsible for planning, designing, and managing transportation projects, construction contracts for these projects can be let by either the Central Office or by the districts. According to Department officials, construction contracts let by the Central Office are generally the large dollar value contracts ($250,000 and greater) and account for the greatest amount of total construction contracts let annually by the Department.

[2] Includes the Florida Turnpike Office.

Source: Florida Department of Transportation, March 1995.

Program Resources

Funding for transportation construction projects is derived from the State Highway Transportation Trust Fund. Revenue sources for this Trust Fund include state gasoline taxes, vehicle registration fees, and federal grants. As shown in Exhibit 3, FDOT spent approximately $2 billion during fiscal year 1994-95 for transportation construction projects. Of this amount, approximately two-thirds ($1.3 billion) was spent for construction contracts, while the remaining one-third ($681 million) was spent for support activities (planning, preliminary engineering and design, right-of-way acquisition, materials testing and research, and construction inspection). Most ($480 million, or 70%) of the support funding was for work performed by consultants, while $201 million (30%) was for work performed by FDOT staff.

Exhibit 3: Florida Department of Transportation Product Support and Construction Expenditures, Fiscal Year 1994-95

Function	Expenditures (in millions)
Support Activities	
Planning	$ 40.7
Preliminary Engineering and Design	327.9
Right-of-Way Acquisition	90.7
Materials Testing and Research	28.1
Construction Inspection	193.2
Total Support Activities	$ 680.6
Construction	1,305.3
Total	**$1,985.9**

Source: Florida Department of Transportation.

FDOT has substantially increased its construction production level in recent years. Over the fiscal year 1990-91 through 1994-95 period, FDOT's construction spending increased by 54%, from $845 million to over $1.3 billion. FDOT plans to continue its current production level through the turn of the century and spend approximately $6 billion on these activities through fiscal year 1999-2000. FDOT has also significantly increased its use of consultant firms in recent years. For example, FDOT's expenditures for consultant design services increased from approximately $142 million in fiscal year 1990-91 to $252 million in fiscal year 1994-95 or approximately 77%.

CHAPTER II Findings and Recommendations

Our review addressed three questions:

- How prevalent are cost overruns and delays in Florida Department of Transportation (FDOT) construction projects?
- What factors contribute to cost overruns and delays in FDOT construction projects? and
- What additional actions could FDOT take to minimize construction cost overruns and delays?

Our overall conclusions and recommendations are discussed in question 3.

Question 1

How prevalent are cost overruns and delays in Florida Department of Transportation construction projects?

Section 334.046(1)(2), F.S., requires FDOT to construct and maintain the state transportation system in the most efficient and cost-effective manner. Two important measures of FDOT's performance are whether it constructs transportation projects within budget and on time. Cost overruns reduce the amount of money available to meet other transportation needs. Delays in completing projects are inconvenient to the traveling public and can further increase costs due to inflation. Some cost increases and delays are unavoidable in transportation projects. For example, prices for construction materials may rise due to inflation, and inclement weather conditions may delay project completion. However, other cost overruns and delays can likely be reduced through better project management.

To determine if the Department constructs transportation projects within budget and on time, we reviewed data on construction contracts let by FDOT's Central Office and completed during the period between July 1, 1980, through June 30, 1995. [2] We found that completing transportation projects on time and within budget has been a chronic problem for FDOT. Specifically:

- Cost overruns have increased over the past 15 years. Transportation projects completed during fiscal year 1994-95 experienced cost overruns that averaged 15% of the projects' initial budget; and

- Project delays have also been a problem for FDOT. Transportation projects completed during fiscal year 1994-95 32% over the original contract schedules.

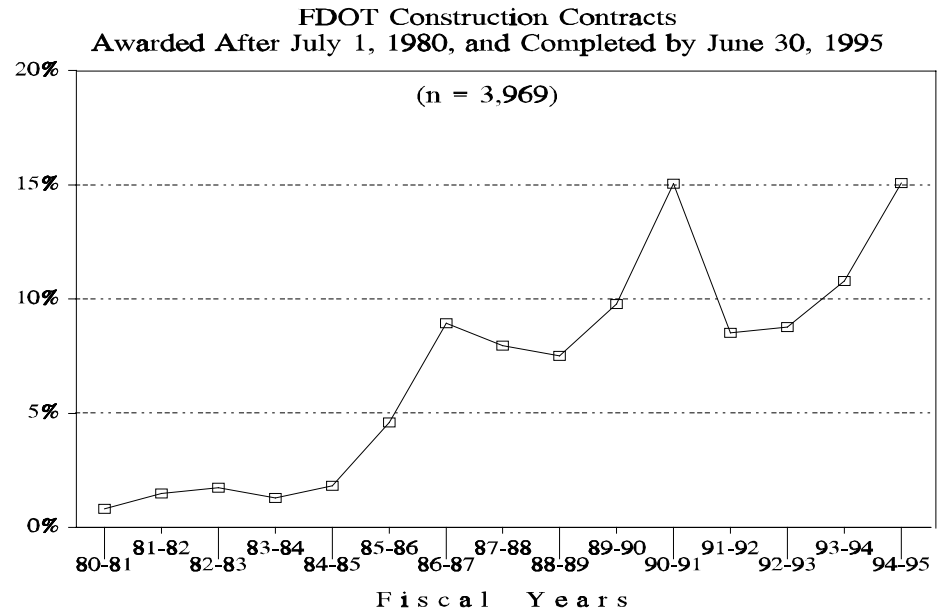
Cost Overruns Are Worsening

As shown in Exhibit 4, FDOT has experienced consistent cost overruns for transportation construction projects during the past 15 years. Over this period, FDOT awarded and completed projects that had an initial contract budget of $6.8 billion. However, supplemental agreements to these projects resulted in cost overruns of $629 million, a 9% increase. These overruns have increased over time. Cost overruns averaged less than 2% for projects completed in fiscal years 1980-81 through 1984-85. In contrast, projects completed during fiscal year 1994-95 had cost overruns that averaged 15%, or about $450,000 per project. [3] (See Appendix C for the average cost overrun for each fiscal year.)

[2] Our analysis was based on the 3,969 construction contracts that were awarded by the FDOT Central Office and accepted as complete between July 1, 1980, and June 30, 1995.

[3] It should be noted that our analysis used a somewhat different sample of FDOT projects than have other recent studies by the Florida Transportation Commission. Our analysis was based on projects that were accepted as complete during our study period, while the Commission has reported on projects where fiscal activity was closed; this accounts for the somewhat different cost overrun figures reported by the Commission.

Exhibit 4: FDOT's Construction Contract Cost Overruns



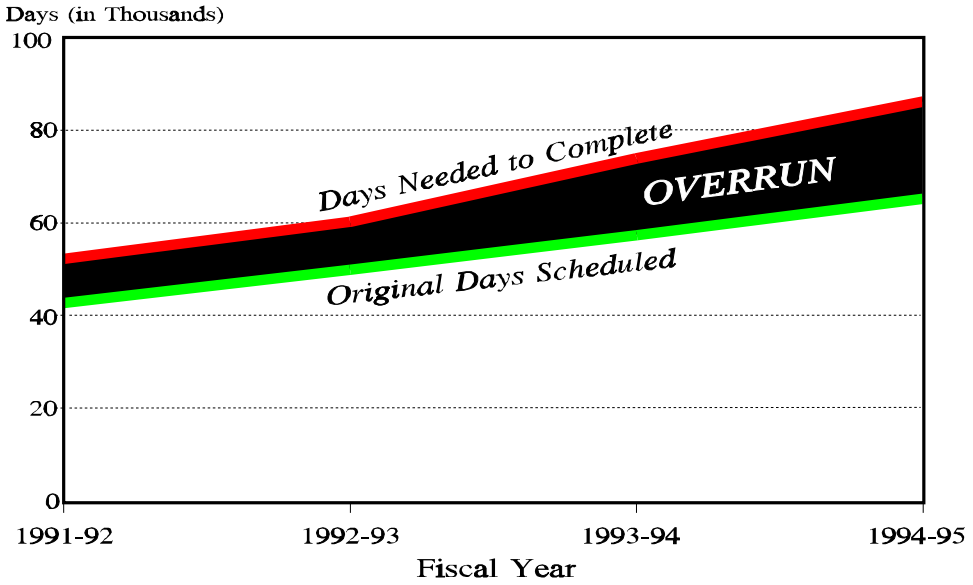
Source: Florida Department of Transportation's Contract Reporting System.

Project Delays Also a Problem

FDOT has also experienced a problem with projects taking longer to complete than anticipated. Due to limited data, we were able to analyze project delays for only the 1991-92 through 1994-95 period. Exhibit 5 shows that projects experienced substantial and increasing delays over this period. The projects completed in fiscal year 1991-92 were scheduled to be done in 42,785 working days but took 52,285 days to complete, a 22% overrun. In contrast, the projects completed in fiscal year 1994-95 were scheduled to be complete in 65,198 working days but took 86,031 days to complete, an average 32% increase over the original contract schedules. [4] These additional days required an average of 2.5 months of additional work days per project to complete than planned.

[4] These figures do not include "weather days" (days that projects were extended due to inclement weather) or suspensions (suspension of work due to holidays, vacations, or other special events).

Exhibit 5: FDOT's Construction Contract Time Overruns



Source: Florida Department of Transportation's Contract Reporting System.

Question 2 addresses the factors that have contributed to these cost overruns and project delays in FDOT transportation projects.

Question 2

What factors contribute to cost overruns and delays in Florida Department of Transportation construction projects?

To identify the reasons why FDOT has experienced cost and time overruns in transportation projects, we examined a sample of 132 projects the Department recently completed that had experienced these problems. [5] These projects had

[5] The projects in our sample had been completed and accepted by FDOT during the July 1, 1993, through March 31, 1995, period. Because our objective was to study reasons why FDOT transportation projects experience cost increases and delays, we selected our sample to include those projects that had the greatest overruns in each of FDOT's eight districts. Accordingly, our sample should not be considered to be representative of all FDOT transportation projects.

original contract budgets of approximately $674 million, but experienced cost increases totaling $112 million (17%). Information was not available for two projects, but projects also experienced delays that extended project completion by 18,259 days (43%). We focused our review on 448 supplemental agreements to these projects that accounted for 93% ($104 million) of the total cost overruns, and reviewed contract documents to identify factors that caused these cost increases and project delays. See Appendix A for a detailed description of the methodology we used to study this issue.

Many Factors Contribute to Project Overruns

We determined that there are complex and interrelated reasons why FDOT experiences cost increases and delays in constructing transportation projects. Some of these factors are within FDOT's control and are likely due in part to the increased volume of construction FDOT has initiated in recent years and the strong emphasis it has placed on meeting production schedules. These cost overruns and/or delays could be reduced with better project management. Other construction cost increases reflect expenses to resolve unforeseen site conditions. FDOT would have incurred these costs in any event, although these expenses probably could have been lower if FDOT had detected the site problems before construction had begun. Finally, some overruns are due to factors that are largely outside of the Department's control. These costs may have to be accepted as part of the transportation construction process.

Factors Accounting for Cost Overruns

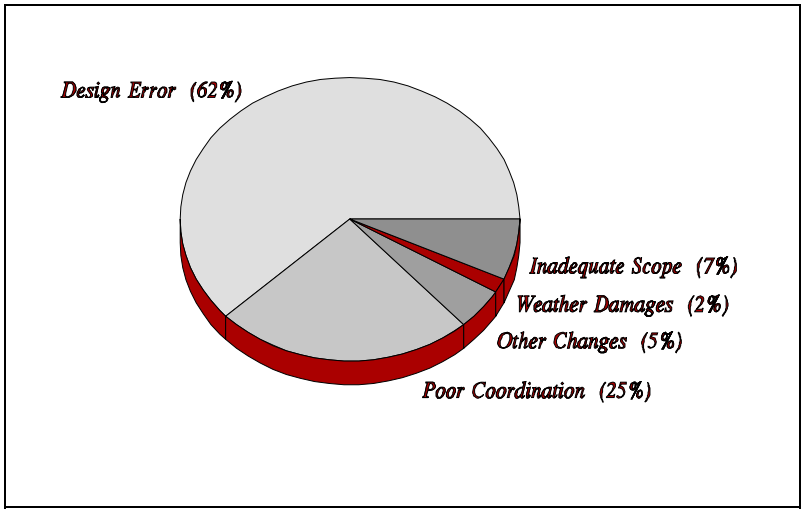
Cost overruns in the projects we examined were generally attributable to five factors:

- Errors and omissions in design plans;
- Inadequate coordination with local governments and utility companies;
- Problems in identifying the scope of work that needed to be done during project development;
- Changes in project specifications after design plans had been completed; and

- Damages to construction sites due to extreme weather.

Exhibit 6 shows that about two-thirds of the overruns ($65 million of $104 million) were attributable to design plan errors and omissions. This was followed by coordination problems, project scope problems, changes in project requirements, and damages caused by extreme weather.

Exhibit 6: FDOT's Construction Contract Cost Overruns: Review of 448 Supplemental Agreements



Source: Office of Program Policy Analysis and Government Accountability analysis of the Florida Department of Transportation's construction contract documents.

Most Cost Overruns Attributable to Design Errors and Omissions

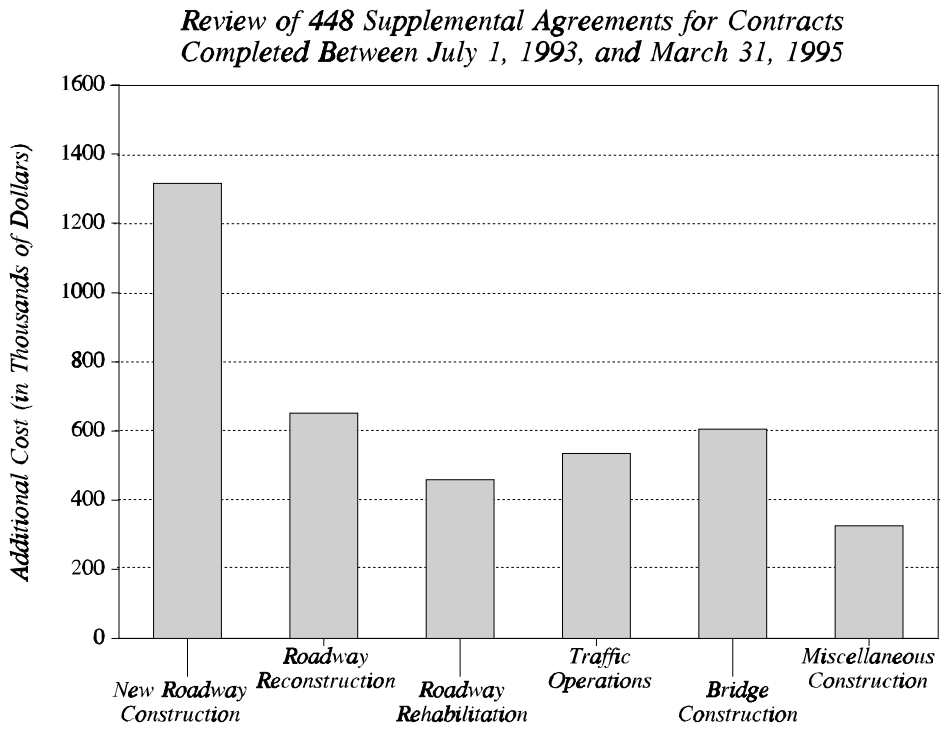
Design Plan Errors and Omissions. The majority of cost overruns in the projects we reviewed were attributed to errors and omissions in project design plans. These plans are developed by both in-house staff and consultants. The plans include construction blueprints and specifications, and identify the materials and quantities needed for the job. In developing these design plans, engineers rely on data collected by FDOT on project site conditions. This data includes technical information on soil, drainage, and hydrology conditions.

Errors and omissions in design plans can lead to cost overruns. FDOT is required by statute to provide "a complete and accurate set of design plans" to construction contractors. These companies can demand additional payment if they need to do extra work or their progress is delayed because design plans are incorrect or incomplete. For example, a design plan may erroneously specify that existing soil at a project site can be used for embankments or foundations. A cost overrun would occur if the contractor subsequently had to remove the soil and bring in new materials before construction could proceed. Similarly, a contractor may demand additional payment if they had to build additional access driveways that had been omitted from the design plans.

Over 60% ($65 million of $104 million) of the cost overruns in the projects we reviewed were attributable to design plan errors and omissions. Exhibit 7 identifies the cost overruns attributable to design errors and omissions for different types of construction projects. Design errors on projects to build new roads had the largest fiscal impact, as the projects we examined had cost overruns averaging almost $1.3 million because of this problem. Bridge construction and roadway reconstruction projects (involving resurfacing and/or adding new traffic lanes) had average cost increases of about $0.6 million due to design errors. [6] Design errors in these projects typically resulted in the need for additional earthwork, drainage, and bridge pilings. This indicates that FDOT should place a priority on reviewing design plans for these types of projects to reduce or eliminate these problems.

[6] New road construction projects had the greatest fiscal impact in our sample as well as the population from which the projects were selected. For example, in our sample new road construction accounted for 37% of the cost overruns, while new construction projects in the population accounted for 40% of the cost overruns.

Exhibit 7: Average Cost Overruns of Sample Projects By Type of Project



Source: Office of Program Policy Analysis and Government Accountability analysis of sample cases.

Examples of design errors and omissions in our sample projects included:

- The design plans for a road resurfacing and repaving project specified that the contractor was to use a certain type and thickness of asphalt. However, after the contractor began laying the new asphalt it was determined that this additional layer left insufficient clearance for trucks to safely pass under bridges. To correct this design problem, FDOT paid the contractor an additional $232,000 to mill down the new asphalt and the existing roadway and then repave the roadway using the new type of asphalt. This error had not been detected during FDOT's review of the design plans;

- The design plans for a road widening and reconstruction project had several errors. These

included plans for drainage systems that would have been non-functional given site conditions and errors in the specified widths of roadway segments. Total cost overruns for design errors on this project were approximately $840,000. If the plan errors had been corrected prior to letting, the overruns would have been competitively bid. The design plan errors had not been detected during FDOT's review of plans, although the file noted that numerous review comments were unresolved when the project was let for bid; and

- In another road widening and resurfacing project, the design plans provided inaccurate specifications for the amounts of subsoil excavation to be done and quantities of materials needed for road construction. FDOT's site research had underestimated the amount of unsuitable materials at the project site. The Department paid the contractor an additional $757,580 to remove and replace the unsuitable materials.

FDOT would have paid some of these additional costs in any event, as the additional work needed to be done to carry out the project. However, it likely could have saved money if the design plans had been correct because it could have competitively bid the full range of work to be done and contractors would have avoided unnecessary work.

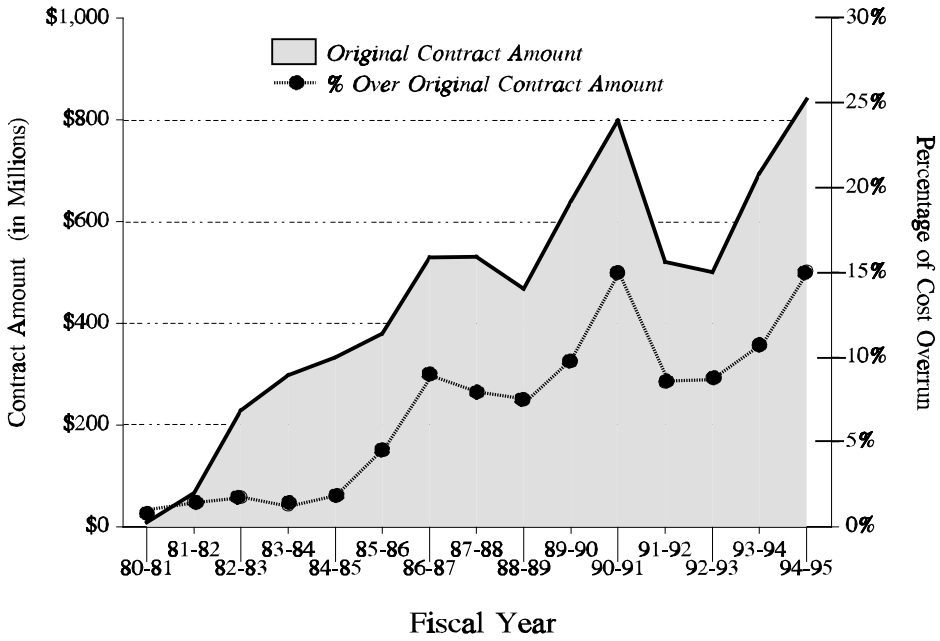
Emphasis on Meeting Schedules and Increased Production Volume Can Lead to More Design Errors

Factors that contribute to the high prevalence of design errors and omissions are the increased volume of FDOT construction and the emphasis the Department has placed on meeting production schedules. Over the fiscal year 1990-91 through 1994-95 period, FDOT's construction spending increased by 54%, from $845 million to over $1.3 billion, and FDOT management has placed a priority on "delivering the Work Program." This emphasis has been successful as FDOT has largely achieved its production goals. From fiscal year 1990-91 through 1994-95, FDOT planned to let contracts for 2,294 construction projects for bid and actually let 2,204 contracts, or 96% of its production schedule.

Design Plans Not Always Carefully Reviewed

However, this emphasis on production quantity can affect product quality. Exhibit 8 shows that there is a high correlation between the volume of construction projects that FDOT has carried out in a year and the average cost overruns of these projects. In the years when construction volume has been the highest (such as fiscal years 1990-91 and 1994-95), projects have had the highest average percentage cost overrun. As the value of construction has fallen in some years, average cost overruns have also decreased.

Exhibit 8: Original Contract Amount and Average Percentage Cost Overrun



Source: Office of Program Policy Analysis and Government Accountability analysis of sample cases.

A reason for this linkage between construction volume and cost overruns is that due to production pressures design plans are not always carefully reviewed before being released for bid. FDOT's Inspector General has reported that due to pressures to meet production schedules, staff are not always given enough time to review design plans and that changes recommended by staff are not always

discussed or adopted into design plans. [7] FDOT managers we talked with agreed that many cost overruns could have been avoided if more accurate data on site conditions were available and if review questions had been followed up.

Need for Design Plan Reviews Magnified by Increased Use of Consultants

The need to carefully review design plans is magnified by the increasing use of consultants to develop design plans. As the volume of construction activity has expanded in recent years, FDOT has increasingly used consultants rather than in-house staff to design transportation projects. In fiscal year 1994-95, 65% of projects were designed by consultants. FDOT staff said that many consultants are relatively inexperienced and do not fully understand Florida's project requirements. As a result, design plans developed by consultants need to be carefully reviewed to help ensure that errors and omissions are detected and resolved before the projects are let for bid. [8]

Lengthy Project Development Periods and Use of Outside Plans Contribute to Errors

Other factors that contribute to design errors are the lengthy development periods for some projects and FDOT's practice of adopting design plans developed by other entities. Some projects are not let for bid until several years have passed since site research was conducted and design plans developed. As a result, site descriptions in design plans may no longer match construction conditions. For example, contractors may have to maintain access to new businesses during construction, or pavement conditions may have deteriorated, requiring the contractor to do additional work. Also, in at least seven cases we examined FDOT had adopted design plans that had been developed by other entities such as expressway authorities. To save time, FDOT staff performed only cursory reviews of these plans prior to letting them for bid. Numerous design errors were found during construction of these projects, resulting in cost overruns totaling $11 million.

[7] Florida Department of Transportation Office of Inspector General Advisory Memorandum No. 02C3010, dated July 27, 1995.

[8] Design errors were somewhat more prevalent in the projects in our sample that were designed by consultant engineers than those projects developed by FDOT staff. While consultants had designed 73% of the projects in our sample, these cases accounted for 82% of the total cost overruns.

FDOT Faces Cost Trade-Offs When Managing Projects

FDOT faces trade-offs when determining the amount of engineering research and plan reviews to be done. Research such as test borings to identify site conditions can be costly to perform. Spending extra money to collect additional data may be a good investment if the extra tests find site problems that would significantly affect construction, but may be an unnecessary expense if extensive tests do not find such problems. FDOT could identify and resolve more design errors if it performed more detailed plan reviews. However, the Department can be criticized for not meeting its commitments if this additional work causes the Department to miss planned project bid dates. Nonetheless, the level of cost overruns that were attributed to design errors and omissions indicates that FDOT should place more emphasis on the project research and review processes.

Coordination Problems Lead to Cost Increases

Poor Project Coordination. The second major factor we identified that contributes to cost overruns is breakdowns in communication between FDOT and various entities. When planning and designing transportation projects, FDOT must coordinate with local governments, utilities, and other entities to identify environmental and local requirements, utility lines that must be moved as a result of the project, and other factors that must be considered during the planning and construction process.

About a quarter ($25.7 million of $104 million) of the cost overruns in the projects we examined resulted from breakdowns in coordination. Exhibit 9 shows the types of coordination problems encountered by these projects. About half of these cases involved the need to change project designs and/or construction operations to meet local government requirements; these changes included modifying roadway and lighting designs, medians and turning lanes, and the hours of construction operation. About 30% of the cases encountered coordination problems with utilities; these cases generally involved doing extra work to locate and move utility lines impacted by projects. About a tenth of the cases involved permit conflicts where other government entities, (e.g., local governments and the Florida Department of Environmental Protection) required FDOT to do extra work to protect the environment from

construction impacts. A few cases involved work conflicts where progress on one project was dependent upon the timely completion of a companion project. Finally, three cases involved right-of-way issues that had not been resolved prior to construction.

Exhibit 9: Florida Department of Transportation Coordination Problems Encountered by Sample Projects

Coordination Problems	Number of Supplemental Agreements	Cost Overruns
Local Government Requirements	41	$ 9,724,000
Utility Conflicts	25	4,767,000
Permit Requirements	11	4,055,000
Other Projects	5	1,069,000
Right-of-Way	3	6,111,000
Total	**85**	**$25,726,000**

Source: Office of Program Policy Analysis and Government Accountability. analysis of sample cases.

Examples of these coordination problems included:

- In a road reconstruction project, FDOT provided design plans to utility owners to enable them to identify and move the affected utility lines prior to construction. The utility companies did not move the affected lines prior to construction, causing the construction contractor to delay scheduled work. FDOT paid the contractor approximately $500,000 for these delays.

- FDOT awarded a bridge replacement project to two different contractors. One contractor was to handle construction on the bridge span while the other was to build the roadway approach to the bridge. Work on the roadway approach was scheduled to be completed at the same time as the bridge construction. However, coordination problems with the local

government and unforeseen buried timber piles delayed completion of the roadway approach; these problems included realigning roadway ramps, accommodating an overhead rail system, and adding additional sidewalk lighting. As a result, the approach contractor had to accelerate work on the approach span. FDOT paid the bridge contractor approximately $3 million for these delays.

Better Coordination Could Help Avoid Problems

FDOT Central Office managers said that in many cases these problems could have been avoided if better coordination were done with local governments and utility companies before construction. This would have enabled FDOT to incorporate local government requirements into its design plans and helped to ensure that utility lines had been identified and moved prior to construction. Local governments are provided design plans during project development and can request design changes at that time and during public hearings where the public can voice their concerns with projects. However, FDOT staff told us that local governments do not always have the expertise needed to review design plans and identify conflicts prior to construction. FDOT could refuse to make changes requested by local governments unless the cities and counties agreed to pay these additional costs. However, Department staff indicated that such actions would harm its cooperative relationships with local governments and are not politically feasible.

Similarly, although utility companies are responsible for reviewing design plans and paying the costs to move their utility lines, this process frequently breaks down. FDOT staff noted that utility companies generally lack accurate records about the precise locations of underground utility lines and may not know if a project will require lines to be moved. This is particularly a problem in urban areas where utility lines may have been installed many years ago. As a result, FDOT may not be notified about a utility conflict before it finds a line during excavation; in these cases work is disrupted and cost and time overruns occur. FDOT managers said that to help avoid these problems the Department is taking additional steps to locate underground utilities during its site research. These managers noted that it is less expensive to pay these up-front costs than to pay

for project delays if the utility conflicts are not found until construction has begun.

Problems in Defining Work to Be Done Lead to Cost Increases

Project Scope Problems. Once FDOT decides to carry out a construction project and includes it in the five-year Work Program, the Department performs preliminary studies to define the scope of work needed to achieve the project's objectives. For example, if FDOT decides to correct a problem with a bridge, it must decide whether the existing structure can be rehabilitated to correct deficiencies or whether a new structure needs to be built. This determination is critical, as later design work is based on this scope definition.

About 7% ($7.4 million of $104 million) of the cost overruns in the projects we reviewed were attributable to problems in determining project scope. Most of these expenses ($4.6 million) pertained to bridge projects where FDOT assumed that existing structures were in better condition than was later found during construction. The remaining cost increases were associated with projects such as roadway resurfacing, toll plaza construction, and installation of motorist emergency call-box systems. Examples of these scope development problems included:

- In one case, FDOT's preliminary research indicated that a bridge could be rehabilitated to bring it up to standards. FDOT developed project design plans based on this information and awarded a $1 million contract for the work. However, during construction it was found that the bridge pilings were heavily deteriorated and that additional work needed to be done. FDOT suspended the project and paid the contractor $778,000. FDOT then developed new rehabilitation plans and awarded a new contract for the bridge repairs. While FDOT needed to do the more extensive work on the bridge, it could have avoided some of the costs of the initial contract if its preliminary research had accurately determined the bridge's condition.

- In another project, FDOT's preliminary research indicated that a draw bridge could be rehabilitated to bring it up to construction standards. The Department

developed design plans for this project and awarded a $1.5 million contract for the work. However, during construction it was found that major elements of the bridge such as bearings, pinions, girders, drive machinery and decking required additional work. FDOT did not rebid the contract but paid the existing contractor at least $1.8 million more for the extra work. While the additional repair work needed to be done, FDOT may have been able to reduce this cost if its research had accurately identified the bridge's actual condition and the work had been competitively bid.

FDOT Central Office staff indicated better preliminary research would save money because the Department could competitively bid all aspects of such projects and avoid paying contractors for work that is later redone because the scope of the project is changed.

Changes to Project Requirements Lead to Cost Increases

Specification Changes. The fourth major cause of construction cost overruns is changes to project specifications after design plans are complete. When developing project design plans, engineers are required to incorporate various state and federal engineering, environmental, and safety standards, such as the type and strength of construction materials to be used and the width of traffic lanes. However, the Federal Highway Administration and FDOT at times amend these standards to improve safety, reduce environmental impacts, or experiment with new materials. These changes can be costly to implement, particularly if they are retroactively imposed on projects that have already been designed.

About 5% ($4.8 of $104 million) of the cost overruns in the projects we reviewed were attributable to specification changes. These cases included requiring contractors to incorporate new environmental and safety standard changes into projects after contracts were awarded, such as removing volatile organic compounds from lead paint materials, widening pavement markings to aid elder drivers, and using ground tire rubber in pavement surface. For example:

- In a resurfacing and repaving project, the design plans provided for using standard pavement materials. However, during construction FDOT changed its standards and required the contractor to use a rubber membrane between pavement layers and to incorporate ground tire rubber into the asphalt mix to meet its new standards. FDOT did not rebid the project and paid the contractor an additional $854,000 or nearly 40% of the original contract award of $2.1 million, to make these changes.

FDOT managers said they try to balance the benefits and costs of changing specifications during construction. For example, they indicated that including ground tire rubber in pavement was estimated to increase the life of a road by 20% to 25%. They believed the additional supplemental cost and time disruption was worth making these changes. An FDOT manager stated that the Department typically notifies districts in advance of specification changes to enable them to incorporate the change in future design plans. However, districts reportedly do not always update their design plans in a timely manner. As a result, these changes are made during construction.

Weather Damages Can Increase Project Costs

Damages During Construction. The fifth factor we identified that contributes to cost overruns is damage to construction sites that occurs due to extreme weather, such as hurricanes and tropical storms. The high winds and water associated with these storms can damage materials and erode work at construction sites. These problems are generally beyond FDOT's control and the Department pays the costs to repair these damages.

About 2% ($1.8 of $104 million) of the cost overruns in the projects we reviewed were due to weather damages; these problems affected seven projects in our sample. For example:

- In a road widening and resurfacing project, excessive rain washed out shoulder work completed by the contractor. The Department paid the contractor approximately $371,000 for additional excavation material. FDOT determined that the weather effects were beyond any reasonable measures the contractor could have taken to avoid this problem.

Factors Accounting for Time Overruns

The projects in our sample were initially scheduled to be completed in a total of 42,799 work days. [9] However, contractors were allowed an additional 18,259 work days to complete work on these projects, a 43% time overrun. [10] We reviewed 448 supplemental agreements to identify causes for approximately 60% of these delays resulting from increased work requirements. These delays were due to problems with project scope, design plans, and coordination that affected the time required to complete projects as well as project costs.

Most Delays Caused by Need to Do Extra Work

Exhibit 10 shows that over 37% of these delays (6,708 days) were attributable to design errors and omissions, while coordination problems accounted for 14% of the delays.

Exhibit 10: Causes for Delays Resulting From Increased Work Requirements in Sample Projects

Problem Area	Delay in Days	Percent of Total
Design Plan Errors and Omissions	6,708	37%
Coordination Problems	2,536	14%
Scope Problems	1,028	6%
Specification Changes	265	1%
Weather Damages during Construction	241	1%
Not Analyzed [1]	7,481	41%
Total	18,259	100%

[1] These time delays were not reviewed to determine causes for delay.

Source: Office of Program Policy Analysis and Government Accountability analysis of sample cases.

[9] The 42,799 work days represents the original contract days for the 130 contracts we reviewed that included information on time overruns.

[10] In addition to the delays caused by additional work requirements, FDOT extended the project periods by a total of 9,982 days for various reasons that were outside the contractors' control. These included special events such as parades that caused the contractors to suspend work to avoid creating hazardous traveling conditions; changes in design plans that require contractors to stop work until projects were re-designed; and allowances for contractor staff vacations. Also, FDOT extended project periods by 4,933 days due to weather conditions. FDOT grants these "weather days" when contractors are prevented from working productively on priority tasks, or if they have to repair previously completed work that is damaged by weather (e.g., an embankment erodes during a storm).

Examples of these problems included:

- In one project, the original contract provided 150 days to rehabilitate a draw bridge. However, once work had begun, it was determined that the initial field investigations had underestimated the amount of repairs that needed to be done. FDOT extended the contract an additional 627 days (a 418% increase) by supplemental agreement for this additional work; and

- In another project, the original contract provided 160 days to resurface a road. However, due to a design error the contractor had to do additional shoulder work and replace substandard asphalt material. FDOT granted the contractor an additional 232 days (145% increase, 54 days to get the remedial work done and 178 days to obtain new signs) for this work.

In summary, cost overruns and delays in completing transportation projects are attributable to several factors. Question 3 discusses steps the Department could take to address these problems.

Question 3

What additional actions could the Florida Department of Transportation take to minimize construction cost overruns and delays?

As discussed in Questions 1 and 2, there are complex and interrelated reasons for cost overruns and delays in FDOT transportation construction projects. Because many factors contribute to delays and cost overruns, there is no simple solution to these problems. Some of these factors are largely outside FDOT's control and may have to be accepted as part of the transportation construction process. However, other factors are within the Department's control and are in part attributable to the increased volume of construction projects FDOT is managing each year and the emphasis it has placed on meeting production schedules which can shortcut the review process.

FDOT Taking Actions to Address Some Problems

FDOT is taking some steps to address cost overruns and delays. For example, several districts are expanding their reviews of design plans to try to identify and resolve errors and omissions prior to bid letting. These actions include hiring staff to perform "constructability reviews" that examine whether projects can be readily built as designed, and involving construction staff in the early stages of project development. FDOT has also increased its efforts to identify underground utilities that would be affected by projects. This should help to avoid some cost overruns and delays that occur when contractors must halt work because they encounter a utility line that must be moved before construction can proceed. Additionally, FDOT is providing training to its staff in contract management and is offering training sessions to design consultants to help familiarize them with Florida's transportation construction standards.

FDOT is also drafting specifications and procedures for innovative contracting procedures such as design/build contracts, lane rentals, and warranties. These options may help to control project overruns. The advantages and disadvantages of these options are discussed in Appendix B.

Conclusions and Recommendations

The impact of these efforts may not be known for several years, as projects take several years to proceed through the planning and construction cycle. However, we believe that FDOT could take additional steps to help minimize cost overruns and project delays in transportation construction projects. Specifically, we recommend that the Department:

- Assess when it would be cost-effective to conduct additional preliminary research to better identify site conditions before design plans are developed. In the past, particularly for bridge rehabilitation projects, FDOT has experienced significant cost increases and delays when contractors have had to stop work because site conditions were significantly different than those assumed by design plans;

- Improve the quality of project design plans reviews to resolve errors and omissions prior to letting contracts for bid. Specifically, FDOT should strategically focus

its review efforts on the types of projects—new construction or reconstruction projects—and areas of design plans—earthwork and drainage—that have been particularly problematic in the past. The Department should examine the results of the "constructability" reviews being conducted by the districts and identify the best practices that should be implemented statewide;

- Carefully review design plans that it adopts that have been developed by other entities such as local governments or transportation authorities. In the past, many of these projects, which have not been subjected to FDOT's normal plan development process, have experienced significant cost increases and delays due to design errors and omissions;

- Increase its efforts to coordinate projects with local governments, other state agencies, and utility companies to avoid construction conflicts. In the past, FDOT has experienced significant cost increases and delays when these entities failed to move utility lines as required, established new project requirements, or changed permit conditions after design plans were completed and construction had begun. FDOT should consider pursuing recovery of its increased costs from these entities where it can be shown that the Department gave ample notice of its construction plans but these other entities did not meet their statutory responsibilities to avoid construction conflicts;

- Develop formal goals for minimizing cost overruns and delays in transportation construction projects, and monitor district performance in these areas. This will help to balance the current emphasis that FDOT is placing on meeting production schedules and help ensure that districts do not shortcut project development and review activities to meet production goals; and

- Continue developing specifications for using design/build contracts, lane rentals, and construction

warranties in transportation construction projects. FDOT should experiment with these contracting options to gauge their effectiveness in minimizing cost overruns and expediting project completion.

We also recommend that the Legislature:

- Amend Ch. 337, F.S., to expand FDOT's authority to use design/build contracting. At present, the Department's authority is limited to major bridges, rail corridor projects, or buildings. FDOT should be authorized to use design/build contracting whenever it determines that this process could save time or money in constructing transportation projects;

- Amend Ch. 337, F.S., to authorize FDOT to award transportation construction contracts based on both cost and construction time. This "A + B" bid method has been shown to reduce construction time in other states. FDOT should work with the construction industry to develop the criteria to be used in the selection process; and

- Authorize FDOT to use a percentage of its appropriations to experiment with other innovative contracting methods. These methods should focus on obtaining the "best" value for the public. The Department should be required to report the results of these experiments to the Legislature.

List of Appendices

Appendices

Appendix A
Detailed Audit Methodology

To gain a general understanding of the methods FDOT uses to manage transportation construction projects, we interviewed FDOT Central Office and district managers, examined FDOT policy and procedure manuals, and reviewed prior studies conducted by the FDOT Inspector General, the Florida Legislature, the Florida Transportation Commission, and the Office of the Auditor General. We also visited five FDOT districts to interview District Secretaries and staff regarding the procedures used to manage transportation construction projects. [11]

To identify factors that contribute to cost overruns and delays in transportation projects, we reviewed FDOT financial data reported on the Contract Reporting System on all projects that had been let for bid and completed between fiscal years 1980-81 and 1994-95. This enabled us to identify trends in cost overruns and project delays over a 15-year period. Our analysis excluded contracts issued by FDOT's district offices; however, district contracts tend to be small projects under $250,000.

Our analysis was based on the 3,969 construction contracts that were awarded by the FDOT Central Office and accepted as complete between July 1, 1980, and June 30, 1995. We based our analysis on supplemental agreements to these contracts that were recorded in FDOT's Contract Reporting System. This System does not include all contract adjustments made through procedures such as change orders or contractor claim settlements. As a result, the final payment amount on the construction contracts in our sample could have been slightly different than the amounts we analyzed. However, FDOT managers indicated that these adjustments are generally minor and that our analysis covered the bulk of construction contract activity during our review period. [12]

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[11] We visited District 2, Lake City; District 3, Chipley; District 4, Fort Lauderdale; District 5, DeLand; and District 6, Miami.

[12] It should be noted that our analysis used a somewhat different sample of FDOT projects than have other recent studies by the Florida Transportation Commission. Our analysis was based on projects that were accepted as complete during our study period, while the Commission has reported on projects where fiscal activity was closed; this accounts for the somewhat different cost overrun figures reported by the Commission.

To study this issue in more depth, we selected and analyzed a sample of 132 projects that had been let for bid by the Central Office and completed and accepted by the Department during the July 1, 1993, through March 31, 1995, period. [13] There were 495 projects completed during this period. As our objective was to study reasons why FDOT has experienced cost increases and delays, we selected our sample to include those projects that had the greatest overruns in each of FDOT's eight districts. It should be noted that our sample was not intended to be representative of all FDOT construction projects; rather, it was intended to study reasons why many—but not all—transportation construction projects experience cost and time overruns. The projects in our sample generally were the larger projects completed during the July 1, 1993, through March 31, 1995, period. Our sample projects accounted for approximately half the total dollar value of the 495 contracts ($674 million of $1.4 billion), and approximately 61% of the total cost overruns ($112 million of $184 million). The sample also accounted for 40% of the total original contract time (43,567 days of 110,260 days); and approximately 39% of the total time delays (32,583 days of 84,258 days). As shown in Table A-1, our sample included a minimum of 12 projects from each district.

Table A-1: Contracts Selected for Cost and Time Overruns

District	Number of Contracts Reviewed
1	14
2	19
3	17
4	19
5	22
6	12
7	15
Turnpike	14
Total	**132**

Source: Office of Program Policy Analysis and Government Accountability summary of FDOT's Contract Reporting System.

[13] Both the FDOT Central Office and its districts award construction contracts. Typically, the Central Office awards larger contracts (those with budgets of at least $1 million) while the districts award smaller contracts (typically less than $250,000). FDOT managers reported that Central Office contracts represent most of the dollar value of construction contracts awarded by Department.

To conduct our file review, we worked with FDOT Central Office staff to examine project files. In this review, we, together with FDOT staff from the Construction and Roadway and Structures Design Offices examined project documents and identified factors that caused delays and cost increases. We focused our review on 448 supplemental agreements to these contracts that had a cost impact of $40,000 or more. These supplemental agreements accounted for 93% ($104 million) of the total cost overruns in the sample projects. We also obtained information from the relevant district offices to obtain their perspectives on why these projects had experienced problems. This technique allowed us to obtain input from various FDOT units on why cost increases and delays had occurred in the sample projects.

To identify alternative contracting practices that could help to avoid cost overruns and project delays, we reviewed literature, contacted ten other states, and obtained information from the Federal Highway Administration. [14] We discussed these alternatives with FDOT managers to identify the potential advantages and disadvantages of using these contracting methods in Florida.

[14] The ten states we contacted were California, Georgia, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oregon, Texas, and Washington.

Appendix B
Analysis of Alternate Contracting Methods

As a part of our review, we reviewed literature and contacted other states to identify alternative contracting methods that could help to minimize cost overruns and project delays. [15] We identified four contracting practices that may be feasible in Florida:

- **Design/Build**. A single contractor is responsible for both design and construction of transportation projects, thus making the contractor responsible for any design errors or omissions;

- **A + B Contracts**. Construction contracts are awarded to the contractor who submits the lowest and best bid for both project cost and the time needed for project completion, thus providing an incentive to both reduce costs and expedite construction;

- **Lane Rental**. Contractors are charged a daily fee for closing traffic lanes during construction, thus providing an incentive to minimize disruptions to the public; and

- **Warranties**. Contractors and designers guarantee that a project will perform as expected over a certain number of years.

We analyzed these alternatives and discussed them with FDOT managers to identify their advantages and disadvantages and suitability for use in Florida.

Design/Build

Under this option, FDOT would identify the scope and requirements of transportation projects, establish minimum design standards, and acquire any needed right-of-way. However, FDOT would no longer be responsible for developing engineering design plans for these projects. Instead, contractors would submit proposals to both design

[15] The ten states we contacted were California, Georgia, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oregon, Texas, and Washington.

and build projects. FDOT would evaluate these proposals and award the contract based on a formula that considered design quality, timeliness, management capability, and cost.

This process is intended to expand contractor's freedom to innovate and to finish a high-quality product at a lower cost. At least two states have used this procedure for some transportation projects (California, and Georgia), and two states plan to use it (New Jersey and Michigan). FDOT has also experimented with the design/build concept. FDOT awarded at least 11 design/build contracts for 7 roadway, 2 bridge, and 2 office building projects. Although a study showed there were no documented cost savings generated from these projects, they did produce time savings as well as a significant reduction in after-bid changes to the contract. [16] FDOT managers agreed that design/build contracts should be used for more projects. However, the Florida Transportation Builder's Association, Inc., believes that design/build is not a good contracting method for all projects because the projects would not necessarily be awarded to the low bidder.

There are several potential advantages of using the design/build concept:

- **Clarified Accountability**. In the present system, FDOT is responsible for developing design plans and is generally responsible for any cost increases and delays attributable to design errors and omissions. Under design/build, the contractor is responsible for both project design and construction and would be accountable for any cost increases due to design problems. This would provide contractors with an incentive to closely review plans and to identify and resolve design problems before construction begins.

- **Time Savings**. Design/build projects may be completed faster than traditional construction projects because contractors can perform some design and construction activities simultaneously. For example, a

[16] Evaluation of the FDOT Design/Build Program, Department of Civil Engineering, College of Engineering, University of Florida, August 1991.

contractor could procure materials and begin site preparation work at the same time as finalizing design blueprints.

- **Lower Costs**. When design and construction personnel work as a team during the design process, innovative materials and methods can more readily be used and evaluated. Also, FDOT could reduce its overhead costs, as it would no longer have to support design plan development, materials testing, and construction supervision activities. Under design/build, many of these functions would be shifted to contractors. In fiscal year 1994-95 FDOT spent about $550 million for preliminary engineering, material testing, and engineering inspection activities. While FDOT would still have project oversight responsibilities, its overhead costs could be reduced.

Two potential drawbacks of this option also need to be considered:

- **Increased Contract Costs**. Under design/build, contractors would be responsible for additional tasks that are currently performed by FDOT. This includes developing engineering data and design plans and obtaining necessary permits from local governments and state agencies. These costs would need to be built into contract prices. Also, contractors may increase their prices to compensate for the higher risks they would bear for design errors.

- **Reduced Competition**. This option could reduce the number of companies that bid on contracts. Construction contractors would need to have the resources needed to perform both design and construction work. This could limit the ability of small and minority-owned businesses to compete for FDOT contracts.

A + B Contracts

Under this option, construction contractors would submit bids that specify both proposed cost and the time required to complete transportation projects. FDOT would evaluate

the proposals using a formula that considered both bid price and the calculated cost of project time to road users (e.g., the value of time lost to motorists due to construction traffic delays). FDOT would award the contract to the contractor with the lowest overall cost. Contractors would receive a bonus if they completed the project ahead of schedule, and would pay a penalty if project completion was delayed. At least eight other states (California, Georgia, Maryland, North Carolina, Texas, Michigan, Washington, and New Jersey) have used A + B bidding. The FDOT has not awarded any contracts based on time. However, in at least one contract we reviewed the Department successfully used supplemental agreements to induce the contractor to complete ahead of schedule.

Potential advantages of this contracting option include:

- **Faster Project Completion**. Because contractors may be rewarded for expediting construction and are penalized for delays, projects may be completed in less time than in traditional contracting. This can be important in emergency situations. For example, California used A + B contracts to repair damage after the 1994 earthquake, and subsequently awarded $24 million in bonuses when contractors finished work on reconstruction of its transportation system. [17]

- **Reduced Impact On Road Users**. The inclusion of incentive and disincentive provisions in contracts encourages contractors to finish work quickly so that traffic can resume its normal flow.

There are potential drawbacks to this option:

- **Increased Costs**. As contractors can earn incentives by expediting transportation projects, construction costs may be higher. Also, FDOT may need to perform more inspection services to ensure that expedited projects meet quality standards. Texas explored but did not adopt the A + B contracting

[17] Leigh Stoner, "Managing The Work," Governing, July 1995, p. 71.

method due to the higher costs and because it did not have the personnel to provide the increased inspection services necessary. [18] A North Carolina official also noted that the method may encourage contractors to take short cuts that reduce construction quality.

- **Reduced Competition**. A + B contracts may limit competition because smaller and minority firms may not have the capability to expedite construction, and may not be able to afford the penalties that would be imposed if they miss completion deadlines.

Lane Rental

Lane rental is a variation of the A + B option in which contractors are charged a specified amount for each day that they block traffic lanes during construction. This rental fee is based on the number and type of lanes closed and the estimated cost of delays and inconvenience to road users. Contractors can also receive a bonus of the "saved" lane rentals if they complete projects early. At least three states have used the lane rental concept, including Washington, Oregon, and Texas. FDOT has not used lane rentals in the past, but Department managers said that they were developing specifications to use this technique in future projects.

The potential advantages of this option are similar to those of the A + B alternative:

- **Faster Project Completion**. Contractors have an incentive to expedite projects to minimize lane rental fees and to receive bonuses for faster project completion.

- **Reduced Impacts on Road Users**. Contractors would be encouraged to schedule their work in a manner that minimizes traffic impacts to the public. FDOT managers indicated that this approach could be useful for projects in major urban areas that already have traffic congestion problems.

[18] Ibid., p. 72.

- **Encourages Efficient Construction**. This method encourages contractors to use efficient construction and engineering management practices to keep their projects on schedule.

Potential disadvantages to this option are also similar to the A + B option:

- **Increased Costs**. FDOT may pay a premium for projects under this option as contractors may receive bonuses if they minimize traffic lane closures.

- **Financial Risks to Contractors**. Contractors could face sizable penalties if they do not meet project schedules and must pay extended lane rentals. This could pose a financial burden to some contractors, particularly smaller and minority firms that have limited capital, and limit competition for these contracts.

Warranties

Under this option, construction contractors and/or designers would provide guarantees that transportation project will perform as expected over a given number of years. Thus, if a roadway is designed to last for 15 years but lasts only 10 years before FDOT must make significant repairs the Department could recover these costs from the designer or contractor. This concept is supported by the Federal Highway Administration. At least four states (Michigan, Washington, New Jersey, and California) have used this alternative, typically for projects such as bridge painting and pavement rehabilitation. FDOT managers told us that while the Department has not used warranties in the past, it was developing specifications to use this technique in future transportation projects.

This option has several potential advantages:

- **Encourages High Quality Products**. Transportation designers and contractors would have an incentive to produce high-quality products to avoid warranty claims.

- **Reduced State Risk**. The state could pursue recovery of repair costs if projects were poorly designed or built.

Potential disadvantages include:

- **Increased Litigation**. Warranty claims would likely be disputed by designers and contractors, resulting in more litigation. This could harm the generally supportive relationships that FDOT currently has with the construction industry.

- **Enforcement Difficulties**. It could be difficult to enforce warranties. Projects are designed for specified transportation conditions such as traffic loads. If FDOT, the Legislature, or the Federal government subsequently changed these conditions in a way that increased pavement stress (such as by approving higher truck weights) maintenance costs could rise for reasons beyond the control of the project designer or contractor. This would likely violate warranty conditions and preclude recovery of these costs.

- **Reduced Competition**. Small or minority contractors could be eliminated from the bidding process because of the difficulty in acquiring bonds needed to pay future warranty claims.

Table B-1 summarizes the potential advantages and disadvantages of the four contracting alternatives.

Table B-1: Summary of Advantages and Disadvantages of Alternative Contracting Methods

Contracting Methods	Advantages	Disadvantages
Design/Build	■ Accountability for design errors clarified ■ Faster project completion ■ Reduced administrative costs	■ Increased contract costs ■ Could reduced competition
A + B Contracts	■ Faster project completion ■ Reduced impact on road users	■ Increased costs ■ Could reduce competition
Lane Rental	■ Faster project completion ■ Reduced impact on road users ■ Encourages efficient construction	■ Increased costs ■ Increased risks for contractors could reduce competition
Warranties	■ Encourages high product quality ■ Reduced state risk	■ Increased litigation ■ Could limit competition ■ Could be difficult to enforce

Source: Office of Program Policy Analysis and Government Accountability.

FDOT managers we interviewed believed that these contracting options would be feasible to use for Florida transportation projects.

Appendix C
Summary of Cost Overruns and Delays

As part of our review we analyzed construction cost overruns for each of the 15 fiscal years (1980-81 through 1994-95). Table C-1 is a schedule of the cost overruns per fiscal year.

Table C-1: Cost Overruns for Fiscal Years 1980-81 Through 1994-95

Fiscal Year	Number of Contracts	Original Contract	Supplemental Agreement Amount	Percent Overrun	Average Cost Overrun Per Contract
1980-81	57	$ 8,011,648.39	$ 64,575.75	0.81%	$ 1,132.91
1981-82	146	65,891,164.90	976,794.66	1.48%	6,690.37
1982-83	318	228,232,586.00	3,975,653.41	1.74%	12,502.05
1983-84	279	297,972,036.00	3,851,170.27	1.29%	13,803.48
1984-85	343	333,062,132.00	6,035,453.54	1.81%	17,596.07
1985-86	366	379,573,656.00	17,409,953.20	4.59%	47,568.18
1986-87	364	528,938,962.00	47,266,348.80	8.94%	129,852.61
1987-88	357	530,548,725.00	42,206,589.20	7.96%	118,225.74
1988-89	299	467,982,947.00	35,160,916.00	7.51%	117,595.04
1989-90	193	640,345,550.00	62,708,032.00	9.79%	324,912.08
1990-91	236	799,082,615.00	120,277,790.00	15.05%	509,651.65
1991-92	226	521,234,704.00	44,439,193.80	8.53%	196,633.60
1992-93	241	500,574,616.00	43,907,320.20	8.77%	182,188.05
1993-94	263	694,140,527.00	74,866,796.00	10.79%	284,664.62
1994-95	281	840,008,201.00	126,789,634.00	15.09%	451,208.66

Source: Florida Department of Transportation, Contract Reporting System.

In addition, we analyzed delays for fiscal years 1991-92 through 1994-95. Table C-2 is a schedule of the delays per fiscal year.

Table C-2: Delays for Fiscal Year 1991-92 Through 1994-95

Fiscal Year	Number of Contracts	Original Days	Additional Work Days	Percent Overrun	Average Days Overrun Per Contract
1991-92	226	42,785	9,500	22.20%	42
1992-93	241	49,858	10,322	20.70%	43
1993-94	263	57,306	16,462	28.73%	63
1994-95	281	65,198	20,833	31.95%	74

Source: Florida Department of Transportation, Contract Reporting System.

Appendix D
Response From the
Florida Department of Transportation

In accordance with the provisions of s. 11.45(7)(d), F.S., a list of preliminary and tentative review findings was submitted to the Secretary of the Florida Department of Transportation for his review and response.

The Secretary's written response is reprinted herein beginning on page 43.

Florida Department of Transportation

January 4, 1996

Mr. Jim Carpenter, Interim Director
Office of Program Policy Analysis
and Government Accountability
111 West Madison Street, Room 312
Tallahassee, Florida 32302

Dear Mr. Carpenter:

We are pleased to respond to the preliminary and tentative findings and recommendations concerning the review of Construction Cost Overruns and Delays. In accordance with section 11.45(7)(d), Florida Statutes, our response to the preliminary report is attached.

We agree with the findings identified by this review and will implement the recommendations made to reduce our costs in time and money.

We appreciate the efforts of you and your staff in assisting to improve our operations. If you have any questions please contact Cecil Bragg, our Inspector General, at 488-2501.

Sincerely,

Ben G. Watts, P. E.
Secretary

BGW/nm

Attachment

FLORIDA DEPARTMENT OF TRANSPORTATION

Response to the Office of Program Policy Analysis
and Government Accountability's
Preliminary and Tentative Findings

Review of Construction Cost Overruns and Delays

Question 1:

How prevalent are cost overruns and delays in Florida Department of Transportation construction projects?

Finding:

We found that completing transportation projects on time and within budget has been a chronic problem for FDOT. Specifically:

o Cost overruns have increased over the past 15 years. Transportation projects completed during fiscal year 1994-95 experienced cost overruns that averaged 15 % of the projects' initial budget; and

o Project delays have also been a problem for FDOT. Transportation projects completed during fiscal year 1994-95 were approximately 32% over the original contract schedules.

FDOT Response:

The Department agrees cost and time overruns have been increasing since the mid-eighties. We have been monitoring our projects for several years and have taken several steps to evaluate the increases and make specification and procedure changes that should reduce the overruns in time and money. We are continuing to work to reduce the overruns.

Question 2:

What factors contribute to cost overruns and delays in Florida Department of Transportation construction projects?

Finding:

Cost overruns in the projects we examined were, generally attributable to five factors:

o Errors and omissions in design plans;

o Inadequate coordination with local governments and utility companies;

o Problems in identifying the scope of work that needed to be done during project development;

o Changes in project specifications after design plans had been completed; and

o Damages to construction sites due to extreme weather.

FDOT Response:

The Department agrees that cost overruns involve a number of complex factors. Many overruns are due to design errors. To address this FDOT has increased plan constructability reviews and made them mandatory. Plans reviews have been made a part of the design schedule and should reduce the errors. The success of our constructability reviews will be monitored in future years as these projects are built. It should be noted that because of the long lead time required to develop plans and the changing conditions along our existing roadways, total elimination of this problem is not possible. FDOT has implemented a construction "partnering" program to address, among other things, improved coordination with local governments and utility authorities. Legislation proposed by FDOT to reduce utility conflicts is currently being considered by the House Transportation Committee.

Question 3:

What additional actions could the Florida Department of Transportation take to minimize construction cost overruns and delays?

Finding:

We believe that FDOT could take additional steps to help minimize cost overruns and project delays in transportation construction projects. Specifically, we recommend that the Department

Recommendation:

Assess when it would be cost-effective to conduct additional preliminary research to better identify site conditions before design plans are developed. In the past, particularly for bridge rehabilitation projects, FDOT has experienced significant cost --increases and delays when contractors have had to stop work because site conditions were significantly different than those assumed by design plans.

FDOT Response:

The level of preliminary engineering warranted must be considered on a project by project basis. The Department, in its Plans Preparation Manual, stresses that all projects should be reviewed by a team of experts from the various offices with interest in the project. Typically the team will include expertise in environmental issues, drainage, structures, utilities, traffic operations, property appraisal, surveying, construction, maintenance, and project management. The team performs as much preliminary investigation work as determined cost effective to identify the scope and intent of Work. The Plans Preparation Manual requires a "must" on-site review for all projects and two such visits for complex projects. FDOT is placing increased emphasis on geo-technical investigations and utility location.

Recommendation:

Increase its review of project design plans to identify and resolve errors and omissions prior to letting projects for bid. FDOT should concentrate its reviews on those areas of design plans--earthwork and drainage--that have been problematic in the past. The Department should examine the results of the "constructability" reviews being conducted by districts to determine if this process should be implemented statewide.

FDOT Response:

As noted above, plans reviews are required statewide. To help improve the quality of project design plans, the Department is looking at methods to improve constructability and biddability reviews. Plan reviews are presently established in the design schedule and we expect to see improvements in this area in the near future. The Secretary has directed the districts to submit plans to improve the process in their respective areas. The plans, due in January, will be evaluated and improvements replicated for statewide benefit. The projects reviewed in this report did not have a constructability review because such reviews have been included in the Department’s procedures for only the last couple of years.

Recommendation:

Carefully review design plans that it adopts that have been developed by other entities such as local governments or transportation authorities. In the past, many of these projects, which have not been subjected to FDOT,’s normal plan development process, have experienced significant cost increases and delays due to design errors and omissions.

FDOT Response:

Plans developed by others, to be utilized by FDOT, should be reviewed as they are being developed. If FDOT is to be responsible for contract/project management of their work, outside entities should involve FDOT early in the planning and design of a project. Such arrangements would help ensure that plans for which FDOT is to become responsible are designed to FDOT standards, specifications and quality control processes. The FDOT will modify its procedures and specifications to provide that such coordination is made a condition

of future projects of this nature. Where this has not occurred, plans from outside entities may still be used after a detailed review for conformance to FDOT requirements.

Recommendation:

Increase its efforts to coordinate projects with local governments, other state agencies, and utility companies to avoid construction conflicts. In the past, FDOT has experienced significant cost increases and delays when these entities failed to move utility lines as required, established new project requirements or permit conditions after design plans were completed and construction had begun. FDOT should consider pursuing recovery of its increased costs from these entities where it can be shown that the Department gave ample notice of its construction plans but these other entities did not meet their statutory responsibilities to avoid construction conflicts.

FDOT Response:

The FDOT's planning and project development efforts include outside entities and others in the vicinity of a specific FDOT project. They are made aware of these projects through public meetings, work program presentations, utility liaison efforts, permitting contacts and by other means. The "partnering" process also addresses potential conflicts and changed conditions. As this process continues to evolve a reduction in conflicts and delays is expected. The FDOT fully supports the report's recommendation that when local entities delay a project because of utility conflicts, permitting problems, or right-of-way efforts, they should be held accountable for any resulting increase in project costs. It is FDOT policy to pursue recovery of these costs where responsibility is clear cut and it is cost effective to do so.

Recommendation:

Develop formal goals for minimizing cost overruns and delays in transportation construction projects, and monitor district performance in these areas. This will help to balance the current emphasis that FDOT is placing on meeting production schedules and help ensure that districts do not shortcut project development and review activities to meet production goals.

FDOT Response:

There is no "industry standard" or other basis for setting specific goals for cost increases or time extensions. In the absence of such standards, the Department's Executive Committee monitors trends in these areas. The current upward trend has been identified as a serious problem and priority given to reversing the trend. Construction contract condition is reviewed by the Executive Committee at each monthly Production Management Meeting. The Transportation Commission also reviews and reports on construction contract performance during its quarterly and annual reviews. No issue in FDOT is receiving greater scrutiny. While specific goals have not been established a comprehensive effort to reduce cost increases

and time extensions is underway. Enhancements in process, plans and project oversight will be monitored against construction performance as part of a continuing improvement process.

Recommendation:

Continue developing specifications for using design/build contracts, lane rentals, and construction warranties in transportation construction projects. FDOT should experiment with these contracting options to gauge their effectiveness in minimizing cost overruns and expediting project completion.

FDOT Response:

The FDOT agrees and is currently working to implement each of these measures as well as many others.

OPPAGA also recommended that the Legislature:

Recommendation:

Amend Ch. 337, F.S., to expand FDOT's authority to use design/build contracting. At present, the Department's authority is limited to major bridges, rail corridor projects, or buildings. FDOT should be authorized to use design/build contracting whenever it determines that this process could save time and money in constructing transportation projects.

FDOT Response:

The Department supports the design/build concept as an appropriate tool to be used in selected projects. It may be appropriate to gain experience with the current level of authority before expanding to other types of projects.

Recommendation:

Amend Ch. 337, F.S., to authorize FDOT to award transportation construction contracts based on both cost and construction time. This "A + B" bid method has been shown to reduce construction time in other states. FDOT should work with the construction industry to develop the criteria to be used in the selection process.

FDOT Response:

Agree. The Department is currently working with the House Transportation Committee and the construction industry to provide this authority.

Recommendation:

Authorize FDOT to use a percentage of its appropriations to experiment with other innovative contracting methods. The Department should be required to report the results of these experiments to the Legislature.

FDOT Response:

Agree. Adoption of this proposal will enhance the ability of the FDOT to work with contractors to encourage their sharing of successful construction practices with the Department. The Department is working with the House Transportation Committee and the construction industry to develop needed legislation.

General FDOT Response:

The Department has been working to control project costs and time, especially as our workload has significantly increased. The Department will utilize this report to evaluate its actions and decisions as we strive to reduce costs in time and money while constructing a project that will give maximum service to the traveling public. We appreciate the recommendations to the Legislature that will expand our authority to use innovative methods in awarding and administering our projects.

We also appreciate the cooperative spirit shown by the OPPAGA staff during the review. They are to be complimented on handling a difficult subject well.