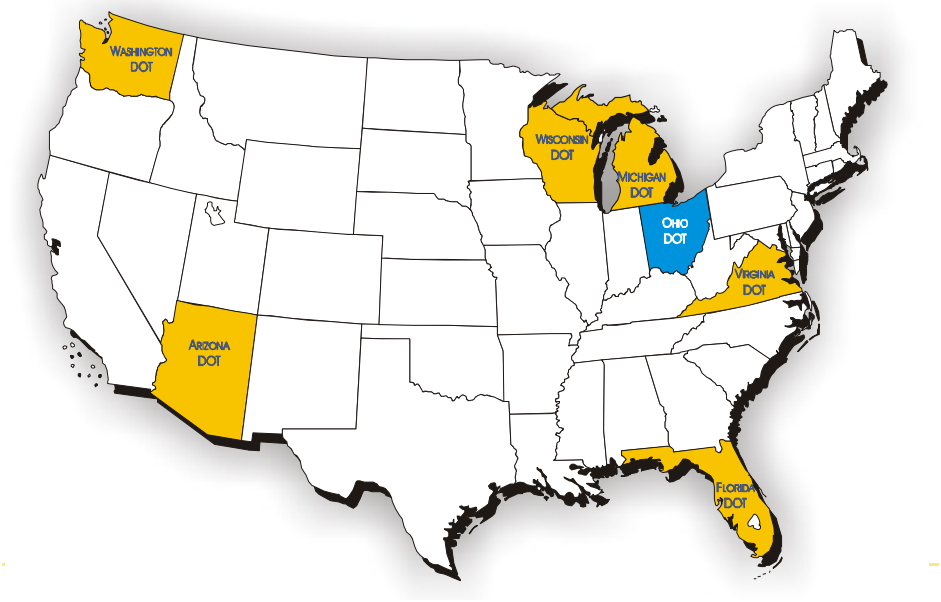
Final Report

Six-State Survey of Construction Administration Practices and Procedures



Commissioned By:

Ohio Department of Transportation
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Compiled By:

Ohio Department of Transportation and
Trauner Consulting Services, Inc.

Dedication to DON R. CONAWAY

This report is dedicated to the loving memory of our co-worker, mentor and friend Don R. Conaway, former Deputy Director of Construction Management at ODOT. His remembered wit makes us smile, his wisdom still guides us, and his presence can be found on each page. While we are diminished by his passing, we are forever grateful that we had the good fortunate to know this wonderful man and experience his many gifts. He is missed by all. We trust that this report, born from an idea long ago, helps our agency become a reflection of Don's competence and grace. He led us well.

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List of Acronyms and Abbreviations Used in this Report

ADOT Arizona Department of Transportation

ADR Alternate Dispute Resolution

ARBA Arizona Road Builders Association

ATI Arizona Technical Institute

ATMS Automated Training Management System

ATSSA American Traffic Safety Services Association

BAM Bid Average Method

CE Construction Engineering and Inspection

CMS Construction Management System

CPAM Construction Project Administration Manual

CPM Critical Path Method

CQC Contractor Quality Control

CQIP Construction Quality Improvement Program

CRS Construction Reporting System

CTQP Construction Training Qualification Program

D-B Design-Build

DCE District Construction Engineer

DFEO District Final Estimate Office

DRB Dispute Review Board

EBS Electronic Bidding Software

FAST Field Office Automation System

FDOT Florida Department of Transportation

FOOH Field Office Overhead

FOSSC Field Operations Support Service Central

FTBA Florida Transportation Builder's Association

FTE Full-Time Equivalents

HOOH Home Office Overhead

HTCP Highway Technician Certification Program

I/D Incentive/Disincentive

ITS Intelligent Transportation Systems

MDOT Michigan Department of Transportation

MOT Maintenance of Traffic

MRBA Michigan Road Builder's Association

NCHRP National Cooperative Highway Research Programs

NHI National Highway Institute

OCA Ohio Contractors Association

ODOT Ohio Department of Transportation

OSC Olympia Service Center

PE Project Engineer

PEP Partnering Evaluation Program

PS&E Plan, Specification, and Estimate

QC Quality Control Programs

QMP Quality Management Program

QPL Qualified Product List

RBC Relationship Bar Chart Schedules

RE Resident Engineer

TCP Traffic Control Plan

TCS Trauner Consulting Services, Inc.

TSCs Transportation Service Centers

VDOT Virginia Department of Transportation

VECP Value Engineering Cost Proposal

VRA Virginia Road Builder's Association

WisDOT Wisconsin Department of Transportation

WFIT Wisconsin Field Information Tracking

WSRBA Washington Road Builder's Association

WSDOT Washington State Department of Transportation

WTBA Wisconsin Transportation Builder's Association

EXECUTIVE SUMMARY

ODOT, like many DOTs across the country, has been downsized, re-engineered, and reorganized in recent years. These changes have occurred during a period when DOTs report that the traveling public has demanded an increased focus on strategies to minimize impacts to highway users during construction. The pace of technological advances in construction methods and materials has been accelerating, and DOT administrators have been charged with doing more with less.

This six-state survey seeks to determine better ways of meeting the challenges presented by this dynamic professional, political, and technological environment. The study concentrates on identifying construction contract administration practices that yield cost-effective ways of designing and building roads safer, better, and faster, with less inconvenience to road users as well as businesses and others who are affected by construction activities.

ODOT, together with FHWA, selected six states that either had similar sized programs or were known to have adopted innovative practices. After meticulously dissecting ODOT's own organization and practices, a comprehensive questionnaire was developed around seventeen aspects of construction contract administration. Administrators in the six selected states were then asked to provide written responses to the questionnaires. After the research team analyzed these responses, the team spent two-and-one-half days in each state interviewing DOT personnel to more fully understand the way they did business. The interviews were carefully designed to elicit all relevant perspectives. In addition to central office personnel, the team interviewed district and project personnel, visited representative project sites, and interviewed representatives of contractors and suppliers in each state. The result of this process is set forth in the Findings section of this report.

Finally, after exhaustive analysis and discussion, the team distilled the multitude of varying practices down to a list of Best Practices. The filters and screens used during this process included: 1) the impact that the practice has on quality, 2) the effectiveness of the practice, 3) how the cost of the practice compared to its benefit, 4) how readily the practice could be implemented, 5) was it a very common practice in the other states, and 6) was the practice truly different, or was it just a minor variation on another practice that was already in use.

The 37 practices that the team identified through this process are described in the Best Practices section of this report. Highlights of that list include:

The 37 practices that the team identified through this process are described in the Best Practices section of this report.

- Development of a core project staff with flexible skills through an expanded training curriculum that focuses on work elements of highway projects, requires certification and re-certification for certain tasks, and is tied to a career ladder.
- Requiring objective contractor evaluations by project engineers.
- Reducing required documentation through simplification of the change order process for minor changes and the use of bidding contingencies.
- Implementing a specification revision process that uses standing committees to cover functional areas, and an Executive Committee for final approval.
- Expanding ODOT's proficiency in and use of CPM schedules for managing projects and analyzing claims.
- Reducing the causes of change orders and claims through constructability reviews, greater emphasis on geotechnical design and subsurface investigations, a contractual provision dealing with the issue of home office overhead, forward pricing of changes (especially time-related changes), partnering, and publication of a claims digest.
- Revamping Maintenance of Traffic practices to enhance safety and sensitivity to the traveling public and others affected by construction.
- Transferring more responsibility for quality to contractors while establishing appropriate quality assurance measures.
- Continuing to use innovative contracting methods that are carefully designed to help meet the goal of finding more cost-effective ways of designing and building roads safer, better, and faster and with less inconvenience to road users as well as businesses and others who are affected by the construction activities.

These practices span the spectrum of implementation difficulty. Some of the practices, such as partnering, quality control/quality assurance changes, development of in-house CPM scheduling expertise, and development of a comprehensive training curriculum, will require adding

These practices span the spectrum of implementation difficulty.

skills not currently found within ODOT or making some fundamental changes in ODOT's mindset and practices. Some other practices, such as implementing a new specification revision process, constructability reviews, and innovative contracting will only require the adoption of practices found elsewhere. Still other practices, such as changes in documentation requirements, the use of contingencies, the encouragement of forward pricing of change orders, and maintenance of traffic changes are best described as minor improvements to ODOT's current practices. Finally, some practices fall into a category of requiring further study.

In summary, the report concludes that the adoption of these best practices will result in time and cost savings, improved quality and safety, and less inconvenience to road users and others affected by construction activities.

INTRODUCTION

Ohio has a very large transportation system for a state its size. According to the United States Department of Transportation, Bureau of Transportation Statistics, Ohio is the 35th largest state geographically, however, it has the 4th largest interstate network, the 10th largest overall highway network, the 5th highest volume of traffic, including truck traffic, and the 2nd largest inventory of bridges. Managing this infrastructure requires not only a dedicated and professional staff within the Department of Transportation, but also the implementation of state-of-the-art practices and procedures.

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In recent years, ODOT, like many other agencies in many other states, has "downsized," "re-engineered," and undergone numerous other substantial staffing, procedural, and organizational changes. In addition, advances in technology, materials, construction means and methods, techniques for selling and scheduling projects, and ways of administering contracts to save time, control costs, and improve quality have all been emerging at a rapid pace. Amid such rapid-paced changes, a basic question emerged among senior managers at ODOT: How does a state Department of Transportation assure itself that it is using the best and most cost-effective contract administration practices? In July 1999, ODOT started formally contemplating this question. This soon led to many other questions:

In recent years, ODOT, like many other agencies in many other states, has "downsized ...

- Is staffing "too fat" or "too thin"?
- Is ODOT allocating its human resources in the most cost effective way?
- Have management and training practices kept up with the times?
- How are states with similar annual budgets organized?
- Do states in ODOT's geographic area manage projects differently?
- Does ODOT resolve problems in a cost-effective way?
- How do contractors feel about the way ODOT does business?
- How do contractors in other states feel about the way their state DOTs do business?
- Does ODOT's organizational structure help do things efficiently, or does it hinder efficiency?
- Does ODOT have enough oversight to ensure quality, or does its oversight function overwhelm productivity?
- Is ODOT spending tax dollars wisely?
- How does ODOT get the answers to these questions?

By October 1999, ODOT decided that it was going to develop a comprehensive scope of work to find answers to these questions. It elected to use the well-respected and recognized technique of benchmarking to obtain the answer to these questions. ODOT retained TCS seeking its specialized experience and background, to assist in this effort.

In this report, ODOT and TCS (The Team) not only explain the methods used to conduct this investigation, but summarize the findings as well.

In this report, ODOT and TCS (The Team) not only explain the methods used to conduct this investigation, but summarize the findings as well. The findings presented herein also set forth recommendations for contract administration procedures and practices that potentially will best serve the industry and the taxpayers of Ohio. The multi-disciplined team from TCS and ODOT worked long hours to complete this study, and strived to be open-minded, thorough, and objective.

METHODOLOGY

Selection of Six States

In an effort to identify best contract administration practices presently being used in the industry, and those most relevant to ODOT's program, ODOT identified six state departments of transportation construction programs to compare to its own. The six state DOTs identified were Arizona (ADOT), Florida (FDOT), Michigan (MDOT), Virginia (VDOT), Washington (WSDOT), and Wisconsin (WisDOT). These states were selected with the assistance of FHWA from across the entire country based upon a combination of the following diverse criteria: size of construction program, geographic size of state, number of highway miles, weather conditions, regional similarities, innovative contracting methods, partnering philosophies, recent re-organization, and variety. The following table summarizes various construction program statistics provided by the states involved in the study.

VARIOUS DEPARTMENT OF TRANSPORTATION STATISTICS FOR YEAR 2000

	ODOT	ADOT	FDOT	MDOT	VDOT	WisDOT	WSDOT
FY 2000 Budget	$2,248,055,200	$1,577,776,900	$4,097,915,942	$2,829,895,700	$3,200,000,000	$2,058,102,000	$3,044,325,513
Lane Miles	48,240	17,397	39,730	27,239		30,783	24,870
Number of Bridges	13,831	4,399	6,251	4,626	11,787	4,858	3,300
Bridge Deck Area	96,353,140	44,340,300	123,193,741	15,088,214		45,236,357	
Total Employees	5,900	2,315	8,854	2,509	10,000	3,928	6,142
Construction Employees	580	620	1,218	647		89	709
Maintenance Employees	3,689	918	2,574	705		250	1,344
Design Employees	847	724	1,300	680		95	1,434
Capital	$1,476,227,163	$1,281,803,300	$2,204,146,674	$1,056,700,581		$531,891,399	$431,200,287
Maintenance	$361,614,800	$83,033,300	$535,996,400	$207,529,815		$88,590,297	$131,939,544
Administration	$125,561,200	$39,849,500	$123,096,173	$30,186,141		$119,350,831	$119,042,720
Construction Engineering	$120,439,800	$148,049,000	$783,624,245	$18,552,734		$97,946,270	$54,018,107
Projects Awarded	664	196	780	776		458	
Total Value of Projects	$1,093,053,337	$476,495,037	$1,244,769,442	$1,106,559,785		$605,033,803	
Consultant Design	49.6%	100% Urban 75% Rural	98%	70%	60%	50%	
Consultant Inspection	3.3%	20%	50%	25%	30%	70%	

Preparation of Questions

Following the project kick-off meeting, the survey was reorganized and expanded to seventeen categories: change orders/claims avoidance/analysis techniques, maintenance of traffic, specifications, project scheduling, inspection, testing, organization and staffing, legal requirements, documentation, partnering, innovative contracting, utilities, quality management, progress payments/finalization, safety, computerization, and construction contract administration training.

ODOT initially developed a survey outlining twelve areas of focus. These were organization, staffing, inspection, claims avoidance/analysis techniques, finalization, project scheduling requirements, legal requirements, documentation, computerization, the specifications updating process, training, and contract innovations. Following the project kick-off meeting, the survey was reorganized and expanded to seventeen categories: change orders/claims avoidance/analysis techniques, maintenance of traffic, specifications, project scheduling, inspection, testing, organization and staffing, legal requirements, documentation, partnering, innovative contracting, utilities, quality management, progress payments/finalization, safety, computerization, and construction contract administration training.

The Team ultimately organized the questions from the seventeen survey categories into matrices. The matrices were set up with the questions listed in one column, and seven columns available to the right for each of the six states and ODOT to record their answers.

Delivery of Questionnaires to the States

Ron Williams addressing Team at the Kick-Off Meeting for the Arizona DOT visit.

Gordon Proctor, ODOT's Director, sent a letter to the Directors of the six states, requesting their participation in the study. Each of the six states responded affirmatively, confirming their interest and participation in the project. Contacts were identified within each state to coordinate the visits. The Team followed up with telephone calls to schedule each visit and to elaborate on the details of the project.

Soon after scheduling the surveys, the seventeen questionnaire matrices were sent out by mail and by e-mail to each of the six states, requesting that responses be provided in advance of the Team visit. Once each state responded to the questionnaires, the matrices were updated with their responses, and the matrices were distributed to the Team members for review and analysis prior to the state visits.

ODOT's Self Analysis—Baseline

To serve as a benchmark when comparing the various programs to its own, ODOT first had to identify its own contract administration procedures. To accomplish this, the seventeen questionnaires were distributed to the appropriate personnel within ODOT's organization.

Using the completed questionnaires, TCS performed an onsite survey of ODOT's program. The agenda for the ODOT visit essentially followed the template defined in TCS's proposal. On the first day, the TCS team split up into three groups and interviewed ODOT Central Office personnel. On the second day, the TCS team visited two construction projects—an urban and a rural job--and on day three contractors, suppliers, and officials from the Ohio Contractors Association (OCA) were interviewed. After completing the visit, ODOT's answers to the seventeen questionnaires were updated, and the questionnaires finalized.

Conduct Site Visit

With the objective of the study to identify best contract administration procedures, it was imperative to obtain the in-depth perspective of personnel at all levels. The best way to achieve this was through on-site interviews with DOT and industry personnel to gain the different perspectives within each state. ODOT identified four groups to be interviewed: central office personnel, district personnel, job site personnel, and contractors. A three-step survey plan was developed to accomplish this.

With the objective of the study to identify best contract administration procedures, it was imperative to obtain the in-depth perspective of personnel at all levels.

On the first day of each state visit, the Team interviewed the central office staff using the survey questionnaires as a template for the interviews. In the evening following the central office interviews, the Team developed selected questions to be asked of the district and job site personnel the following day.

On the first day of each state visit, the Team interviewed the central office staff.

On the second day, the Team split into two groups with one traveling to an urban district and job site, and the other to a rural district and job site. During the morning of day two, interviews of district office personnel were conducted at the district offices using the questions developed the

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night before. In the afternoon, the survey teams conducted interviews of the field staff at their respective job sites.

On the third day of the state visits, the survey team conducted interviews of select contractor personnel and trade association leaders.

On the third day of the state visits, the survey team conducted interviews of select contractor personnel and trade association leaders. A questionnaire, distilled from the survey, was also developed for these interviews with the emphasis on identifying contract administration procedures that each state performed well.

FINDINGS

The Team obtained a tremendous amount of information as it interfaced with the six departments of transportation and contractors associations. This information came in three basic formats: 1) written responses to the questionnaires, 2) notes taken by the Team members during the interviews that were conducted with DOT employees in their central, district, and field offices, and with contractors, and 3) manuals, reports, studies, and other documents obtained during the interviews, that were forwarded to the Team as a follow-up to the meetings.

In the pocket on the back cover of this report is a compact disc containing an electronic version of matrices for each of the state's written responses to the questionnaires. In addition, ten banker's boxes filled with manuals, reports, and other documents that were collected and reviewed by the Team as a part of the follow-up to our meetings are stored at ODOT's central office in Columbus.

This section of the report is a summary of the wide variety of practices and procedures that were encountered by the Team. The findings convey factual information and opinions or impressions derived from the interviews.

The findings are presented under four major headings, each of which contains several subheadings shown below.

In the pocket on the back cover of this report is a compact disc containing an electronic version of matrices for each of the state's written responses to the questionnaires.

Basic Organization and Procedures

Organization and Staffing

General

For the purposes of this report, however, decentralization can be defined as the distribution of authority and operations to the district/regional or local authorities, with central offices serving in an oversight capacity.

All of the DOTs involved in this study, including ODOT, have not been immune to the political pressures to downsize government, and to empower districts and local authorities to control their own projects. In response, all of the states have, or are still in the process of, decentralizing and downsizing their operations. Decentralization is a relative term, and each state has pursued this in its own unique way. For the purposes of this report, however, decentralization can be defined as the distribution of authority and operations to the district/regional or local authorities, with central offices serving in an oversight capacity.

ODOT

Our mission is to provide a world-class transportation system that links Ohio to a global economy while preserving the state's unique character and enhancing its quality of life.

ODOT initiated a reengineering effort in 1995 that resulted in the elimination of six divisions and fifteen offices within the Central Office. ODOT modeled its reorganization in part after FDOT and WisDOT. ODOT's twelve district offices were also reorganized at that time with much internal consolidation. The resulting organizational structure has one district deputy director with four office administrators each responsible for one of the following areas: Planning and Programs, Production (Design), Highway Management (Construction and Maintenance), and Business and Human Resources. The intent of the reengineering effort was to decentralize ODOT operations by shifting more responsibility to the districts. Responsibilities included control over budgets, sole responsibility of plan design and review, increased contract administration, and all highway maintenance.

Decentralization has not occurred without encountering some difficulties. ODOT has monitored these, and repeatedly refined its structure in order to overcome these difficulties. This effort requires constant attention and diligent efforts by its staff.

According to ODOT, decentralization and empowerment of the districts within ODOT has yielded several benefits.

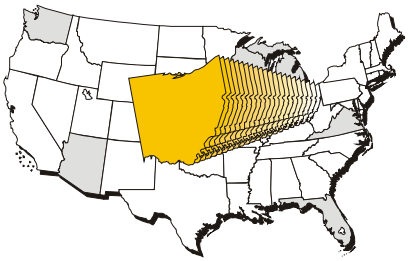
According to ODOT, decentralization and empowerment of the districts within ODOT has yielded several benefits: more innovative solutions, enhanced relationships with local governments, greater responsiveness to individual concerns, a reduction in workforce from 7,800 to 5,900, and $400 million in actual and deferred savings since 1994 that was returned to the capital program for more construction projects. ODOT's operating expenses had been growing at nearly 6% a year from 1984 to 1994. In that eight-year period, operating expenses rose by $150 million. Since that time ODOT has reduced its operating expenses, and held them to a 2% rate of growth.

BASIC ORGANIZATION AND PROCEDURES

Organization and Staffing

The Governor appoints Ohio's Director of Transportation. The Director appoints three assistant directors, each responsible for one of the following areas: 1) Finance, Facilities and Equipment Management, Human Resources, and Information Technology; 2) Planning and Production (Design); and 3) Highway Management (Construction and Maintenance).

Three central office Deputy Directors report to the Assistant Director for Highway Management. Two of these Deputy Directors support construction contract administration. These are the Deputy Director of Construction Management and the Deputy Director of Contract Administration. The Office of GeoTechnical Services, the Office of Construction Administration, and the Office of Materials Management (the Test Lab) report to the Deputy Director of Construction Management. The Office of Estimating and the Office of Contracts report to the Deputy Director of Contract Administration.



These offices move the projects through the bid letting process and provide support to the district construction personnel with policy interpretation, quality assurance reviews, training, and technical and legal advice. There are six technical specialists in the Office of Construction Administration who perform the quality assurance reviews and render technical advice and policy interpretations to the twelve districts.

Within each district, there is a District Construction Engineer (DCE) responsible for the construction program of that particular district. The DCE staffs the projects with Project Inspectors and Project Engineers.

Within each district, there is a District Construction Engineer (DCE) responsible for the construction program of that particular district.

ODOT's Project Inspectors, Series 1 and 2, and Project Supervisor series are non-engineer classifications. The Project Engineer series is officially labeled Transportation Engineer 1 through 5. Many inspectors are "1,000-hour transfers" from Maintenance. ODOT employs very few consultants for testing and inspecting on projects. However, it should be noted that consultants do not supervise construction projects.

Construction staffing levels vary from district to district with project engineers usually managing multiple projects. Each district has a number of project engineers who are responsible for several projects simultaneously.

BASIC ORGANIZATION AND PROCEDURES

Organization and Staffing

ODOT's District Offices also coordinate efforts with maintenance personnel in each county. These maintenance forces are managed by a County Manager who is charged with providing routine maintenance operations on interstate and state highway systems within a particular county. The county manager also participates in project scoping and is involved in the construction project. The County Manager's staff typically includes fifteen to thirty-five highway workers. Some of these highway workers (1000-hour transfers) function as inspectors during the construction season when the workload increases.

Construction projects are initiated in the districts within the Office of Planning and Programming and the Office of Production with limited coordination from the Office of Highway Management (Construction and Maintenance). Nearly 65% of the design work for ODOT's projects is accomplished with private firms. Constructability reviews are sometimes informally performed in the districts. No constructability reviews are performed after the plan package is sent to Central Office for sale.

ODOT has developed and implemented various performance measures, such as quality and timeliness of plan submittals, construction duration, construction engineering costs, a project finalization time frame, and roadway conditions (maintenance and planning areas). The performance measures are used to allocate budgets, direct personnel and equipment resources, hold managers accountable, and identify system needs (i.e., pavements, bridges, etc.). These measures are constantly under review and are subject to modification.

ADOT

ADOT's organization includes a Central Office, ten district offices that primarily perform engineering functions, and 27 construction offices within the districts that manage construction projects. Maintenance offices handle maintenance operations. The Phoenix area is the only location in the state that has a separate construction and maintenance districts.

Basic Organization and Procedures

Organization and Staffing

ADOT does not have responsibility for county or local roads. It will contribute to the upgrade or maintenance of a county or local roadway through local and federal funding when it is mutually beneficial and financially possible.

Engineering Consultants Section (ECS) is dedicated to providing our stakeholders with professional administration of contracts through focus, vision, and total quality management.

This mission requires ECS to provide equitable, efficient, and effective service, aligned with Department goals and objectives in meeting the transportation needs of the State of Arizona.

The Assistant State Engineer of Construction, who is at the same reporting level as the District Engineer, manages the Construction Office in the Central Office.

Districts are charged with initiating, selecting, and scoping projects. Both construction and design personnel are involved in the scoping process. ADOT is exploring ways to implement better communication and coordination between Central Office and the districts when the project is under review by Central Office Planning.

ADOT is developing performance measures for program delivery. Currently, ADOT has two performance measures governing construction administration. These are to remain within the 9% goal of CE cost per project, and to remain within the 5% goal for change order cost per project.

ADOT is developing performance measures for program delivery.

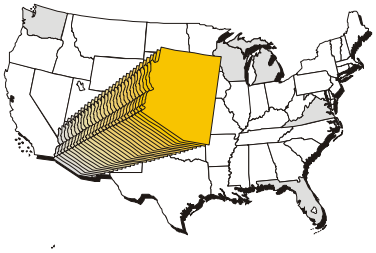
ADOT's Central Office Construction Office reviews and provides oversight of several contract administration functions performed by the districts. These include wage rate compliance, quality reviews, training, value analysis, consultant contract administration, and contractor final payment.

The determination of staffing at the project level involves consideration of ADOT's previous experience and the project's complexity, together with use of the Department's Construction Engineering Manpower Management System. This system provides a computer analysis of the Department's projects, broken down by work items performed, and assists the districts and the twenty-seven construction offices in determining who and how many construction personnel should be assigned to a particular project. Occasionally, this program has led to ADOT moving employees from one area of the state to another. It also helps ADOT identify the need for consultant assistance with inspection and project management.

ADOT's Construction Engineering Manpower Management System provides a computer analysis of the Department's projects, broken down by work items performed, and assists the districts and the twenty-seven construction offices in determining who and how many construction personnel should be assigned to a particular project.

Basic Organization and Procedures

Organization and Staffing



ADOT currently employs construction consultants to perform construction-related activities on approximately 30% of its projects. On the design side, 85% of all preliminary engineering and design work for the Department is accomplished with outside consultants. The authority to retain a construction consultant rests with the District Engineer and the State Construction Engineer. ADOT districts typically use one of three available methods for retaining consultants: 1) rent-a-technician, 2) on-call consultants (for contracts less than $3 million), or 3) full contract administration (for contracts greater than $3 million). These consultant contracts are cost-plus-fixed-fee and are monitored by the district staff. The contractors have not reported any significant problems in working with consultants. Many construction consultants are former ADOT employees who, like their counterparts in other states, have left state service to work in the private sector.

FDOT

FDOT's Central Office is responsible primarily for policy, quality assurance reviews, and training. FDOT was re-organized in the late 1980s and is presently being reshaped again by the Governor's mandate to reduce its staff by 25% over the next five years.

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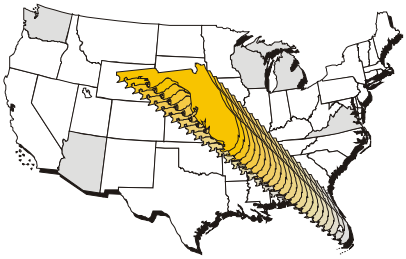
FDOT has ten districts, and within the districts there are multiple Resident Construction Offices and Resident Maintenance Offices. The district offices have primary construction contract administration responsibilities. Specifically, the Resident Construction Offices have oversight of construction activities on state and interstate highways covering multi-county areas. Resident Maintenance Offices have maintenance and operations responsibilities also covering multi-county areas.

Throughout the design phase of a project there is considerable coordination between design and construction.

Throughout the design phase of a project there is considerable coordination between design and construction. During the early scoping and plan development process, Construction provides constructability reviews in the districts or at the Resident Engineer's offices.

The District Construction Engineers along with the Resident Engineers make the project staffing decisions.



FDOT uses performance measures to monitor contract changes and time extensions on construction projects in order to appraise the quality of the plans and the effectiveness of its contract administration. Each district is also responsible for Quality Assurance. These performance measures are used to hold the proper parties accountable, and to take corrective action if necessary.

Currently job classifications for the district and resident engineer's construction staff are changing.

FDOT employs construction consultants on all levels on approximately 50% of its projects to augment the Resident Engineer's staff. The cost of these construction consultants totals about 80% of the project management budget. FDOT anticipates that more downsizing in the near future will cause these percentages to increase further. The districts can employ construction consultants on an as-needed basis. With the exception of minor projects, private consultants design virtually all of FDOT's roadway projects.

> The Department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities.

The Florida Transportation Builders Association (FTBA) reported that typically consultants staff projects with more personnel than does FDOT on its projects. They also indicated that at times, consultants are reluctant to make decisions, without first consulting with FDOT.

MDOT

MDOT has recently reorganized its operations, and has become smaller and more decentralized. MDOT has been given a ceiling of 2,600 full-time positions by the Governor, but only has 2,300 full-time employees at this time. The reorganization consolidated some of MDOT's regions. Region offices previously numbered nine, but there are now seven. Within the various regions, MDOT has set-up 23 Transportation Service Centers (TSCs). MDOT plans to add more TSCs throughout the state.

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Basic Organization and Procedures

Organization and Staffing

Within the various regions, MDOT has set-up 23 Transportation Service Centers (TSCs).

The TSCs are sub-regional offices responsible for providing specialty expertise, and for enhancing local awareness and involvement. The specific responsibilities of a TSC include: issuing permits, designing and delivering projects to Central Office ready for bid, performing roadway maintenance, and administering construction projects. It is noted that a large portion of the roadway maintenance work is subcontracted to the counties.

The coordination between construction and design is accomplished through various meetings in which the prospective construction plans are reviewed and discussed. These so-called "errors and omissions meetings" have resulted in fewer plan errors.

Our commitment to mobility of our customers will carry us into the next century. We aggressively work with our partners in the public and private sectors to address issues of congestion management; balance growth with environmental management; and continue to develop safety features, equipment to smooth pavements that will last longer, reducing motorist inconvenience.

MDOT is currently developing general performance measures that will be implemented soon. Specific contract administration performance measures already in place include: review and evaluation for constructability and accuracy of plans and schedules; resolution of claims at the appropriate level and within established time frames; timely payments to contractors; maintaining acceptable percentages for PE and CE construction contract amounts; all project phases completed, submitted, and constructed on schedule and within budget; and performing comprehensive post-construction reviews on the major projects. These performance measures are used to spot problem areas and direct corrective action. Attention within MDOT is being focused on performance.

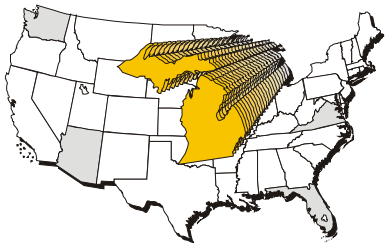
The Central Office's Construction Section has fifty employees who provide technical construction expertise in several areas including concrete, bituminous, grading and drainage, and environmental. Other responsibilities of the Central Office Construction Section include construction information management, training, engineer certification, specifications, the Disadvantaged Business Enterprise program, and consultant construction engineering administration.

MDOT advertises and awards all of its projects during its first and second fiscal quarters, thereby affording the construction staff ample time to determine the staffing needs for the projects sold.

The region determines construction staffing at the project level and at TSCs, based upon the number and type of projects let. MDOT advertises and awards all of its projects during its first and second fiscal quarters, thereby affording the construction staff ample time to determine the staffing needs for the projects sold.

BASIC ORGANIZATION AND PROCEDURES

Organization and Staffing



MDOT contracts out many services that the Department is required to perform such as design, construction engineering, real estate, and environmental reviews. The number of consultants employed varies with the yearly program. On the design side, approximately 65% of the projects are designed by outside consultants. For construction engineering services, including actual project management and inspection, about 2% of construction program dollars expended are spent on consultants. Consultants provide full construction engineering services including project management on only a few of MDOT's projects. MDOT employees in the regions that select the consultants and evaluate them provide oversight of the consultants. Contractors reported that initially consultants were not comfortable making project management decisions. Over time that situation has changed, however, as the consultants have grown more comfortable with their responsibilities. An MDOT employee is responsible for each MDOT construction project.

The Michigan Road Builders Association (MRBA) reported that decentralization has led to inconsistent contract administration practices across the regions and the TSCs. Contractors claim to use bidding factors to account for this inconsistency.

VDOT

VDOT is responsible for virtually all of the lane miles of roadway in the state outside of cities and towns. There is no county or township road structure. The Central Office in Richmond is responsible for establishing policy, providing technical support, and approving all budgets including those at the district and residency offices.

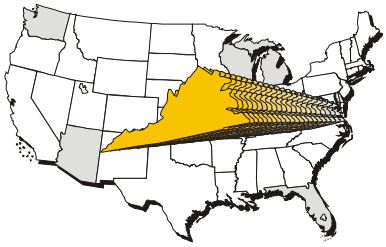
There are nine full-service district offices that perform functions in the area of construction, design, materials testing, traffic, safety, and environmental. Full-time permanent employees range from 900 to 1,600 per district depending on the size of the district.

There are nine full-service district offices that perform functions in the area of construction, design, materials testing, traffic, safety, and environmental.

Within the district structure there are forty-five Residency Engineering Offices located throughout the state. These offices report directly to the

Within the district structure there are forty-five Residency Engineering Offices located throughout the state.

district offices and primarily perform construction and maintenance functions. The Resident Engineer is typically VDOT's contact agent with local governments, and this relationship is considered extremely important. Local agencies must communicate their priorities to the Resident Engineer because VDOT maintains all roads. The construction staff at the district and the Resident Engineer's office is involved in project development from the time of scoping, through pre-bid constructability reviews and value engineering analysis.



VDOT has established several performance measures to ensure that necessary process improvements are made, work products are delivered on time, and work is of an acceptable quality. The performance measures attempt to determine, prior to letting, the accuracy and the completeness of the plans submitted by the districts for bidding by means of a contract readiness index that it has developed. This index assigns risk factors to the areas of utility relocation, bid amount, and project duration based upon an analysis of these factors and other aspects of the project by the reviewers. This information helps to establish contingency amounts, and is useful in allocating staff to projects.

Using outstanding customer service, we will build, maintain, and operate a surface transportation system that represents the highest standards of safety and quality by the year 2006:

- We will maintain the public trust, and treat public dollars with utmost care.
- We will be a leader in utilizing innovation and technology to deliver our products and services.
- We will use the best business practices to get our jobs done.
- We are committed to making VDOT a great place to work.
- We will enhance economic opportunities while preserving the beauty, natural resources, and heritage of Virginia.

Other performance measures developed by VDOT include the design quality index and the construction quality index. Construction personnel rate the designer's work product as the job is being built in order to arrive at the design quality index. Maintenance personnel perform a similar rating on the actual project one year after the work has been completed in order to get the construction quality index.

Within VDOT's Central Office, there are 72 staff members that provide policy and technical or engineering guidance in the area of construction contract administration.

At the district and residency levels there are 682 VDOT employees directly involved in construction administration, and another 200 who are indirectly involved in this function. Approximately 250 consultants augment the VDOT personnel to ensure that contractors are performing properly.

BASIC ORGANIZATION AND PROCEDURES

Organization and Staffing

On approximately 30% of VDOT's projects, consultants perform project management services such as testing, inspection, and contract administration services. Consultants design 60% of VDOT's projects.

On approximately 30% of VDOT's projects, consultants perform project management services such as testing, inspection, and contract administration services. Consultants design 60% of VDOT's projects.

The decision to hire a consultant for construction contract administration is made by the District Construction Engineer and the State Construction Engineer. The various Resident Engineers evaluate the consultant's work and hold them accountable. These project consultants are considered part of the Resident's staff.

VDOT also uses a program that it has developed to assist in the planning and the staffing of projects. This planning system allows a manager to enter the workload, and then derive from the program the number of personnel necessary to ensure proper management and completion of the project.

WSDOT

Washington State Department of Transportation

WSDOT has a Service Center located in Olympia (the Olympia Service Center - OSC) and six regional offices geographically located throughout the state. The Northwest Region, the largest of the six, is comprised of five geographical sub-areas. The state has 48 widely distributed permanent project offices, thirty-eight of which focus primarily on construction, and the remaining ten focus primarily on design. A great deal of autonomy and responsibility are given to the regional and permanent project offices.

The Regions and their Project Offices perform a wide variety of transportation engineering, from cost/benefit analysis for programming purposes, to performing virtually all design functions (excluding bridge and structures), as well as construction inspection, and testing. Maintenance operations are also handled at the Regional level, through the Regional Maintenance Offices.

WSDOT has elected to the extent possible, to combine the design and construction functions within a given office. Frequently the same Project Engineer may design and construct a project. Maintenance functions are performed in the region under the supervision of Maintenance Superintendents. The maintenance functions are separate from

WSDOT has elected to the extent possible, to combine the design and construction functions within a given office. Frequently the same Project Engineer may design and construct a project.

Together we efficiently build, maintain, operate and promote safe and coordinated Transportation Systems to serve our public.

construction administration functions with the exception of one Region, where they have a common point in their reporting structure. Since design and construction are so closely aligned in WSDOT, internal practices also include having construction personnel involved in project scoping and constructability reviews at various stages of plan development. According to WSDOT, these practices have resulted in a reduction of plan errors and improved plan quality.

Some of the performance measures used in the contract administration areas include tracking construction engineering costs, comparing final construction costs to bid price, and tracking change orders that add no value. Performance measures, some of which are reported to the Governor and the legislature, are used to identify trends, establish responsibility for monitoring and reporting, identify who is accountable, and allocate resources. Communicating the effectiveness of the Department's actions with solid data and taking corrective action where necessary are by products of these performance measures.

Bid solicitation, bid opening, contract award, and contract execution occur primarily in Olympia, at the Olympia Service Center, with the exception of two of the Regions. The Eastern Region performs the bid opening, awards and executes the contracts, and the North Central Region elects to open the bids. All advertisement and prequalification occur in the Olympia Service Center.

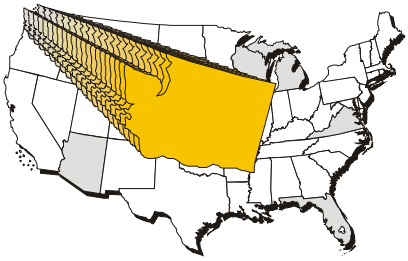
The Construction Office resides within WSDOT's Olympia Central Services Center consisting of fifteen construction positions, and seven positions in the bid advertising, award and prequalification areas. The Construction Office reports to the Field Operations Support Service Center, another component of the Olympia Services Center.

Generally, the function of the Construction Office in Olympia is to provide support and consistency to the project offices and regions.

Generally, the function of the Construction Office in Olympia is to provide support and consistency to the project offices and regions. Change order assistance and review are minimal. Resolving construction issues at the project level is encouraged. Training is a large component of Olympia's responsibility to the region and project offices.

BASIC ORGANIZATION AND PROCEDURES

Organization and Staffing



Construction administration staffing levels within the regional and project offices varies. Statewide there are 2,300 to 2,500 full-time equivalent positions allocated. There has not been a need to hire consultants to perform construction project management, especially in view of a major reduction in program funds. WSDOT expected to have a construction program exceeding $1 billion for FY 2000, but a voter initiative reduced its construction program to approximately $650 million. Therefore, staffing projects is accomplished with departmental personnel only. Engineers are classified as E-1 through E-5. E-4s and E-5s must have a Professional Engineer's license. Technicians are classified as T-1 through T-3.

Outsourcing in WSDOT is limited to design work, generally large bridge projects. A minor amount of survey work and material testing responsibilities have been contracted out. Temporary or seasonal employees are used to assist with construction administration or to perform duties at construction sites on an as-needed basis.

WisDOT

WisDOT re-organized approximately five years ago. Currently, WisDOT has six divisions and four executive offices. Construction contract administration duties primarily fall within the Division of Transportation Infrastructure Development at the Central Office in Madison, and within the Division of Transportation Districts, which is comprised of a small staff in the Central Office, and the eight district offices. The Central Office Bureau of Highway Construction has been organized into six functional sections with 89 full-time positions. The six sections are: Geotechnical (20 full-time employees), Pavements (15 full-time employees), Quality Management (21 full-time employees), Proposal Management (17 full-time employees), Standards Development (5 full-time employees), and Operations Management (8 full-time employees). There are 3 full-time employees assigned to the Director's Office. These Central Office sections provide a wide array of policy and engineering support as well as technical expertise in the area of construction management administration, materials, geotechnical services, claims resolution, etc. This bureau also reviews and finalizes the bid proposals and conducts the highway bid lettings.

WisDOT re-organized approximately five years ago. Currently, WisDOT has six divisions and four executive offices.

At the district level, the construction contract administration responsibilities have been assigned to the Project Development section

that encompasses both design and construction. The district's Project Development section is charged with delivering both in-house and consultant-designed plans, PS & E preparation, the affirmative action/ equal employment opportunity, and labor compliance oversight for all construction projects within its district. A primary goal of the merger of design and construction is to have each staff member with an engineering background perform design work 50% of the time and construction administration the other 50% of the time. Additionally, WisDOT requires those who primarily do design work in the districts to spend a full year in the field to gain construction experience.

WisDOT contracts with county governments to perform the bulk of the maintenance work on State, US, and Interstate roadways. District maintenance personnel perform some maintenance functions and identify the work to be completed by the county forces. Typically, county forces perform pothole patching, guardrail repair, and snow and ice removal. WisDOT does not own a snowplow. Funds for these county contracts and services are provided by the legislature within the WisDOT budget allocation.

To provide a forum for state Departments of Transportation to identify and improve the methodologies concerning program and project management through the exchange of ideas and best practices. The successful implementation strategies will be documented, benchmarked and shared to continuously improve project and program delivery.

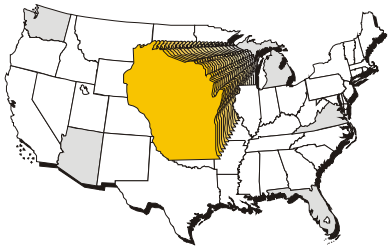
When initiating a construction project, the district consults with the County Highway Commissioners in order to receive input at the local level. Then, District Planning develops the Concept Definition Report, which is used by Project Development in the district to establish the project scope. A memorandum of understanding that sets forth the scope of each project must be written and approved by District Planning. This document also contains a delivery schedule and preliminary construction cost estimate.

WisDOT does not have a formal constructability review process, but some districts review plans at 90% completion. On complex projects, WisDOT often hires consultants to perform a constructability review prior to the letting.

WisDOT uses performance measures to measure timeliness of design, cost of design, quality of design, and quality of construction.

WisDOT uses performance measures to measure timeliness of design, cost of design, quality of design, and quality of construction. The data for the above measures are gathered at the division and district levels. The measures assist in gauging the effectiveness of project management, and are also used to hold managers accountable. WisDOT believes that performance measures have contributed to

raising the awareness of the employees to meet customer expectations. Customer expectations include effective cost management, delivery of quality products and services in a timely manner, and being responsive to the traveling public. WisDOT indicated that performance measures have been in place for seven years in various forms and clearly the measures are accepted by its employees more now than in previous years.



The district offices are organized in the following manner: Business Services Section (Communications, IT, Human Resources), Systems Planning and Operations (Maintenance, Traffic, Planning), Project Development (Design and Construction), and Technical Services (Environmental, Geotechnical, Real Estate, Survey, Utilities).

There are approximately 550 full-time employees assigned to the Project Development sections in the eight districts. They are charged with developing and constructing approximately 600 projects annually costing in excess of $600 million.

WisDOT is subject to a legislative mandate limiting the number of full-time employees. WisDOT reported that this limitation caused districts to retain consultants for both design services and for construction contract administration services. On the design side, private consultants perform slightly more than 50% of the work. This work includes: environmental and planning studies, and preliminary and final design. On the construction side, consultants perform up to 70% of the contract administration duties on WisDOT projects. These duties range from material inspection to full project management on jobs. Project Development supervisors in the districts are responsible (along with the advanced level engineer) to coordinate project staffing, which includes hiring and evaluating consultants for project construction contract administration services.

WisDOT is subject to a legislative mandate limiting the number of full-time employees.

On the construction side, consultants perform up to 70% of the contract administration duties on WisDOT projects.

The in-house project staff has been affected by the retirement of senior-level personnel during the last few years, leaving voids that have been filled by the consultants.

Organization and Staffing

The Project Development Supervisors and the advanced level engineers consider the following when staffing a particular project: complexity of project, type of project, availability of internal staff, budget constraints, contractor's prior performance, contractor's schedule, and project completion date.

Construction Contract Administration Training

TRAINING

General

ODOT defines "Construction Contract Administration Training" as the training deemed necessary in order for its personnel to provide oversight and administration of the Department's construction contracts, including inspection, testing, and quality control. An "institutionalized training curriculum" is a training curriculum that is set down in writing, funded, and is currently active.

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ODOT

ODOT initiated a contract administration training effort for project engineers and project inspectors three years ago. During the first year of ODOT's training program, senior construction personnel worked with a consultant to develop a comprehensive contract administration workbook. This workbook emphasized the importance of thorough and accurate contract administration practices, and provided detailed instructions on how to properly administer a construction contract. This course was then taught by a consultant to over 1,000 of ODOT's construction personnel.

ODOT offered three additional classes for project personnel during the second year of this training initiative. The subjects covered were scheduling, negotiations, and claims avoidance. Each course was offered at various sites around the state and each class lasted 1½ days. The consultants that developed the manuals taught the classes.

This year was the third year of ODOT's initiative, and four additional courses were offered: an Advanced Damages course, Primavera Scheduling, Partnering, and an Asphalt course. A consultant will teach each of these courses, and the class lengths will vary from one to two days.

The only certifications that are currently required by ODOT are in the areas of bridge painting, nuclear testing equipment, and asphalt testing. ODOT's training is not currently tied to career ladders. Open positions within ODOT are filled by matching an applicant's experience to the specific requirements of the position.

ODOT averages approximately $150,000 per year in outside construction administration training costs, and offers an average of two to three new courses per year.

ODOT hired TCS in 2000 to develop a more comprehensive training curriculum. Due to the downsizing ODOT has experienced over the last several years, it has lost valuable experience. Additionally, contractor personnel have become more sophisticated. Therefore, ODOT has determined that it needs to start replacing that lost experience, and provide new and better training for its personnel.

ADOT

ADOT does not have an institutionalized contract administration training curriculum at this time. ADOT is in the process, however, of institutionalizing training for inspection and testing, and currently has a number of management courses, in addition to classes offered for construction technician certification. ADOT's classes include: Highway Plan Funding, Pay Item Documentation, Field Account Documentation, Construction Office Quantities, Supplemental Agreements, Asphalt Price Adjustments, Certified Payrolls, and Computerized Contractor Estimates.

ADOT personnel work with consultants to develop the training classes. Consultants typically conduct the training for two years, and during this two-year period, the consultants will "Train the Trainer," so that ADOT personnel can take over as instructors for the classes.

Certification is required only in certain areas, primarily in the testing area. ADOT, in conjunction with Contractor Supplier Associations, created a nonprofit organization called the Arizona Technical Institute (ATI) to oversee training in the construction testing area. Both ADOT and industry pay for, and attend, the courses offered by the Institute. ADOT funded much of the initial set up cost for ATI, and also donated a

ADOT, in conjunction with Contractor Supplier Associations, created a nonprofit organization called the Arizona Technical Institute (ATI) to oversee training in the construction testing area.

large portion of the laboratory to start the program. Industry as well as ADOT believe that this method of training has helped both ADOT employees and industry employees become more proficient in their jobs. This organization schedules and trains personnel. Certification is granted based on a passing score of 80% on 40 questions.

ADOT's inspection certification program is available to any employee in the construction office. Inspectors must pass a specific course in order to be promoted to the next level. This promotion concept only exists in the inspection series at the entry levels. It does not extend to the class series, nor does it apply to other class series.

FDOT

FDOT does not have an institutionalized contract administration training curriculum for project engineers and inspectors at this time. FDOT has a two-week Project Engineer School that is offered once a year. During the first week of the course, the focus is on managerial topics. The second week focuses on technical issues. This class is limited to 20 employees each year, and employees must be recommended by the District Construction Training Engineers in order to attend. Because of the limited space available, FDOT fills the class with employees who are newly promoted or have management potential. This class is held offsite and an overnight stay for the two weeks is required. There are many assignments given that the students must complete at night as group activities.

FDOT also offers many managerial classes each year. These classes include, but are not limited to: Communication Skills, Teamwork/Team Building, Conflict Resolution, and Personality Profiling.

Many technical classes are offered each year through a self-study program, including: Asphalt, Concrete, Earthwork, Testing, Geotechnical, and Construction Claims.

Many technical classes are offered each year through a self-study program, including: Asphalt, Concrete, Earthwork, Testing, Geotechnical, and Construction Claims. FDOT personnel can take these classes at any time. They are required to call the training office and schedule a time to take the examination.

To comply with CFR637, FDOT now requires that its technical staff be "qualified" to inspect or to conduct testing. Its staff attains this

qualification by taking the appropriate courses through FDOT's Construction Training Qualification Program (CTQP). FDOT contracts with the University of Florida to teach all of its CTQP courses. FDOT has found that this type of training through the University of Florida is more expensive than previous training. FDOT is required to pay the University of Florida a fee per class per individual. The Districts commented on this expense and the burden it was placing on their budgets. Exams are given for all qualification courses. Some qualification courses require proficiency exams.

FDOT supervisors meet with employees once a year to evaluate performance and to discuss training needs for the upcoming year. In addition, training coordinators are located in each district to help with the employees' training needs as well. FDOT does not have a formal career ladder in place that is tied to training; however, it was reported that employees have a better chance to advance if they have the requisite training.

FDOT supervisors meet with employees once a year to evaluate performance and to discuss training needs for the upcoming year.

MDOT

MDOT does not have an institutionalized contract administration training curriculum at this time. Courses are provided as needed, at the request of management personnel, staff engineers, or field personnel. Some of the courses offered are: Project Documentation, Progress Scheduling, Critical Path Method Scheduling, Claims Avoidance, Surveying, Plan Reading, Aggregate Testing, and Inspection.

Both MDOT personnel and consultants developed the courses. The classes are taught by MDOT personnel and by consultants depending on the topic.

Training for project engineers is not currently tied to career ladders; however, there is a Work Element Program in place that is used for construction technicians. There are approximately 100 work elements in the plan currently. The intent of this program is to:

Training for project engineers is not currently tied to career ladders; however, there is a Work Element Program in place that is used for construction technicians.

- Be fully coordinated with both the state civil service system and the state employee relations policy.
- Be fully work-related.

- Promote the efficient use of personnel by reducing reliance on specialists.
- Require satisfactory individual performance and provide for no automatic promotions.
- Have clearly defined career progression paths and requirements.
- Encourage the development of employees to the journeyman level to enhance employee utilization, improve job interest, and reduce costs.
- Include permanent and temporary employees.

This program is in the process of being revamped internally to reflect MDOT's current work elements.

Technicians working on the NHS must be trained and qualified in concrete, bituminous, aggregate, and density testing and inspection. They must also be certified in Radiation Safety. Certification renewal intervals range from one to five years.

The training for inspectors and technicians is all funded through the Federal Training Budget. The Deputy Director/Chief Engineer and Chief Operator's Office then approve this budget.

VDOT

VDOT does not have an institutionalized training curriculum. It does provide a number of different courses, however, to its employees.

VDOT has an on-the-job Mentor/ Protégé Program.

In place of an institutionalized training curriculum, VDOT has an on-the-job Mentor/Protégé Program. It is the responsibility of the protégé to secure a mentor, as there is no formal application process. According to VDOT personnel, this program is widely known and used throughout the Department.

VDOT offers the following classes to its employees on an as-needed basis: Personnel Development, Roadway Construction Surveying, Major and Minor Structures, Documentation, Record Keeping, Computerization, and Environmental Safety Compliance.

VDOT also offers classes that can be taken at Virginia Technical and other community colleges. These classes include: Basic Plan Reading, Remedial Math, and Remedial English.

There are no training-based career ladders within VDOT at this time; however, certification is required for those responsible for materials such as concrete and asphalt. The annual evaluation process includes a requirement to determine the classes that an employee needs to take during the upcoming year.

There are no training-based career ladders within VDOT at this time; however, certification is required for those responsible for materials such as concrete and asphalt.

Training is partially funded in both the district training budget and the Central Office Construction Division budget. The budget for training has to be approved by the Budget Division and the Executive Leadership team.

WSDOT

WSDOT has a comprehensive institutionalized training curriculum for its project inspectors and project engineers. WSDOT uses a computer program called Automated Training Management System (ATMS) to assist those who manage the training in an effort to determine training needs for its personnel. The program is designed to identify training needs of individuals, schedule individuals for training, register employees for training, confirm attendance at classes, and produce a report that rates the results of the training.

WSDOT has a comprehensive institutionalized training curriculum for its project inspectors and project engineers.

Project Engineers have a number of classes available including Supervision and Management modules, Conflict Management, Partnering, Claims Avoidance and Analysis, Change Order Administration, FHWA Stewardship Reporting, and various environmental subjects. Inspectors have available a Construction Inspection Miscellaneous Documentation Course, in addition to 13 other classes that deal with inspection and materials testing.

All of WSDOT's construction, design, and planning personnel are eligible for technical training. Much of the inspector training is required for advancement in the technician grades.

Each region has a training coordinator who helps employees with their

training needs. Once an employee and a supervisor select the class, the request is entered into the ATMS System. When enough personnel are registered for a class, the class is then scheduled. The employee and supervisor each receive a "Class Registration Notice" when the class is scheduled detailing all of the information needed.

WSDOT soon will be requiring that all of the inspection and materials testing classes have a practical or written exam at the end of the course, and attendees will be required to get 70% of the answers correct to pass. The Kirkpatrick training evaluation model is also being implemented throughout WSDOT. The Kirkpatrick model is a multi-tiered evaluation system that assesses the effectiveness of training in four dimensions. At the second level of assessment, it evaluates knowledge gained in training.

WisDOT

WisDOT is developing a "Just-in-Time" training program.

WisDOT does not have an institutionalized contract administration training curriculum at this time. WisDOT is developing a "Just-in-Time" training program to identify training needs, and then offer training based on the need of the individual and the project to which that person is being assigned. WisDOT's philosophy is that it is not productive to train people if they do not put the training to use immediately following the class.

WisDOT has developed several in-house technical courses. Designated trainers have taught the in-house classes from each of the eight districts after a consultant puts on a "Train-the-Trainer" session for the in-house personnel.

WisDOT also has some training for sampling and testing that is provided through the University of Wisconsin–Plattesville. This program is called the Highway Technical Certification Program.

WisDOT also has some training for sampling and testing that is provided through the University of Wisconsin–Plattesville. This program is called the Highway Technical Certification Program. Certification is required in certain areas of sampling and testing. This program was established as part of WisDOT's new quality control and quality assurance program. WisDOT is now placing the responsibility for quality control on the contractor. Quality control includes routine sampling and testing. WisDOT is responsible for verification testing. WisDOT verifies compliance with the specifications. The purpose of the Highway Technical Certification Program is to certify individuals who have a demonstrated ability in sampling and testing.

Construction Contract Administration Training

WisDOT supervisors discuss employee performance on a yearly basis and, at that time, training needs are discussed. District training coordinators compile this information and then look for classes to meet the employees' needs. Promotions are generally not tied to training courses; however, being certified in a specific area helps when being considered for a promotion. There is an automatic annual progression for the first three years from entry-level inspector to senior Engineering Specialist.

Training is funded through the division and the individual training budgets are developed for each functional area within the districts and the Central Office. Occasionally, Central Office will pay for training of the district staff.

Computerization

TECHNOLOGY

General

All of the states surveyed have developed means of communicating by the Internet and the Intranet for external and internal users with no access restriction to the Internet. As privileged information becomes available on their websites, secured sites will be implemented. All of the states use a computerized construction management system, which they believe has reduced the number of days it takes to pay contractors, streamlined processes (making the staff more efficient), and improved quality of processing information.

ODOT

ODOT has developed both Internet and the Intranet communications for external and internal customers. Currently, there are no access restrictions to the Internet, but as ODOT moves to provide key contractor and testing information on the Internet, ODOT plans to develop password restrictions.

Information available on ODOT's website includes: Plans for viewing and downloading (to encourage this process, the downloading of the plans is free), plan holder's lists, award sheets, proposal notes, supplemental specifications, bid tabulations, award meetings, and

standard drawings. Currently, contractors, subcontractors and bonding companies have access to all contractor payment information. Projects are advertised on the Internet, but all formal advertisements also appear in the newspapers.

Projects are advertised on the Internet, but all formal advertisements appear in the newspapers.

ODOT's Construction Management System (CMS) is a mainframe system that fully integrates construction and testing management. ODOT staff access project data by using CMS interface, GQL, or XISQL.

Four programmers and twelve District Data System Managers support CMS. It should be noted, however, that the District Data System Managers also support the district servers, assist in PC set-up and maintenance, and write programs for the district offices.

The majority of construction job site documentation has been computerized. Hand held devices, such as Palm Pilots, are being used by inspectors on a trial basis to record data in the field; however, the expanded use of these devices in the field is under review by ODOT pending the outcome of their trial use.

ODOT believes that it has experienced several benefits from having a computerized construction management system including: reducing the number of days it takes to pay contractors, streamlining processes making staff more efficient, improving communication between all levels at ODOT and with the contractors, and improving the quality of the construction process.

In-house computer training is offered to ODOT employees for CMS and other software applications as needed.

ODOT upgrades its computer hardware every three to five years, and its software every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

ADOT

ADOT has developed both the Internet and the Intranet for external and internal customers. Currently there are no access restrictions to the Internet.

Information and services available on ADOT's website include: titles and registration renewals, driver's license replacements, current traffic conditions, construction project status, road closures, construction bidding process (pilot), ADOT standards and specifications, plan holders lists, bid tabulations, bid opening schedules, contractor prequalification application forms, and stored specifications. Documents are hyperlinked where appropriate.

Current and future projects are advertised on the Internet, all formal advertisements also appear in the newspapers. ADOT is in the process of implementing electronic bidding using AASHTO's "Expedite" software.

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ADOT's Field Office Automation System (FAST) was designed in-house to integrate construction and testing and monthly pay estimates. It is a client server with a centrally located SQL database.

ADOT has established procedures whereby consultants and other local government entities may obtain a license to use ADOT's custom software.

Currently, two programmers and four full-time staff support ADOT's construction system.

The majority of construction job site documentation has been computerized. Panasonic laptops are used in the field to access a field module of FAST.

ADOT reportedly has experienced several benefits from its computerized construction management system, including: reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process.

In-house computer training is offered for ADOT's system and other software applications as needed through professional training services.

Computer hardware upgrades take place every three to five years, and software upgrades occur every three to four years. ADOT plans to use cost benefit analyses to determine the cost impact of upgrades.

FDOT

FDOT has developed both the Internet and Intranet for internal and external customers. Currently, there are no access restrictions to the Internet.

Information available on FDOT's website includes: contract lettings, design-build project development, current project status, plan holders lists, awarded contracts, specifications, addendum notices, bid tabulations, fuel indices, and wage rates. Documents are not hyperlinked.

FDOT is in the process of developing an in-house system to provide electronic bidding.

FDOT is in the process of developing an in-house system to provide electronic bidding.

FDOT is currently implementing Site Manager from AASHTO as its construction management system. This will replace its in-house

developed Construction Reporting System (CRS). This new system will use client server technology. Site Manager does not integrate construction and testing. Currently four programmers from Office Information and three end user offices support FDOT's construction system.

Electronic bidding software is shared with the contractors.

Most construction job site documentation has not been computerized. FDOT is exploring the use of Palm Pilots or an equivalent hand held device to record field data.

FDOT, as do the other states surveyed, believes it has experienced several benefits from having a computerized construction management system, including: reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process.

In-house computer training is offered for FDOT's programs and other software applications as needed.

Computer hardware upgrades take place every three to five years, and software upgrades occur every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

MDOT

MDOT has developed both the Internet and Intranet for external and internal customers. Currently, there are no access restrictions to the Internet, although the plan is to introduce passwords when contractor-privileged information is provided.

Information available on MDOT's website includes: standard plan and specifications, up-to-date information on construction projects, bidding and letting documents and data, bid results, live shots of project sites on high-impact construction projects, average daily traffic, plan holders, DBE directory, prequalified contractors directory, electronic bidding files, electronic bidding software, addendum, bid tabulations, manuals,

and contractor payment status reports. Standard specifications, plans, and special details are available in an indexed PDF format. Users can search using specific terms and the results provide an index to access the documents. Documents are hyperlinked where appropriate.

MDOT currently offers electronic bidding on an optional basis to contractors. The focus is to implement a total electronic bidding and letting process. MDOT uses AASHTO's Expedite software.

MDOT uses FieldManager and FieldBook to electronically record project information in the field. MDOT uses FieldManager by InfoTech to manage and track projects. FieldManager fully integrates construction and testing. It enables MDOT to track work item progress, prepare daily reports, prepare daily diaries, manage stockpiles, generate contractor payments, manage change orders, track test results, and prepare over 60 standard reports. MDOT requires its engineering consultants and local government agencies to obtain a license for FieldManager from InfoTech for all projects let. MDOT is studying the possibility of requiring contractors and subcontractors to also access FieldManager, by obtaining licenses from InfoTech. Currently two people support FieldManager.

FieldBook is a component of FieldManager that is designed to operate on a laptop computer so that information can be recorded at the construction site. MDOT is testing FieldPad, which is completely integrated with FieldManager and operates on hand-held devices. All of an inspector's daily reports can be recorded using FieldPad and downloaded into FieldManager by cable or by infrared technology.

MDOT estimated that Field Manager saves the state $16.8 million in reduced time to manually produce reports in addition to reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process.

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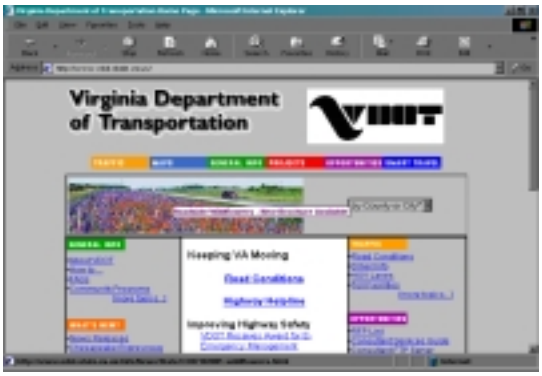
In-house computer training is offered to MDOT employees for FieldManager and other software applications as needed.

MDOT upgrades its computer hardware every three to five years, and its software every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

VDOT

VDOT has developed both the Internet and Intranet for external and internal customers. Currently, there are no access restrictions to the Internet. Different categories of data are available on the Intranet versus the Internet.



Information available on VDOT's website includes: specifications, construction division memoranda, forms, project descriptions, requests for proposals, plan holders list, pre-qualification list, certification list, debarment list, six-month advertisement schedule, price sheets for advertised projects, revision announcements, bid results and tabulations, standard and non-standard item code tables, price and fuel adjustment indices, division directories, short lists, and selected forms.

VDOT is planning to implement electronic signatures and electronic submission of data by external and internal customers.

Projects are currently advertised on VDOT's website.

VDOT is in the process of implementing AASHTO's SiteManager as its construction management system. Currently VDOT uses AASHTO's TRNS*PORT.

Currently, four programmers, four district personnel, and five personnel within the Division of Construction support VDOT's construction system.

The majority of construction job site documentation has been computerized.

Technology currently being considered or tested by VDOT includes: SitePad hand-held device for project data collection, electronic submission of bids from contracting industry, wireless Local Area Network/Wide Area Network (LAN/WAN), electronic notepad technology, and electronic document management system.

VDOT, as do the other states surveyed, believes that it has experienced several benefits from having a computerized construction management system, including reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process. In-house computer training is offered to VDOT employees for its construction management and other software applications as needed.

VDOT upgrades its computer hardware every three to five years, and its software every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

WSDOT

WSDOT has developed both the Internet and Intranet for its external and internal customers. Currently, there are no access restrictions to the Internet. Different categories of data are available on the Intranet versus the Internet.

Information available on WSDOT's website includes: construction progress status and bid status, bid tabulations, and results of award meetings. Specifications and bids are not available online, nor are the data available by hyperlink. Projects are advertised on WSDOT's website.

Computerization

WSDOT's construction management software is a mainframe system that tracks a wide variety of contract information including key dates, contractor identification, subcontractors, EEO information, change orders, item quantities, and weekly statements of working days. Inspector diaries are not kept on the system. Contract payments are done through another system. All files are stored on the mainframe, and reports can be generated from a SQL database using Access or Excel.

WSDOT has not shared its construction management software with contractors.

Currently, four programmers and three workstation support staff support WSDOT's construction system.

The majority of construction job site documentation is not computerized. Hand-held devices such as Palm Pilots are under consideration at this time.

WSDOT believes that it has experienced several benefits from having a computerized construction management system including reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process.

In-house computer training is offered to WSDOT employees for its construction management system, and other software applications as needed.

WSDOT upgrades its computer hardware every three to five years and its software every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

WisDOT

WisDOT has developed both the Internet and Intranet for external and internal customers. Currently there are no access restrictions to the Internet. Different data are available on the Intranet versus the Internet.

Basic Organization and Procedures

Computerization

Information available on WisDOT's website includes: all pre-bid and post-bid information, and bid files for electronic bidding. Specifications and drawings are not available online, nor is the data available by hyperlink.

WisDOT mandated the use of electronic bidding in October 2000.

WisDOT mandated the use of electronic bidding in October 2000. WisDOT uses a secured website "BidExpress" where it puts all pre-and post-bid information, and make bid files available for the electronic bid software Expedite.

Projects are advertised on WisDOT's website.

WisDOT currently uses AASHTO TRNS*PORT/CAS and FieldManager for progress reporting, estimates, and contract modifications. WisDOT uses Wisconsin Field Information Tracking (FIT) to track various status dates, performance measures of design quality index, and construction on time. WisDOT uses Enterprise Wisconsin Project Tracking System to create management reports. Lastly, WisDOT uses Wisconsin Materials Information Tracking to track testing performed in the field. This system feeds a program called Materials Tracking, which tracks central and district lab testing and generates reports.

WisDOT has shared AASHTO Expedite with contractors at no cost. Licensing and support is handled through AASHTO.

Currently, three programmers and eight district personnel support WisDOT's construction system.

FieldPad is being used in the field in conjunction with FieldManager. Consideration is being given to using Palm Pilots in the future.

WisDOT has experienced several benefits from having a computerized

Computerization

construction management system, including reducing the number of days it takes to pay contractors, streamlining processes, and improving the quality of the construction process.

In-house computer training is offered to WisDOT's staff for its various software applications as needed.

WisDOT upgrades its computer hardware every three to five years, and its software every three to four years. A cost benefit analysis is performed to determine the cost impact of the upgrade.

Documentation/Finalization/Progress Payments

DOCUMENTS

General

Most states surveyed had documentation requirements similar to ODOT's with respect to quantity and survey calculations, supporting documents, and narratives concerning the work performed. Each of the states had manuals detailing its documentation requirements.

Some states such as Arizona, have relaxed documentation requirements, citing smaller inspection resources as the reason behind the relaxation.

In all states, the primary source of field documentation is the inspector's diary.

ODOT

ODOT generates progress payments twice monthly. All or part of a payment may be withheld due to a lack of material documentation, failure to submit payrolls, or other performance problems. Payment bond and prompt payment rules protect subcontractors. ODOT has no retainage against progress payments.

ODOT has no retainage against progress payments.

ODOT's diaries are handwritten in the field, and the information in the diaries is subsequently entered into ODOT's computerized CMS.

The districts perform some interim reviews of project record keeping and documentation in an effort to enhance uniformity. ODOT selects 25% of their projects for review as part of the final audit.

The quality of the plans and design are reviewed and assessed at the end of each project by ODOT's Project Engineer. Post-construction meetings are sometimes held with the contractor and the designer to develop lessons learned. Change order reasons are compiled. The minimizing of preventable change orders is a district performance measure.

Within ODOT, the project engineer is responsible for determining the final quantities on a project. ODOT's goal is to have 90% of construction projects finalized including all required documentation, completed within six months of completion of the work in the field. Timely finalization is a district performance measure.

As a part of the Finalization process, ODOT's project engineer evaluates all contractors and subcontractors.

As a part of the Finalization process, ODOT's project engineer evaluates all contractors and subcontractors. Evaluations are sent to the contractors and the subcontractors when approved. Contractors have the right to appeal. Low evaluations can result in a reduction of a contractor's bidding limit. Low evaluations must be accompanied by specific documentation prepared by the project engineer.

ADOT

ADOT generates progress payment estimates monthly. Progress payments can be withheld or reduced due to payroll problems or material deficiencies. Specifications protect subcontractors. DBE payment affidavits provide additional protection for DBE subcontractors.

Site visit to Rt. 202 Extension Project in the Phoenix Construction District, Maricopa County. $60 million contract for +/-3.2 miles of highway and structures.

Within ADOT, all diaries are generated on laptops by ADOT inspectors. These inspectors also have a calculation program available to them on their laptops to assist in quantity calculations. The Field Reports Section reviews documentation on each ADOT project.

The design for each project is reviewed by Construction and all change orders are categorized as to cause. This information is provided to the

designer for informational purposes, and for use on future projects. Design feedback is also provided through ADOT's partnering process.

Once a final payment package is prepared by ADOT's project engineer, it is sent to the Field Reports Section for review. A survey is done on all diaries, calculations, and material reports. No data was available about actual finalization time but ADOT tries to finalize in 45 days.

Contractors are not evaluated by ADOT due to an Arizona Attorney General's opinion that precludes such evaluations.

FDOT

FDOT generates progress payment estimates monthly. Progress payments can be withheld or reduced due to payroll problems or material deficiencies. Subcontractors are protected by the contractor's certification of payment to all subcontractors and material suppliers.

At a consultant - managed FDOT project in rural district

All diaries are handwritten, and diary information is then summarized and put into FDOT's computer system. The Final Estimates Engineer discusses documentation requirements with the contractor at the pre-construction meeting.

The Final Estimate Office reviews the documentation on all projects both while work is proceeding, and once it is completed. FDOT's project engineer evaluates all project designs, and provides feedback to the designer.

Within FDOT, the project engineer prepares the finalization package. The District Final Estimate Office (DFEO) reviews all projects while the work is proceeding. FDOT's goal is to have the project substantially finalized when the work in the field is completed. This "preliminary" final package is then submitted to the DFEO within 20 days of completion of work in the field. Every project is then reviewed.

A secondary goal of FDOT's is to submit the final quantities to the contractor within 75 days of the work being complete in the field. An estimate that is based on the submitted final quantities is then paid to the

contractor in order to avoid interest payments.

FDOT's project engineer, as a part of the finalization process, evaluates all contractors. The evaluations can affect the contractor's bidding limits for FDOT work.

MDOT

MDOT generates progress payment estimates twice monthly. Progress payments can be withheld or reduced due to payroll problems and/or material deficiencies. Prompt payment statutes and special provisions in the contract protect the subcontracts.

Michigan DOT Concrete pavement resurfacing project

Within MDOT all diaries are generated on laptops by MDOT's inspectors on the project. Information from the diaries is then downloaded into the MDOT's FieldManager system. MDOT's documentation is totally electronic. The only paperwork is backup information.

The Resident Engineer Certification Program periodically evaluates and certifies both MDOT and local government engineers. Once an engineer is certified, final estimates can be processed without an independent project review. For uncertified engineers, all projects must be reviewed before final estimates are processed. MDOT's Resident Engineers are certified after formal reviews of project records. The Commission Audit Team also performs final audits on selected projects.

Plan and design evaluations are regularly performed by the Region's design division and by personnel at the Transportation Service Center. Low evaluations can affect the consultant's rating.

MDOT's goal is to finalize all projects within 120 days of completion of work in the field. MDOT meets this goal on 80% of its projects. Timely finalization is a performance goal for the Regions and Transportation Service Centers.

MDOT's Construction Management System monitors finalization.

Contractors are evaluated by MDOT's Resident Engineer as a part of the finalization process. Low evaluations can lower a contractor's bidding limits for MDOT work.

VDOT

VDOT generates progress payment estimates monthly. Progress payments can be withheld or reduced due to payroll problems or material deficiencies. Subcontractors are protected by prompt payment statutes, and must be paid within seven days of the prime contractor being paid.

VDOT's diaries are handwritten. Diary information is then transferred to the Construction Workbook (computer). The documentation on each project is reviewed by the District Location and Design unit (L&D).

Virginia DOT Fredericksburg District Rt. 3 Project

VDOT construction personnel evaluate the design on each project, and feedback is provided to the designer. VDOT district and residency personnel do constructability reviews. Within VDOT, Construction and Design hold monthly meetings to provide feedback.

VDOT's Resident Engineer's office is responsible for determining the final quantities for a project. The final package is submitted to the district where all diaries, calculations, materials, and reasons for differences are reviewed by L&D.

A final estimate is then generated for review and approved by the Central Office Construction Division. The goal for finalization is 90 days after completion of the work in the field. VDOT's Construction Division performs random project documentation reviews as work is proceeding.

VDOT's Resident Engineer evaluates contractors during each project and at the end of each project. These evaluations are then summarized in the Central Office. If a contractor receives three scores of 70 or less, or one score less than 60, that contractor can be removed from the bidders list. A contractor's average evaluation score will affect a contractor's bidding limit for VDOT work.

WSDOT

WSDOT generates estimates monthly. Payment can be withheld due to payroll problems or material deficiencies. Payment bonds and prompt payment statutes assure that subcontractors are paid in a prompt and timely manner.

Washington DOT New 4-Lane Relocation

WSDOT's diaries are handwritten. WSDOT also uses "pay notes," which document completed pay items. Information from the diaries is entered into a computer program mostly for payment purposes.

WSDOT regional personnel review project records when 50% of the work is complete and after the project is complete.

Plan and design quality issues are reviewed and discussed with the designer. The reasons for change orders are also compiled and discussed with the designer.

WSDOT's final quantities and reports are developed by the Project Engineer who then certifies the results. The region reviews projects when they are 50% complete and when they are 100% complete. The region also performs process reviews at the project. WSDOT's goal is to finalize each project within six months of completion of work in the field. The Olympia Service Center reviews projects for proper paperwork only. The Olympia Service Center also does process reviews at the regions.

WSDOT's Construction Contract Information System monitors the progress of a project toward finalization.

WSDOT's project engineers evaluate all contractors. Poor evaluations can result in the reduction in the size and type of contract that a contractor may bid.

WisDOT

WisDOT generates estimates twice a month. Payments may be withheld due to payroll problems, specification non-compliance or

material deficiencies. Prompt payment statutes and special provisions protect subcontractors in WisDOT contracts. WisDOT also posts the estimates in the project office so that subcontractors may review them.

Some WisDOT diaries are handwritten. The information is then transferred to WisDOT's Field Manager computer system. Otherwise, diaries are maintained electronically using Field Manager software. The district reviews all project records as part of its finalization process.

After the project is constructed, WisDOT's Project Manager and the contractor rate all plans and develop a Design Quality Index. This evaluation is given to the designer for information and for use on future projects. In addition, the quality of construction is rated by WisDOT's District Area Engineer and WisDOT's Maintenance personnel to develop a Construction Quality Index.

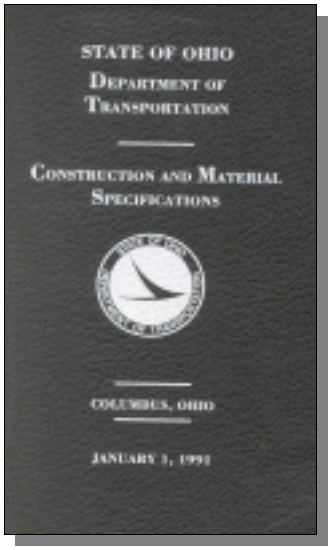
Wisconsin DOT District 2 site visit to G/I-94 Interchange Project

Within WisDOT, the Project Manager determines the final quantities. WisDOT's goal is to submit the final quantities to the contractor for review within 90 days of acceptance of the work in the field. When the project manager submits a tentative final estimate, the contractor is allowed up to 90 days to accept or reject WisDOT's tabulated final quantities. WisDOT attempts to finalize prior to the beginning of the next construction season.

The Project Manager or district produces a material test report concerning the disposition of all materials on WisDOT projects. The district's Project Development Section checks all finals.

All contractors (prime and subcontractors) are evaluated by the WisDOT Project Manager. The evaluations may affect a contractor's bidding limits.

SPECS



General

FDOT is the only state visited that has a written policy defining specification development. The states reported updating the specifications every two to eight years, and there is a trend toward active voice, imperative mood, and Quality Assurance end-result specifications.

ODOT

ODOT has a specifications committee that consists of the Deputy Director of Construction Management (chairman), the Administrators for the Offices of Construction Administration, Maintenance Administration, Materials Management, Traffic Engineering, Pavement Engineering, two District Construction Engineers, a District Production (design) Administrator, and the Engineer of Specifications Development serves as secretary. The Deputy Director of Contract Administration serves as ex-officio legal advisor. This committee meets monthly to review and approve new or revised specifications. Also represented on this committee, but not as voting members, are representatives from the FHWA, Ohio Contractor's Association, Flexible Pavements Association, Ohio Ready Mix Concrete Association, Ohio Industrial Mineral Aggregate Association, American Concrete Pavement Association, and department technical experts from various areas such as structures, traffic, pavements, soils, and hydraulics, as needed.

ODOT personnel, contractors, trade associations, and any political entity can initiate a new specification or a revision. An idea for a new or revised specification is transmitted to the specification committee secretary, who then brings it to the committee for review of the merits of the idea; and to decide whether or not to move forward with the draft or to take no further action. If it is decided to move forward, the specification language is normally drafted by a department technical expert from the area involved, with a subcommittee, if necessary, of contractors, trade associations, FHWA, and other department personnel.

The draft is then sent both electronically and by hard copy to the specification committee, districts, various Central Office departments, contractors, trade associations, and FHWA for review and comment. There is no time frame set for this process.

The draft specification and review comments are then discussed at a specification committee meeting, where a decision on the comments is rendered, and where a decision is made regarding whether further action is required. This procedure is repeated until the committee reaches a consensus. The final draft of the revised specification is then sent to FHWA for final approval.

There are five levels of the specifications: the Standard Construction and Material Specification, the supplemental specifications (including Special Provisions), proposal notes, plan notes, and construction drawings. The supplemental specifications are individual documents describing construction and material specifications for items whose requirements are changing year to year, are still in the developmental or experimental stage, or are used only occasionally. Supplements provide necessary information not properly covered by the specifications book, usually for laboratory testing methods and certification procedures for materials. Proposal notes are used to correct errors in or to make changes to existing specification items until such time as they can be updated in the specification book. They are also used to implement various bidding requirements. Plan notes are used to describe non-standard pay items that deviate from the specification book, the supplemental specifications, or the standard construction drawings.

ODOT has no written policy defining the specification revision process. FHWA has voiced concern over the current process for drafting, review, approval, and distribution of new and revised specifications. When changes are made to an existing specification, a typical problem is that the changes may not be obvious and many times are missed by ODOT field personnel and contractors. Furthermore, there are no performance measures in place to evaluate how the department is doing with this process.

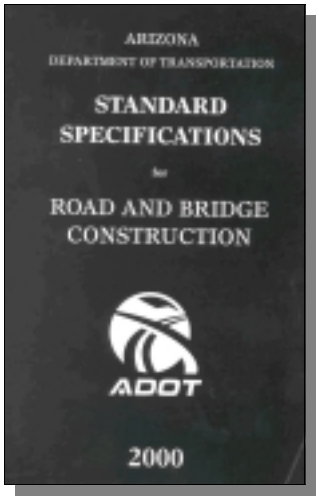
In the past, the specification book was updated every two years, with the last update in 1997. Currently, ODOT is rewriting the specification book to active voice, imperative mood, incorporating all applicable supplemental specifications, proposal notes, and policies, and clarifying or updating all existing specifications using technical committees for each section. The next issue will be released in 2002.

Currently, ODOT is rewriting the specification book to active voice, imperative mood.

The specifications, supplemental specifications, and proposal notes are maintained on both the Intranet and the Internet.

ODOT uses end-result specifications for asphalt density, and for asphalt and concrete smoothness. Asphalt and concrete smoothness have an incentive/disincentive (I/D) for smoothness, and an I/D is currently being developed for asphalt density. An end-result specification for concrete strength is also being developed. The contracting industry generally favors specifications with I/D, and ODOT believes both quality and ease of inspection have improved as a result.

ODOT does not perform cost-benefit analysis prior to specification revisions.



ADOT

ADOT has no formalized specification review and approval committee. The Office of Contracts and Specifications makes routine changes to the specifications. Joint industry/ADOT committees develop new specifications and revisions. These joint committees work behind the scenes with various ADOT offices to develop and update the specifications. When the joint committees have reviewed a draft specification or revision, it is sent to the district engineers for concurrence.

After the State Construction Engineer/Senior Design Engineer approves a new or revised specification, they become stored specifications, and can become part of each individual contract by special provision in the proposal. Stored specifications are reissued three to four times a year. The standard specifications book is updated with the stored specifications additions every three years.

ADOT does not use plan notes to modify existing specifications, but include these in each proposal as project supplemental specifications. There is latitude in using these supplemental specifications with no central office review or oversight.

Changes to a specification by a stored specification or by supplemental specifications are not highlighted. This leads to misinterpretation by both ADOT field personnel and contractors. There are no guidelines

for the process of drafting, reviewing, approving, and distributing of new and revised specifications. Arizona Associated General Contractors (Arizona AGC) would like all changes made to the specifications underlined for each job.

Arizona DOT Rural project site visit. Bridge construction on a new alignment.

The standard specifications are only available in hard copy and they are not maintained on the Internet. The stored specifications are maintained on the Internet because they become part of each proposal.

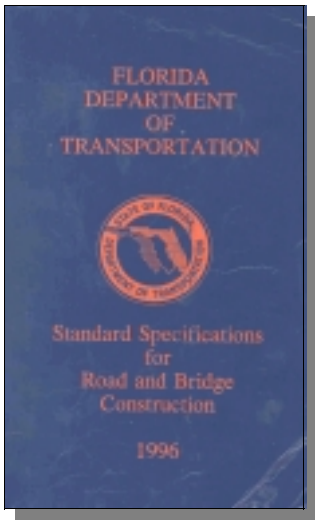
ADOT uses end-result specifications with I/D for asphalt and concrete pavement smoothness. They also use I/Ds for traffic control such as paying contractors based on travel times through work zones during construction compared to travel times prior to construction.

ADOT uses quality control/quality assurance for concrete and asphalt pavement, structural concrete, sub-base, and aggregate. While contractors are responsible for quality, the Department still performs acceptance testing for payment purposes. ADOT does not believe that its quality control/quality assurance specification requirements are effective in reducing DOT staffing levels on projects, nor have they permitted personnel to focus on other areas. This appears to be a result of ADOT performing the acceptance testing independent of the contractor's quality control acceptance testing.

ADOT uses quality control/quality assurance for concrete and asphalt pavement, structural concrete, sub-base, and aggregate.

FDOT

FDOT has a State Specifications Office with a staff of five. This office has four sections—Specification Development, Product Evaluation, Quality Assurance and Product Processing, and District Specifications Offices. The Specification Development section publishes the standard specifications, the implemented modifications, and processes the specifications from proposed modifications to adopted standards. The Product Evaluation section has a staff of six, which reviews and evaluates transportation-related products, and maintains the qualified products list. The Quality Assurance and Production Processing section has a staff of two and is responsible for assisting the districts with quality assurance activities, and processes plans and specifications submitted by the districts. The District Specifications Offices, with a Specification Engineer and a staff of three, prepare the proposal and specification packages for each contract.



Specifications

FDOT is the only DOT of the six visited by ODOT during this study that has a written policy for specification development. The policy, Topic No. 630-010-001-9, has an effective date of 11-20-98, and is available on the Internet at *www.dot.state.fl.us/specificationoffice.*

All FDOT employees, FHWA, contractors, and material suppliers can request revisions to the standard specifications, special provisions, or supplemental specifications. Contractors and material suppliers need a department sponsor to actually submit and support a proposed revision. FDOT defines special provisions as specific clauses that are added to, or that revise, the standard specification or supplemental specification for a specific project. A supplemental specification is an addition or revision to a standard specification, applicable to all department contracts.

The originator or department sponsor of a proposed revision prepares the draft, using the standard specifications as a formatting guide. The draft must be in active voice, and include the usage note or the conditions under which the specification will be used. The proposed revision is submitted to the State Specifications Engineer, who evaluates the draft along with the Office of Design Director, and the State Construction Engineer. This committee then refers the proposed revision to the Specification Development Review Committee, where the proposed revision is either approved for further processing or returned to the originator rejected. The Specification Development Review Committee is chaired by the State Specifications Engineer, and includes individuals from Design, Construction, Materials and Research, General Counsel, FHWA, and industry.

The State Specification Engineer determines which specifications are minor or mandatory and establishes the effective letting date for the revisions. A mandatory change is a revision required due to changes in federal or state statutes, rules, or technological changes. A minor change is a revision to provide clarification, typographical, and grammatical corrections.

If it is determined that a rewrite is necessary, the revision is sent back to the originator, who has two weeks to perform this. Once the rewrite is complete, the specifications office electronically transmits the proposed

specification via FDOT's website for an industry review. The reviewers include all key FDOT offices (thirteen total), the FTBA, trade associations, and FHWA. The reviewers have four weeks to complete their reviews.

All review comments are collected by the Specifications Office and returned to the originator. The originator must review the comments and compile a summary of responses, make the necessary changes, and return the proposed specification to the Specifications Engineer within two weeks. The Specifications Engineer then forwards a copy of the summary of responses to the individuals who made the comments.

The State Specifications Engineer reviews the final draft recommendation with the Office of Design Director and the State Construction Engineer, who either recommend implementation as a special provision, reject it, or refer the recommendation to the Specification Development Committee. Unless FDOT determines that a revision will not be used until formal approval by FHWA, the new special provision is included in the next workbook. The workbook is a collection of all approved special provisions and supplemental specifications that the District Specifications Engineers use when compiling the specifications packages for each contract. It is updated every six months.

Florida DOT District 3 site visit to bridge replacement project.

If FDOT determines that a proposed specification revision, or an existing special provision, require formal FHWA approval, they are submitted by the State Estimates Engineer. Once FHWA approval is obtained, the revision is implemented as a supplemental specification in the next workbook.

The Product Evaluation Section establishes procedures for review and evaluation of transportation-related products and materials, and maintains a qualified products list (QPL). The QPL reduces field personnel time and effort for material approval. This is discussed in more detail in the testing section of this report.

FDOT is presently initiating a requirement that the design consultants compile the specification packages for each contract. The District Specification Engineer would then be responsible for quality assurance.

FDOT uses end-result specifications with I/Ds for asphalt density and smoothness, in addition to concrete pavement smoothness.

MDOT

There are generally four levels of specifications: special provisions for a specific project, frequently used special provisions, supplemental specifications, and the standard specifications book.

The Project Manager, who is either from Central Office, the region, or is the consultant lead designer, decides on the need for special provisions. The Construction and Technology Division reviews all special provisions to ensure that new special provisions are in proper format, not redundant, or in conflict with existing special provisions. They also are reviewed for clarity and constructability. Whenever possible, previously approved special provisions are used.

There is no industry involvement in writing most special provisions or frequently used special provisions, although they are distributed to industry after approval. Special provisions are not distributed; they are part of each contract's proposal. Prior to a frequently used special provision becoming a supplemental specification, there is a 60-day industry and FHWA review period.

The specification book is typically updated every five to eight years. Consequently there are a large number of special provisions and supplemental specifications that become part of the proposal.

The Engineer of Specifications provides oversight to nine specification committees, one committee for each of the nine specification sections. These committees are made up of central office and region personnel, as well as FHWA. The committee chairs are from the regions and have experience and knowledge in their particular specification section. They control all changes within their section of the specification. There is no overall specification committee. It was reported that it is difficult for field personnel to manage and track all of these changes.

Any unresolved issues on a proposed revision go to an Impasse Panel for a final decision. The Impasse Panel is made up of the Deputy

Director of Bureau of Highway Technical Services, the Design Engineer, the Construction and Technology Engineer, and a Region Engineer.

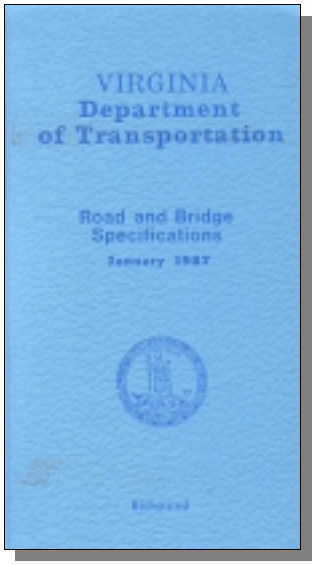
MDOT has used quality control/quality assurance specifications extensively for eight years on structural concrete, concrete pavement, and asphalt. It uses I/D payments for concrete pavement and structural concrete based on compressive strengths, and asphalt pavement based on density and mixture. It is also using I/D payments for asphalt and concrete pavement smoothness.

Michigan DOT Concrete Pavement for a New Interchange Project

The concrete industry is a strong proponent of the quality control/quality assurance process, while the asphalt industry has shown resistance. MDOT believes that quality has improved as a result of the I/D specifications. With the contractor quality control/quality assurance process, MDOT's inspection staff has been able to concentrate on other areas of the projects.

VDOT

VDOT has a specifications section within the construction division with a staff of six engineers, headed by the State Specifications Engineer. Their role is to oversee all new and revised specifications, and to review the specifications package for each contract. In addition to the Specification Section, there are ten subcommittees made up of technical experts from all functional areas within VDOT, including asphalt, concrete, grading, structures, drainage, etc. These subcommittees are responsible for drafting specification language for new specifications and revisions.



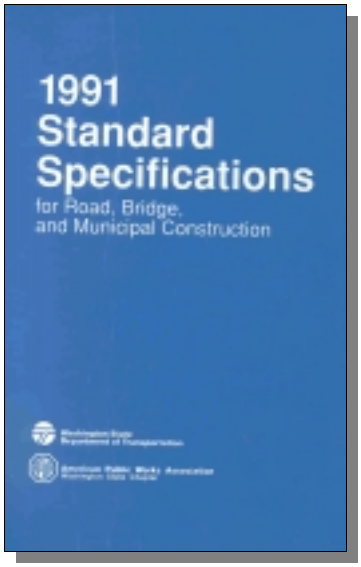
VDOT has a specification committee consisting of staff from technical areas to sign off on most specification changes; however, there is no formal specifications committee. Any issue pertaining to a new or a revised specification is finally approved by the Central Office Construction Division Engineer, the Chief Engineer, and FHWA. There is a joint committee made up of the Chief Engineer, Construction Division Engineer, District Administrator, FHWA, and five industry representatives. Their role is to provide policy input for new and innovative specifications. Virginia Roadbuilder's Association (VRA) believes this joint committee is effective in getting all parties involved with the process. VRA also noted that this committee is effective because it has authority.

The Central Office Construction Division Engineer meets with district construction staff twice a year for a week to discuss specification-related issues, and possible new specifications to be considered by the subcommittees.

VDOT has no written policies or guidelines for the drafting, review, approval, and distribution of specifications. New or revised specifications become supplemental specifications and if appropriate or widely used, are incorporated into the specification book every four years. VDOT performs a cost benefit analysis prior to some specification changes.

VDOT's only performance-based specification is an end-result specification for asphalt pavements using I/D payments for pavement smoothness. Others are being developed.

While contractors perform quality control testing on concrete and asphalt pavements, and on structural concrete, VDOT still performs acceptance testing.



WSDOT

WSDOT has no formalized process for new or revised specifications, and has no formal specification committee. A multi-discipline team is developing a formalized process.

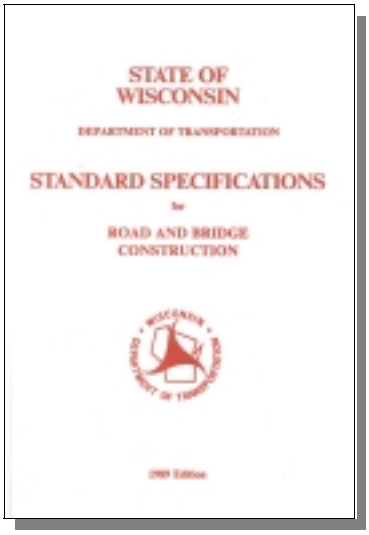
The Specifications Engineer in the Olympia Service Center (OSC), and the Division of Construction, coordinate all new or revised specification requests. The OSC Specification Engineer and the Construction Engineer, Administration perform an initial review. During this initial review, they determine whether there is adequate information, if there is a need, if it is time critical, whether design support is needed, what the current practice is, if management supports it, whether it is legal, and if there are conflicts with current policies or other specifications. Based on this initial review, the proposed change is either rejected, approved with no further review required, or designated for a more detailed review.

The OSC Construction Engineer coordinates or assigns the coordination of the detailed review with input from the regions, industry, technical experts, FHWA, policy, AGC, and design. Issues that are reviewed include cost, staffing, time, equipment, and training. The OSC Specification Engineer prepares a draft specification, coordinates the review and comment period, incorporates comments, assigns specification type and number, and reviews existing specifications for conflicts. The final approval of the new specification, or revisions to an existing specification, is by the OSC Construction Engineer.

Three times per year, on a fixed schedule, new or revised specifications are implemented through the plans branch of the OSC. Revisions to an existing specification are incorporated into the bid documents as "pink" sheets; revisions to general and special provisions are incorporated as "white" sheets. The standard specifications are updated every two years.

Contractors, in general, believe that they have sufficient input into the review of new or revised specifications, and are given sufficient notice of the revisions.

WisDOT


STATE OF WISCONSIN

DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS

for

ROAD AND BRIDGE CONSTRUCTION

Within the Bureau of Construction of WisDOT, there are standing committees for asphalt, concrete, grading, and structures that meet quarterly to discuss specification-related issues. These standing committees are made up of representatives from the various sections within the Bureau of Construction, the WisDOT transportation districts, contractors, trade associations, FHWA, consultants, and other interested and expert personnel.

Subcommittees or workgroups are assigned the task of taking the standing committees' policy decisions and drafting them into specification language. The Standards Development section generally is included during this initial draft stage. The full committees then review and approve the draft specification and forward it to the Standards Development section for final editorial work and any additional reviews as required.

A new specification or revision can be submitted by industry or department personnel to the standing committee chair for inclusion at the

quarterly meetings. The standing committees have the final approval for any new specification or revision.

Industry is represented on each of the standing committees and is thus intimately involved throughout the specification development and review process. The Standards Development section also consults with industry during the final editing stage and the final review process.

Industry is represented on each of the standing committees and is thus intimately involved throughout the specification development and review process. The Standards Development section also consults with industry during the final editing stage and the final review process.

New specifications are published annually statewide as supplemental specifications. If a new specification is needed prior to the annual release of the supplements, an interim supplement can be issued. For new provisions that are unique, pilot specifications are issued as special provisions on selected projects only for one to two construction seasons before adopting them statewide as part of the annual supplement. Industry-wide changes that have to be implemented before the annual supplements are issued can be implemented through Project Special Provisions or through policy directives called Construction Notes. The standard specifications are updated every six years and they are currently being rewritten into active voice, imperative mood.

Wisconsin DOT District 2 Site Visit to G/I-94 Interchange Project

WisDOT has no formal policies or guidelines for drafting, reviewing, approving, and distributing specifications. Each new edition of the standard specifications, supplements, and interim supplements, are mailed to each pre-qualified contractor and eligible consultant. No formal subscription service is available, and there is currently no Internet access for any of these. WisDOT plans to provide a "non-contractually binding" electronic version of the standard specification on the Internet.

WisDOT uses Quality Assurance (QC/QA) specifications through a program known as the Quality Management Program (QMP). It uses I/D for asphalt density, concrete pavement compressive strength and smoothness, and for structural concrete compressive strength. It is developing a specification for asphalt pavement smoothness and subgrade density. The contractor performs the quality control for these areas, and they must be certified through WisDOT's Highway Technician Certification Program.

Contractors favor quality assurance specifications and WisDOT believes that they have had a positive impact on quality. The adoption

Specifications

of I/D pay adjustments has made contractors more conscious of quality. With the QMP process, WisDOT is developing a reliable database of key quality-related parameters, which will make it possible to objectively assess quality in the future.

Wisconsin DOT Bridge Construction on the G/I-94 Interchange Project

As a result of the QMP process and I/D pay adjustments, fewer WisDOT inspectors are required in the field. Consequently, the role of the inspector is changing. Contractors must also add to their bids the cost of the additional testing now required.

WisDOT does not perform a cost benefit analysis prior to a specification change.

Project Scheduling

SCHEDULING

General

All states surveyed refer to some historical data to set the contract time in the bid documents. For larger and more complex projects, the trend continues to be toward more effective use of critical path method (CPM) schedules, though this trend is slowed by the need for training in the software programs used for the schedules. It seems that the lack of training leads to a lack of confidence in the schedules and suspicions that contractors are able to manipulate schedules to their advantage. Both contractors and DOTs noted that this can lead to posturing for claims and a reluctance to “accept” or “approve” schedules.

All states surveyed, except ODOT, issue Notices to Proceed to contractors.

ODOT

Most ODOT contracts are fixed completion date contracts. ODOT also uses a contract provision that specifies that the work shall be performed within a window of “x” days, with the provision that it must be completed no later than a specified date.

Experience and some historical data are used by ODOT to establish contract completion dates. Preliminary internal schedules are not developed by ODOT prior to putting a project out for bids.

The start of work is typically determined at the discretion of the contractor unless there are specific provisions to the contrary in the contract. ODOT does not issue a notice to proceed to the contractor.

ODOT typically uses one of three different types of progress schedules: 1) the standard general specifications require a bar chart schedule, 2) Proposal Note 102 requires a relationship bar chart schedule showing interdependency between activities and the project's critical path, and 3) Proposal Note 107 requires a CPM schedule. The bar chart schedule is used most often, and is only updated when requested by the Project Engineer. The relationship bar chart schedule and the CPM schedule are used for larger or more complex projects and require monthly updates.

OCA believes that schedules are good informational tools; however, it does not want schedules to be used to penalize contractors.

OCA noted that schedules are typically used on the big jobs, but not on the smaller jobs. It reported that when schedules are submitted, they are generally not well thought out, and are only submitted because the specifications require it. OCA believes that schedules are good informational tools; however, it does not want schedules to be used to penalize contractors. On projects where there is plenty of time in the schedule to get the work done, the benefit of using a schedule is questionable. OCA questioned why certain expensive scheduling software is required by ODOT in its specifications, when less expensive software is available to perform the required functions.

ADOT

ADOT uses working day, calendar day, and fixed completion date formats to establish contract time. Working day contracts are used most often. The designer initially establishes the proposed project duration. This proposed duration is then reviewed by ADOT's District Office and the actual contract duration is established.

ADOT issues the contractor a notice to proceed. A weekly notice is issued by ADOT's project personnel to the contractor advising it of the

number of working days used during that week and for the project to date.

ADOT's standard scheduling specification requires that the contractor submit a bar chart schedule. ADOT also has an optional special provision that requires a CPM schedule. The CPM schedule is generally required for projects greater than $10 million. The CPM specification is comprehensive and requires monthly updates of the CPM schedule as well as weekly submittals of bar chart schedules of the work proposed for the next two-week period. Payments are withheld if the contractor fails to submit updated schedules.

Arizona DOT Newly Widened and Re-surfaced Rural Road

ADOT always gets a two-week schedule from the contractors in accordance with its scheduling specifications. Arizona AGC supports the use of these schedules because it helps the contractors keep track of the work.

FDOT

FDOT typically uses a calendar day format to establish contract time. Each district has a scheduling engineer who works in the Construction Office. In general, the scheduling engineer establishes the proposed project duration for a project by entering historical production rates into a CPM schedule. This is an FDOT construction department responsibility.

FDOT issues a notice to proceed to contractors. Its standard scheduling specification requires a bar chart schedule. A CPM schedule is generally required for projects greater than $5 million or for complex projects. The CPM specification requires monthly updates. Payments are withheld if a contractor fails to submit updated schedules.

A CPM schedule is generally required for projects greater than $5 million or for complex projects.

FTBA noted that schedules are frequently used for supporting claims or defending against claims.

MDOT

MDOT uses working day, calendar day, and fixed completion date formats to establish contract time. It is the responsibility of the Resident Engineer to establish the performance time or completion date for a

project. Duration and dates are generally set by reference to historical data. CPM schedules that use generic production rates derived from a database developed by MDOT are used to determine performance rates or completion dates for complex projects. A study is being performed by MDOT to determine production rates for work performed under expedited conditions. When this study is completed, MDOT intends to use it to establish contract time and completion dates for expedited projects.

CPM schedules are required on complex projects and on all A+B and I/D projects.

MDOT issues the contractor a notice to proceed. Its standard scheduling specification requires as a minimum a list of controlling work items for completion of the project. MDOT also uses linear schedules, bar charts, CPMs and a schedule format that simply lists the critical activities with the start and finish dates. A new CPM specification is currently under development. CPM schedules are required on complex projects and on all A+B and I/D projects. CPM schedules typically must be updated monthly.

As provided in the specifications, schedules must be approved prior to award, and the approved schedule then becomes a contract document.

MRBA representatives reported that the State Transportation Commission pre-approves most projects and the schedule duration for each project. If a bid is rejected, or if there is only one bidder for a job over $500,000, or if the bid is 10%+ over the Engineer's estimate and over $500,000, the Commission must re-approve the project. Because the Commission only meets once a month, the award of a contract can be delayed if it has to go back before the Commission. The vast majority of contracts do not need Commission reviews after approval. For urgent projects, the Chair of the commission has the authority to waive Commission review if it is in the best interest of MDOT after reviewing the details pertaining to the urgent project.

In general, MDOT has 49 days to award a contract. MRBA noted that extending the award can also delay a contractor's schedule because the contractor does not typically build this time into the schedule.

MRBA supports the fact that MDOT lets 90% of state projects by the end of the first quarter of each calendar year.

MRBA supports the fact that MDOT lets 90% of state projects by the end of the first quarter of each calendar year. This enables contractors

to plan their schedules and allocate their resources in advance of the season.

VDOT

VDOT uses either a calendar day or fixed completion date format to establish contract time. VDOT also uses what it calls "dual date contracts." Dual date contracts require, for example, that the contractor must complete the work in 90 calendar days, but no later than November 1. VDOT issues a notice to proceed to the contractor. VDOT's standard scheduling specification requires a CPM-type schedule; however, all types of schedules are actually used. Resource-loaded CPM schedules are required on large or complex projects to determine contract durations and contract completion dates. The durations for activities and the completion dates for projects are determined by judgment and experience.

VRA reported that special provisions may vary regarding schedules. On small projects a meeting to discuss the sequence of work may be the only requirement. CPM schedules may be required on others.

WSDOT

WSDOT typically uses a workday format to establish contract time. WSDOT generally develops an internal schedule during the design phase to establish the original contract duration.

WSDOT issues a notice to proceed to the contractor. At the end of each week, the Project Engineer advises the contractor in writing of the number of workdays actually used that week and for the project to date.

WSDOT's standard scheduling specification requires a CPM schedule. The specification also requires the contractor to submit a preliminary schedule showing the first 60 working days. Additional schedule updates are required when requested by the Project Engineer. Special provisions in contract documents may change this standard requirement on smaller projects.

Washington State AGC noted that on larger jobs, the detailed CPM schedule is required. Contractors reported that reaction to their schedules

varies from job to job. The only consistency was WSDOT's refusal to "approve" a schedule. On more complex jobs, updates and recovery schedules are an integral part of project management.

WISDOT

WisDOT uses working day, calendar day, and fixed date completion date formats to establish contract time**.** Most contracts are working day contracts. Designers estimate original durations based on experience and historical data.

WisDOT issues a notice to proceed to the contractor. WisDOT's standard scheduling specification requires a bar chart schedule; however, it is piloting the use of relationship bar chart (RBC) schedules in 2000 and CPM schedules in 2002. These new schedule provisions will require schedule updates and the RBC and CPM schedules will be pay items in WisDOT's contracts.

Wisconsin Transportation Builder's Association (WTBA) noted that scheduling is in the developmental stage at WisDOT. Some contractors have experience with scheduling because many private owners require it. Because of this the transition may be easy for some contractors. Contractors believe the use of schedules will help when they try to negotiate time extensions due to owner-caused delays. Contractors do not believe that the use of RBC or CPM schedules is necessary on smaller jobs, when bar charts could be just as effective.

Contractors noted that schedule updates every month are fine; however, more frequent updates may be necessary in some cases. WisDOT requires that contractors submit revised baseline schedules when the work falls behind schedule by 14 days.

General

Administration of change orders in the states surveyed was similar with respect to the ultimate documentation required, but the Team encountered significant variations in methods available to respond quickly to changes on a project. FDOT's use of a contingency item in the contract seemed to permit the quickest response to smaller changes. Dollar limitations on field level authority also varied significantly from state to state.

CHANGE ORDERS

All states surveyed noted the need for more constructability review and implementation of lessons learned from earlier projects. ADOT's Value Analyses Section, MDOT's Quality Assurance and Lettings policy, VDOT's mandatory pre-bid on-site showings, and WisDOT's pre-bid reviews by the construction personnel who will be administering the contract, are all procedures designed to avoid changes and claims.

the Team encountered significant variations in methods available to respond quickly to changes on a project.

A spectrum of Alternate Dispute Resolution (ADR) techniques was encountered. WSDOT's and FDOT's use of Dispute Review Boards (DRBs), are among the most aggressive attempts at reducing claims.

WSDOT's and FDOT's use of Dispute Review Boards (DRBs), are among the most aggressive attempts at reducing claims.

FDOT and ADOT have or are about to implement contractual answers to the questions concerning payments of home office overhead claims that the courts have been unable to resolve over the years.

ODOT

Most change orders are initiated at the project level. For unit-priced highway construction contracts, change orders are most commonly required to make adjustments to the original contract quantities for established items of work. This is the most common type of change order. Approval by two people within the District above the project level is required to change quantities.

An extra work change order is required to add new items of work to a project. The dollar value of any new item of work is subject to a statutory limitation of: the lesser of 5% of the contract value or $100,000. If the value of the extra work change order is within the statutory limitations, it can be approved at the District level. If the value is beyond the statutory limitations the change order must be submitted to the State Controlling Board (a legislative body) for approval. Approval

by the State Controlling Board is not required for a new item of work if the Director of Transportation has declared an emergency.

If a claim issue is not resolved at the District level, it is ultimately elevated to the Director's Claim Board.

ODOT's claim process requires early notice by the contractor. If a claim issue is not resolved at the District level, it is ultimately elevated to the Director's Claim Board. This board is comprised of two Assistant Directors and a District Construction Engineer from a district different than the District in which the claim originated. The decision of the Director's Claim Board represents ODOT's final position on the claim in the department's administrative process. If a contractor does not accept the decision of the Director's Claim Board, it can file suit in the Ohio Court of Claims. Decisions of the Director's Claim Board are written and published in a Claims Digest, which is distributed throughout ODOT for information and reference, and is made available to the public. The Claims Digest also contains information on claims settled by mediation or by arbitration.

Claims avoidance techniques used by ODOT have included constructability reviews by construction personnel, pre-bid meetings, acceptance of and response to pre-bid questions, contract administration training of construction personnel, and the sharing of the Claims Digest.

ODOT has used mediation and arbitration as ADR techniques.

ODOT recognizes home office overhead (HOOH) costs for delay claims. The Central Office reviews all HOOH claims. Such costs are determined by a modified Eichleay method.

The Ohio Contractor's Association (OCA) believes that the claims process works. It was noted that, because of the contractual notice provisions, contractors must file claims so that its rights are reserved should the issue not be resolved. OCA believes that approving of change orders at the District level (if the work is within the statutory limits of $100,000 or 5% of the contract value) helps avoid claims.

ADOT

Most change orders are initiated at the project level. Quantity adjustment change orders are required when quantity changes exceed 25% of the original quantity. The Project Engineer has approval

authority up to $50,000 (designer concurrence is needed when a change is greater than $25,000). The District Engineer has change order approval authority up to $250,000. The State Engineer has change order approval authority up to $500,000. The Statutory Limits for any one change order is 10% of the original contract amount. Concurrence by the State Construction Engineer is required for approval of changes after the net value of changes plus the original bid amount of the project exceeds 105% of the original bid amount.

Scope change is the most common factor cited to justify a change order. ADOT's policy permits a project's physical limits to be extended by as much as 20% as long as the parameters set forth above are not exceeded (105% of bid cost).

ADOT's specification for pricing extra work is simple and straightforward. Whenever possible, unit prices are used for change orders. The Resident Engineer is required to do an independent estimate, compare that estimate with the contractor's request, and then negotiate the price with the contractor. Previous prices for similar work are considered. Force account is the method of last resort.

ADOT's claims specification requires that the contractor provide written notice; however, constructive notice is frequently accepted. Reportedly, ADOT's extensive use of partnering has resulted in few formal claims. Arizona AGC reported that the most common dispute is when ADOT fails to accept how a contractor planned to do a job, versus how ADOT conceived the job would be built.

ADOT's extensive use of partnering has resulted in few formal claims.

Claims avoidance techniques used by ADOT include constructability reviews on specific projects and an on-going change order review process for all projects by the Value Analysis Section. All change orders are reviewed by the Value Analysis Section to determine what is causing change orders. Findings of the reviews are communicated back through ADOT in an effort to prevent similar mistakes on future projects. Pre-bid meetings have been used but are considered ineffective when contractors do not ask questions.

Arbitration has been used as an ADR technique**.** Arbitration is binding only if both parties so agree.

HOOH claims are considered in only a few instances. ADOT is considering implementing a HOOH specification to address this contentious issue but is awaiting the results of National Cooperative Highway Research Programs (NCHRP) report on this issue before doing so.

FDOT

Most change orders and supplemental agreements are initiated at the project level. Florida uses change orders to modify contract requirements. Supplemental agreements are used to add work items to a project. Adjustments to the original contract quantities do not require the processing of a change order or a supplemental agreement, unless a major item of work has a variation in quantity of more than 25%.

To facilitate the administrative requirements for changes, a contingency pay item is included in most contracts. This item is a lump sum set by the DOT.

FDOT is required by law to encumber the funds necessary to make payment prior to instructing a contractor to perform additional work. To facilitate the administrative requirements for changes, a contingency pay item is included in most contracts. This item is a lump sum set by the DOT. Use of this contingency item allows FDOT to fund supplemental agreements and to instruct the contractor to perform additional work without going through the process that would otherwise be necessary to encumber additional funds. The amount of the contingency pay item is usually about 5% of the contract value up to a maximum of $150,000. FDOT may also use this contingency item to fund a unilateral payment to the contractor. Unilateral payments are payments made pursuant to unilateral supplemental agreements at an amount determined by FDOT. Such unilateral supplemental agreements enable FDOT to direct a contractor to perform work even when a price cannot be agreed upon. A contractor may contest the price established by FDOT, but until final resolution of the issue the contractor is obligated to perform as directed.

Each District Construction Engineer has approval authority up to $100,000. The District Secretary must approve supplemental agreements greater than $100,000. An FDOT attorney reviews nearly all supplemental agreements.

FDOT's policy is to recoup additional construction costs caused by design errors from design consultants. This occurs when the additional costs caused by such errors exceeds $25,000. It is a District

responsibility to pursue collection of these costs from the design consultant.

FDOT is implementing a new claims specification. It requires that the contractor provide detailed notice. Once a claim is submitted, a contractor cannot allege new issues or increase the amount of its claim. An officer of the contracting company must certify, under penalty of perjury, that the reasons cited as causing the claim, and the amount being sought are true and accurate. Costs for acceleration are recoverable only when the acceleration is ordered by the DOT. The new specification also contains a single, simplified calculation for computing all overhead costs associated with delays, including both field and home office costs. This new specification also provides that there is no reimbursement for delay overhead until the total of all delays for the project have exceeded 10 days.

Claims avoidance techniques used by FDOT include pre-bid meetings, constructability reviews, and partnering. The Specifications Engineer who is a Construction Office employee performs constructability reviews when the plans are about 90% complete in the district. In addition, a scoping meeting is held for every project and is attended by both Construction Department and Maintenance Department personnel.

Florida DOT District 3 site visit to bridge replacement project.

FDOT uses mediation, arbitration, and DRBs as ADR techniques. All claims under $250,000 must go to the State Arbitration Board. Claims greater than $250,000 may go to the State Arbitration Board if both parties agree. The decision of the State Arbitration Board has the same binding effect as a decision issued by a court. A decision of the State Arbitration Board may be appealed to the Florida Court of Appeals. In addition to DRBs for specific projects, FDOT is establishing standing DRBs that will serve a number of projects within certain geographic areas. They are also developing standing DRBs for certain complicated types of work.

FTBA supports DRBs, and believes that they will replace State Arbitration Boards. Contractors support FDOT's new claim specification.

MDOT

MDOT classifies modifications as "changes," "extras," and "adjustments." Changes are amendments to existing items. Extras are new items of work. Adjustments are always in dollars and involve existing items. An MDOT Region approves all contract modifications. State Administration Board approval is required beyond certain monetary limits. Sign-off and approval is required by two different engineers. The MDOT Commission is also involved with contract modifications over certain monetary limits. A modification goes to the MDOT Commission before it goes to the State Administration Board.

MDOT has a defined claims process, concluding with the Central Office Review. The Central Office Review Panel consists of three project engineers, one being a Region Engineer. The Panel is selected on a rotating basis with members from Regions different than the Region where the claim originated.

Michigan DOT Rural Project Visit to an Interstate Reconstruction Job

Claims avoidance techniques used by MDOT include pre-bid meetings, partnering, and plan review processes. MDOT has a constructability review process that is defined in a written policy. The process begins when the plan is completed to a required level as described in the policy and is submitted to Quality Assurance and Lettings. Quality Assurance and Lettings schedules a plan review meeting about 4 to 5 weeks after the submission and distributes copies of the plan to the proposed meeting attendees as listed in the policy. This list includes personnel from maintenance and construction, including the Delivery Engineer (Project Engineer). After the plan review meeting, the Quality Assurance Engineer resolves all issues raised and the Project Manager reviews and updates the original scope, estimated costs, and schedule. In addition, an Omission/Errors Check meeting is held for every project about one week prior to advertisement. The purpose of this meeting is to review the bid documents for missing, incorrect, or conflicting data prior to advertising and letting. The process and attendees of the Omission/Errors Check meeting is also set forth in a written policy.

MDOT will pay claims for HOOH when there are long extensions of time. The Eichleay formula is considered in evaluating such claims, but Eichleay is used only as a guide.

MRBA reported that MDOT's reluctance to approve changes and extras is the most common source of claims. Contractors believe that MDOT's constructability reviews have helped reduce the number of claims; however, contractors typically do not participate in these reviews because this may disqualify them from bidding on the work. MRBA would like MDOT's claim review boards to be made up of non-MDOT personnel.

Contractors believe that MDOT's constructability reviews have helped reduce the number of claims;

VDOT

Changes are generally initiated by VDOT personnel at the project site to address a need. Change orders are not required for minor quantity adjustments. Within VDOT, the Resident Engineer may approve change orders up to $100,000 for projects on the secondary road system only. VDOT's District Administrators may approve change orders up to $200,000 for projects on any system. VDOT's State Construction Engineer may approve change orders up to $500,000 for projects on any system. The Chief Engineer must approve change orders over $500,000.

Virginia DOT Launching gantry at Pocahantas Freeway Project

VDOT has a specification defining its claims process. That specification provides that a contractor may only make an official claim after final payment has been issued. The Chief Engineer is the only one authorized to make an offer on an official claim. If the contractor rejects the Chief Engineer's offer, the claim goes to the Commissioner for a hearing. The time prior to a formal hearing may be as much as 12 months. Virginia has limited sovereign immunity and, if the contractor rejects the decision of the Commissioner, it can then bring suit against the state but only after obtaining the approval of the State Attorney General. A settlement at the Commissioner's level requires approval of the State Attorney General and the Governor. Very few claims go this far.

Claims avoidance techniques used by VDOT include partnering, constructability reviews, training, and pre-bid showings. Pre-bid showings are held for all projects at the project site. Attendance at the pre-bid showing is required in order to submit a bid for some projects.

VDOT is trying a DRB on one project as an ADR technique. The DRB's decision is non-binding on the parties.

The Construction Engineer usually negotiates HOOH. VDOT believes that HOOH should be a maximum of 8.5% and FOOH a maximum of

7.5%. If VDOT and the contractor cannot come to an agreement, an audit of the contractor's records will be performed.

VRA reported that right-of-way and utility interferences are the most common claim issues. It supports constructability reviews with contractor participation in the process.

WSDOT

Changes are generally initiated by personnel at the project site to address a need. Change orders are not required for measured variations in quantity of planned work that do not exceed 25%. Within WSDOT, a Project Engineer may approve change orders up to $50,000. The Project Engineer also must make a written recommendation concerning approval for change orders greater than $50,000. Regions execute change orders with a value up to $200,000. Larger changes are executed at the Olympia Service Center. It is WSDOT's goal to have several people review all change orders whether their approval is needed or not. Discussion and consultation with Region Engineers or Olympia Service Center (OSC) experts prior to or during change order negotiation is strongly encouraged. The Project Engineer is responsible for substantiating the prices that are agreed upon. Whenever possible, WSDOT uses forward pricing to establish costs for new items of work, acceleration, and changed conditions. Forward pricing emphasizes the negotiation of agreed upon unit prices or lump sums prior to performance of the work, rather than using time and materials (force account) methods. WSDOT at all levels support forward pricing as the process enables it to put issues aside and concentrate on building the best job.

because of its use of partnering and DRBs, WSDOT reportedly has very few claims.

WSDOT has a specification that defines its claims process; however, because of its use of partnering and DRBs, WSDOT reportedly has very few claims. Claims avoidance techniques include constructability reviews, pre-bid questions and meetings, and partnering. The constructability review process used by WSDOT is performed primarily by WSDOT personnel who will be involved in the construction of the project. The constructability review process is described in a manual recently developed by WSDOT.

ADR techniques employed by WSDOT include mediation (infrequently), arbitration, and DRBs. Arbitration is required for claims under $250,000 by contract and is binding. DRBs are used on certain projects as specified by a special contract provision. The decision to use this special provision on a project is made by the Region.

HOOH is considered only when the contractor can provide convincing evidence. The calculation of HOOH is made by the Project Engineer in consultation with OSC experts. Eichleay is used as a guide. Revenue from change order work is included in the calculation to offset unabsorbed costs.

Washington DOT Rural site - emergency project to repair road damaged by landslide.

Washington State AGC reported that most disputes get resolved at the Project Engineer level; however, for claims that do not, the DRB process is helpful.

WISDOT

Changes are generally initiated by personnel at the project site to address a need. Change orders are only required for new work and are not required for quantity changes. Within WisDOT, a Project Engineer may approve change orders up to $10,000. Area Supervisors can approve change orders up to $50,000. The District Chief must approve change orders over $50,000. The Legislative Survey Bureau has contract change order oversight privileges but is not included in the approval process.

WisDOT has developed a new claims process and specification. This new claims specification requires that contractors provide notice of intent to file before commencing any work that is the basis for a claim. WisDOT strictly enforces this provision. A Claims Appeal Board that includes three WisDOT Administrators is the last step in the claims process. Wisconsin has sovereign immunity and a contractor must obtain permission from the legislature to litigate a claim.

Wisconsin has sovereign immunity and a contractor must obtain permission from the legislature to litigate a claim.

Claims avoidance techniques used by WisDOT include constructability reviews by WisDOT construction personnel, pre-bid meetings, negotiation training, and partnering. Constructability reviews are generally performed by the construction personnel who will be administering the project and prior to PS&E.

Change Orders/Claims Avoidance/Analysis Techniques

WisDOT also uses standing neutrals to hear disputes and issue opinions as an ADR technique. Standing neutrals are commonly used for claims greater than $500,000 or for complex issues.

WisDOT only considers claims for direct costs. HOOH, extended jobsite overhead, inefficiency, and other impact-related costs are not recoverable.

WTBA noted that most disputes get resolved at the project or district level. It reported that the state's sovereign immunity affects the claims resolution process by providing a very real incentive to resolve claims at the project or district level.

Maintenance of Traffic

TRAFFIC CONTROL

General

Maintenance of Traffic (MOT) and minimizing the impact of construction on the traveling public is an important issue with all of the DOT's visited. On complex jobs, specific Traffic Control Plans (TCP) are typically developed. Various innovative contracting methods have also been used for MOT.

ODOT

Minimizing the impact of construction work on the public is among ODOT's primary goals. The Governor recently mandated that no fewer than two lanes of traffic in each direction be open on interstates during construction. In addition, ODOT has design criteria for its TCPs stipulating that delays through a work area due to construction have to be five minutes or less. As required by Ohio statute, contracts typically include job-specific MOT plans that are prepared during the design process in accordance with the specific requirements defined in the plans and specifications.

The Governor recently mandated that no fewer than two lanes of traffic in each direction be open on interstates during construction.

ODOT's Office of Traffic is preparing a policy requiring that a work zone impact study be performed prior to design to specify queue thresholds. ODOT's Production (Design) Office is responsible for

identifying MOT requirements; and invites the public to offer comments during the preliminary design phase. Contractors do not play a role in the development of the original TCP; however, they frequently recommend changes during construction.

If a TCP is modified prior to letting, it can be modified by addendum. After a contract is awarded, and a TCP is modified, a change order is issued if costs or time are affected. If costs and time are not affected, the changes can be documented in job diaries or letters. Usually these changes do not go back to design, but they do get reviewed by the Traffic Management Specialists in the district office.

Traffic flow is managed in a variety of ways, including the use of highway advisory radio systems, changeable message signs, off-peak work hours, limited hours for lane closures (coupled with liquidated damages), public information campaigns, coordinated use of local streets, ramp closures, and ramp metering. Innovative contracting methods have also been used including A+B bidding and I/Ds tied to interim completion dates.

The majority of contracts have lump sum pay items to pay for MOT; however, ODOT does occasionally use unit prices.

Contractors that fail to follow the TCP are subject to breach of contract provisions (suspension of work, termination, etc.), and liquidated damage assessments tied to lane access. ODOT evaluates contractor compliance with the MOT provisions in its contract. This evaluation can also affect a contractor's pre-qualification status.

ODOT monitors workzone safety and enforces posted (reduced) speed limits through the use of police details, fine doubling, and reviews of the project work by the Project Engineer.

The OCA voiced the opinion that night work adversely affects quality because it is difficult to see the pavement during final paving. OCA was also concerned about the safety of its workforce, due to the effects of artificial lighting and sleep deprivation on its personnel.

ADOT

ADOT uses TCPs for discrete sequences of work on projects and on projects that have long-term road closures. Small projects do not have TCPs. The contractors are required to submit plans for each closure. Project-specific MOT requirements are detailed in the plans or special provisions.

The Traffic Designer identifies MOT requirements. The engineer responsible for the construction adds notes for MOT based on experience. Contractors are not involved in the original development of the MOT design. It is common, however, for contractors to recommend changes to the TCP following contract award. After contracts are awarded, TCP's can be modified by change order to reflect cost or time changes or savings. Minor changes are documented by daily diary entries. For scope of work changes involving a change in the TCP, a change order is required. Approval by the Project Engineer or designer is required for contractor proposed TCP changes.

Traffic flow is managed by a number of different means and methods. These include night and weekend work, changeable message signs, limited work hours (non-peak), public information campaigns (i.e., newspapers, Internet, etc.), and construction hotlines. Various innovative contracting methods are also used including A+B bidding, lane rental, I/Ds, and liquidated damages. ADOT also monitors the effectiveness of the TCP by comparing pre-construction travel times through a work zone with travel times during construction.

ADOT usually pays for traffic control with unit prices. On small projects lump sums are used for traffic control items, with some projects using pre-determined prices (approximately 90% of project traffic control is contractor bid, with 10% lump sum and pre-determined pricing). Contractors that fail to follow the TCP requirements receive formal notification and are subject to progress payments being withheld.

The TCP is monitored in a variety of ways including project staff inspections, law enforcement officers enforcing speed limits and serving as flaggers, full-time traffic control personnel pursuant to the

specification, and monthly meetings regarding traffic safety held at the project office. ADOT has new legislation to have fines double in work zones when workers are present.

Contractors reported that traffic should only be restricted when work is actually being performed. Contractors typically implement MOT provisions even when work is not ongoing resulting from payment by unit prices. Arizona AGC likes lane rental and believes that the ADOT lane rental specification is an effective tool for minimizing impacts on the traveling public.

ADOT lane rental specification is an effective tool for minimizing impacts on the traveling public.

FDOT

FDOT's primary goal is to move traffic through work zones without reducing speeds any more than necessary, and without causing driver confusion. TCPs are detailed in the contract plans, standard index plans, roadway and traffic standards, and the specifications. Standard index series 600 through 665 provides approved standard signs.

The Production Department (Design) identifies MOT requirements. The Construction Department reviews the TCPs at 30%, 60%, and 90% production stages for comments on the proposed plan. The Project Engineer (PE) reviews the TCP during the final design stages for completeness.

Contractors are not involved in original TCP design or development. The contractor can elect to use the TCP shown in the plans or submit a proposal for FDOT review. After the contract is awarded, TCPs can be modified per specification 102-2.6. All proposed alternate TCPs must have a Specialty Engineer's seal and signature. FDOT's Resident Engineer must approve the modifications to the TCP in writing.

A value engineering cost proposal (VECP) can be initiated for TCP modifications. Changes to the TCP that alter traffic patterns are submitted to FDOT for approval pursuant to Construction Project Administration Manual (CPAM) section 6-1-1. A professional engineer's seal and signature are required on all MOT changes.

Weekday and nighttime inspections are required of the contractor. The

PE reviews these reports and the project staff conducts independent field inspections. Law enforcement officers also monitor the work zones and enforce speed limits.

To analyze traffic flow in an effort to avoid delays, FDOT uses a lane closure analysis sheet that takes into account a number of factors.

To analyze traffic flow in an effort to avoid delays, FDOT uses a lane closure analysis sheet that takes into account a number of factors, including, but not limited to, seasonal and directional considerations, peak hour volumes, obstruction factors, and lateral clearance.

FDOT manages traffic flow by using highway advisory radio systems, temporary pavement detours, limited work hours (non-peak), public information personnel, and law enforcement officers. FDOT also requires that the same number of lanes open prior to construction be open during construction. Emergency evacuation procedures must also be in place. FDOT also uses innovative contracting methods such as A+B bidding and lane rental as a means to minimize impacts to traffic flow.

Florida DOT Urban District Construction Project that was Consultant Managed.

To manage traffic flow through construction zones FDOT uses speed limit signs in the advance warning area of the work zone, intelligent transportation systems (ITS), motorist awareness systems (rural-high speed), changeable message signs, and the signing of business entrances.

Contractors that fail to follow TCP requirements are subject to breach of contract, lane rental charges, evaluations that could impact bidding capability, project shutdowns, and disqualification of the work site traffic supervisor.

FDOT pays for traffic control measures with unit prices (item and day units of measure). Lump sum payment covers very few items. Consideration is being given to having separate bid items for truck-mounted attenuators. Currently, they are considered incidental to the work.

FTBA likes bidding MOT using unit prices, and supports FDOT's requirement that the worksite safety supervisor be certified in MOT.

MDOT

TCPs are noted as special provisions in each contract. The special provisions include general information about the project, construction influence area descriptions, traffic restrictions, construction staging, traffic control devices and pavement markings, and specific details of the traffic control measures. Specific MOT requirements are detailed in the plans and specifications.

The Transportation Service Centers identify TCP requirements. Public input is solicited early in the design process. Potential business impacts are also analyzed and considered. For instance, between Memorial Day and Labor Day efforts are made to keep all north-south routes open during weekends.

On complex projects, contractors are occasionally involved in the original TCP design to comment on staging sequences. Generally, however, contractors are not involved in the development of the original TCP special provision. If a TCP is modified prior to bid, the change is handled by addendum.

Contractors may, and usually do, recommend changes to the TCP following contract award. After the contract is awarded, TCPs can be modified with agreement from the Resident Engineer (RE). The RE issues a work order for the change followed by written authorization/ approval to validate the contract change. The contractor usually wants to change the staging sequence in order to expedite the work on the project. Modifications are documented in daily diary entries, inspector's daily reports, and work orders issued by the RE and the Transportation Service Center Manager during the authorization process.

Michigan DOT concrete pavement resurfacing project.

Traffic flow is managed by requiring night and weekend work using changeable message signs, limiting non-peak work hours, initiating public information campaigns (brochures, radio, telephone hotlines), and through lane and ramp rental for limited closure times. MDOT also uses innovative contracts to manage traffic flow such as A+B bidding and I/D contracts with interim completion dates.

In addition, MDOT is using techniques such as the Indiana Lane Merge, law enforcement, doubling fines in work zones, and completely closing

roads for limited time frames. MDOT experimented with the Indiana Lane Merge, shifting all traffic to the right. In the event of a right lane closure, traffic is merged into the right lane such that a shift to the left can be accomplished well in advance of the closure point. This eliminated driver confusion regarding which lane they were to merge into during lane closure conditions.

If a contractor fails to follow the TCP, it is subject to suspension of work, negative assessments for lane/ramp rental, pre-qualification impacts, and liquidated damages or disincentives pursuant to the contract provisions.

Typically, the project staff monitors the work zone through inspections. On complex projects, the contractors are required to employ a worksite traffic supervisor to oversee the work zone. Occasionally, radar trailers are used in work zones to indicate actual speeds.

Traffic control measures are typically paid for by unit prices. Preventive maintenance projects, however, use lump sum pay items.

The MRBA prefer total road closure with detours; however, it realizes that this is typically not practicable. It is difficult for contractors to bid A+B contract work using an innovative MOT technique because they do not know whether MDOT will approve the innovation. Also, contractors do not want the competition to learn of the innovation prior to the bid.

Some contractors have adapted to night work and some have not. MRBA believes MDOT goes too far in minimizing impacts on the public. With so much work being done during a short construction season, coupled with restrictive TCPs, contractors and MDOT staff work too many hours over short periods. Consequently, they get burned out. MRBA is trying to pilot a program where MDOT projects would be shut down on certain weekends during the season with no schedule implications on the contractor.

VDOT

TCPs are detailed designs. Specific MOT requirements are detailed in the contract documents, but can change based on field conditions.

Design Units, Traffic Engineering, and the field units identify MOT requirements. Public Hearings are conducted for input on the TCP during design. VDOT construction personnel perform constructability reviews in an effort to minimize impacts to the traveling public. Contractors are not involved in the original TCP design; however, contractors do suggest alternate staging and TCPs after contract award. VDOT staff must approve all TCP change requests.

TCPs may be modified without a change order, unless additional bid items are required or the bid quantities change significantly. If a change order is not required, TCP modifications are documented by daily diary entries or plan revisions.

VDOT manages traffic flow by using advisory radio systems, changeable message signs, public information campaigns (brochures, radio, and telephone hotlines), limiting work hours and lane closure hours with associated liquidated damages, and closing ramps and using local streets. VDOT also uses innovative contracting methods such as A+B bidding and I/D contracts with interim completion dates.

On one project where the contractor was replacing bridge spans, two-directional traffic was shifted to one side of the Interstate so that multiple composite deck sections could be replaced in one night.

Contractors that fail to comply with the TCP requirements are subject to work suspensions, default, loss of bidding privileges, and disincentives or liquidated damages.

The project staff monitors the TCP with inspections. Law enforcement officers enforce speed limits with fines doubling.

Traffic control items are paid for by unit prices or lump sum bid prices.

VDOT and the police teach work zone safety training classes in high schools. Virginia contractors do not favor certifications because it believes that the certifications then become an excuse to not monitor traffic control.

WSDOT

Washington DOT rural site - an emergency project to repair road damaged by landslide

Specific MOT requirements are detailed in the plans and specifications depending on the project's complexity. Less complex projects rely on the standard specifications.

Design standards require a comprehensive work zone Plan, Specification, and Estimate (PS&E). The Design Office is responsible for preparing the PS&E and for coordination with the Traffic and Construction Offices. Strategy meetings are held internally and with the public early in the design process. The expected outcome of the strategy meetings is to identify maintenance of traffic issues/conflicts and incorporate solutions into the project design. Specialized teams are sometimes used to assist with PS&E development and/or modifications during construction.

TCPs give consideration to typical contractor operations and production rates; however, the contractor does not play a role in the development of TCPs prior to bid and award. Work zone design is based on acceptable traffic restrictions from the driver's perspective. MOT plans give reasonable accommodations to traffic maintenance through the work zone. Urban projects may require a compromise between traffic flow and expediting progress of work on the project.

Washington DOT rural site - an emergency project to repair road damaged by landslide

MOT requirements are seldom modified from the time plans are sent out for bid and the award of the contract. Contractors must formally accept the contract MOT traffic control plans in writing or propose modifications and submit a request for approval. Generally, the proposed modification must meet the original contract requirements. The PE and Traffic Engineer are expected to consult and agree changes to the TCPs before the Department approves the Contractor's request.

Traffic is managed through public information, advanced signing, work hour and workday restrictions with hourly liquidated damages, law

enforcement officers, and alternate routes. Innovative techniques to improve traffic flow through work zones include high impact short term closures, zipper barriers, innovative staging, advance notice/alternate routes, consideration of materials and procedures that save time or money or allow for restrictive work zones, and complete interstate closures for limited time frames.

A contractor's failure to follow MOT requirements will result in contract provision enforcement up to and including breach actions, liquidated damages, and unfavorable contractor evaluations.

Contractors are required on most jobs to have an ATSSA-certified person designated as its traffic control specialist. This person is paid for on a unit price basis. The Project Engineer and a Traffic Control Manager designated by the Contractor also perform work zone monitoring. Law enforcement officers enforce work zone speed limits. Regional Traffic Departments review projects as needed for conformance to the Highway Work Zone Review Policy. Annual reviews by Olympia Service Center and FHWA are also performed.

Contractors are required on most jobs to have an ATSSA-certified person designated as its traffic control specialist.

Methods of payment for MOT include individual bid items with unit prices, and lump sum for less complex projects.

WISDOT

TCPs are required on all projects. Standard drawings serve as the TCP on some projects. Detailed staging or project-specific traffic control plans are required for projects with unique features, complex stages, or open to traffic. Contract documents specify TCP requirements by means of standard drawings, project-specific plan details, and special provisions.

Project Development (Design), with input from Traffic Operations, identifies TCP requirements. Occasionally, contractors make recommendations during the design process to change traffic staging; however, contractors typically suggest alternate staging and TCPs during construction. Public information meetings are also conducted to gain input from the public on the TCP during design.

Wisconsin DOT District 2 site visit to G/I-94 Interchange Project.

TCPs can be modified by addendum prior to bid, based upon comments from contractors or the public. After the contract is awarded, the Project Engineer can modify the TCPs by a change order with input from the Project Designer and the Traffic Engineer. In some cases TCP change orders are processed as a cost reduction incentive or to shorten contract time. Modifications are documented by the contractor's proposal detailing changes and impacts.

Traffic flow is managed by limiting the time for lane closures and work operations to off-peak or night work using changeable message signs, highway advisory radio, signs to divert traffic during emergencies and heavy congestion, ramp closures or metering at select times, public information campaigns (brochures, radio, TV, telephone hotlines, and internet display of freeways), state patrol surveillance/advance warning for congested areas with backups/alternate routes, Park-and-Ride, staggered work hours, and subsidized transit service.

Innovative techniques to improve traffic flow in construction zones include interim completion dates with I/Ds, fines doubling for moving violations, lane rental, A+B bidding, towing service during peak hours, and complete road closures for limited time frames.

Work zone safety is monitored by project staff inspections and documentation, law enforcement officers with the use of uniformed or plain-clothes officers, public information campaigns, and radar-activated speed display boards.

Consequences for a contractor failing to follow TCP requirements include work suspension, liquidated damages, and withholding estimates. Traffic control items are itemized for individual devices. Lump sums are used for surveillance and are also used on small or less complex projects.

In general, contractors believe MOT is not a problem. Night work is used frequently in urban areas and the contractors feel that the quality of the pavement is better because of the cooler temperatures at night.

MATERIAL QUALITY

General

All of the states surveyed have a four-tiered approach to assuring material quality. There is a general movement towards using the contractor's quality control test results for acceptance and payment; however, ADOT, for instance, still performs all acceptance testing independently of the contractor's quality control test results.

ODOT

Materials Control Concept and Roles

ODOT's materials acceptance is based on ODOT controlling both the quality of the process and the final product. While QC/QA uses contractor quality control programs for acceptance of asphalt materials, other materials are prescribed by ODOT. ODOT uses a four-tiered approach to assuring materials quality:

ODOT's materials control concepts are based on ODOT controlling both the quality of the process and the final product.

1. The contractor is directly responsible for quality control of asphalt with ODOT only performing random quality assurance.

2. The Project Engineer is responsible for all other materials, quality control including sampling, testing, acceptance, and final materials documentation.

3. District laboratories support the Project Engineer by performing acceptance testing for asphalt and aggregates; approving documentation for other materials; and performing independent assurance sampling, testing, and procedure verification.

4. ODOT's central laboratory performs aggregate quality tests and oversees the aggregate quality program; approves asphalt mix designs; performs concrete compression testing; and controls the approved materials list (or qualified products list). A plant sampling and testing program is also operated that includes pre-sampling and testing. Quality assurance reviews are performed depending on the material acceptance procedure. Geotechnical design and subsurface investigation functions are the central laboratory's responsibility.

Major Materials Acceptance Methods

Contractors supply asphalt pavement under QC/QA, which requires prior acceptance of the contractor's quality control plans by ODOT's central laboratory. Contractor test results are used for acceptance and payment if verified by ODOT testing. Pavement and structure concrete mixes are prescribed in the specifications. ODOT performs all concrete testing for quality control purposes. Payment for concrete is not tied to compressive strength results. Aggregate is accepted from pre-qualified sources based on acceptable ODOT gradation tests.

Pre-manufactured Materials Acceptance

Pre-manufactured materials, such as precast concrete, pipe, guardrail, and reinforcing steel are accepted by ODOT's central laboratory based upon sampling, testing, and certified data supplied by the manufacturers who are part of ODOT's plant sampling and testing program. While this pre-approved program is not required, it has become the standard, and is the most economical way to do business. Suppliers who are not part of the program generally are limited in the amount of work they receive because of the sampling and testing delays created on the project. Contractors almost exclusively use program suppliers so as to avoid sampling and testing delays. ODOT maintains approved lists for some products.

Materials Acceptance Responsibility and Documentation

The Project Engineer is responsible for control, documentation, and acceptance of materials. The District Testing Engineer certifies materials based upon surveys of the Project Engineer's documentation. The CMS computer program includes materials tracking modules for control of quantities and acceptance.

Personnel, Staffing, Training

ODOT, the Ohio Ready Mix Concrete Association, the Ohio Aggregates & Industrial Minerals Association, and the Ohio Flexible Pavements Association co-sponsor training programs for both ODOT and industry materials personnel. The training is required for ODOT personnel and is either desired or required for industry personnel depending on the material. District laboratories have approximately eight full-time equivalents (FTE). The central laboratory has 52 FTEs

performing construction materials acceptance and eight FTEs in a geotechnical design or foundation investigation role.

Local Agencies

Some ODOT warranty specifications have lowered the frequency of testing; however, materials specifications are the same as non-warranty projects.

ADOT

Materials Control Concepts and Roles

ADOT materials acceptance practices and policies are built around quality control/quality assurance concepts. ADOT currently performs all acceptance testing independently of the contractor's quality control results. ADOT's physical materials testing structure includes a central laboratory, four regional laboratories, and some testing capabilities at the project level. ADOT assures materials quality by assigning roles to four different groups:

ADOT currently performs all acceptance testing independently of the contractor's quality control results.

1. Contractors and producers are responsible for the final product and QC.

2. The Project Engineer is responsible for materials quality and acceptance testing, oversight of the contractor's QC, and final materials acceptance for a project. Some physical testing may be performed at the project level.

3. Regional laboratories support the Project Engineer providing acceptance test results for projects, providing concrete mix design approval, performing aggregate soundness testing, and performing asphaltic cement acceptance. Regional laboratories typically serve multiple ADOT districts.

4. The central laboratory approves HMA mix designs, performs reinforcing steel testing, and performs the preliminary geotechnical investigation and testing. ADOT's materials group includes a materials quality assurance staff of 14 ADOT employees who are responsible for laboratory certification, testing personnel qualification and certification, and certification documentation

acceptance. Laboratory certification includes the round robin testing of contractor/private laboratories.

Major Materials Acceptance Methods

The mission of the ADOT Structural Materials Testing Section is to provide accurate and timely testing analysis and evaluation of materials used in highway construction and maintenance in the most efficient and effective manner.

Statement taken from Arizona DOT Web Site

Concrete and asphalt pavement, structure concrete, sub-base, and aggregate are delivered to projects pursuant to the contractor's personnel running QC tests to assure quality. Acceptance testing is still performed by ADOT. ADOT does not require submittal and approval of a formal contractor quality control program. ADOT includes a quality control bid item in its contracts. This item covers both materials and construction methods. Weekly project meetings are held on the project and quality control requirements are discussed during these meetings. If the quality control requirements are not met, payment is withheld.

Pre-manufactured Materials Acceptance

Pre-manufactured materials used on ADOT projects, such as precast, concrete, pipe, guardrail, and reinforcing steel are accepted based on a combination of ADOT testing, test witnessing, and certified test data. ADOT does not have one standard acceptance procedure for all pre-manufactured products. Acceptance is sometimes based on certification and limited to a specific quantity of the certified materials that can then be delivered as accepted to an ADOT project. Sometimes ADOT may test the specific quantity of the product being used. ADOT also has approved certified products lists for some items.

Materials Acceptance Responsibility and Documentation

ADOT's Project Engineer is responsible for the project certification and documentation records. Material quantities are controlled and tracked against bid items. ADOT has a computerized construction field records system. Material tracking is included, as part of this computer system, but it does not control payment to the contractor. The computer program was developed in-house. The project's final materials certification package is sent to the central office for certification by the State Materials Engineer through the materials quality assurance group.

Personnel, Staffing, Training

Construction materials quality management training is generally performed by ATI. This is an independent training center jointly developed by ADOT and the construction industry to perform training for ADOT and construction personnel. ADOT, contractors, consultants, and laboratories each pay ATI for specific training, which makes ATI self-sufficient. Concrete training is provided through American Concrete Institute training programs. Certification is required for the contractor and ADOT personnel who are performing the materials testing. Career ladders for ADOT's transportation construction technicians are tied to completion of training and certification. Project offices have material personnel handling field testing, records, acceptance testing of some materials, and sampling. The four regional labs and the central materials lab include 130 FTEs.

ATI is an independent training center jointly developed by ADOT and the construction industry to perform training for ADOT and construction personnel.

Unique to ADOT is a recently developed program in the Phoenix District that provides pay incentives to ADOT personnel based on the project team's performance in saving construction inspection costs, through reducing overtime, initiating value engineering ideas, and other factors. The program is limited to $100 per month; and is based on a rate of approximately $1 in the fund for every $22 of savings. This program was netting ADOT employees about $60 to $80 per month.

ADOT has established a "Lessons Learned" program within the construction value engineering section. Approved construction value engineering changes are directed to either design, for modification of a design practice, or specifications, for revision of the specification, so future ADOT projects can achieve direct savings though the standard bid process.

Local Agencies

A local agency can administer its own projects by qualifying through ADOT's local agency certification program. Agencies may become certified by submitting their proposed construction and testing administration programs to ADOT for approval. Certified agencies administer their projects in compliance with their program, which may have different requirements than ADOT's standard specifications. Local agencies without certification have its projects administered by ADOT in compliance with the standard specifications and Federal requirements.

Construction Quality Management

ADOT has a formalized construction quality management program in the construction operations section. This is a QA inspection program incorporating 40 specific checklists that are used by the Field Quality Assurance Inspectors. This information is statistically used to evaluate conformance, performance, areas of need, and process changes. ADOT has presented papers at TRB on its Construction Quality Management program. ADOT's formal materials quality management program has 14 FTEs.

FDOT

Materials Control Concept and Roles

FDOT is transitioning from complete materials acceptance oversight to a materials acceptance program ...

FDOT is transitioning from complete materials acceptance oversight to a materials acceptance program where the contractor's quality control results, verified by FDOT, are the acceptance criteria for the materials. FDOT's new program is called QC2000. This program will mandate contractor quality control programs and revise FDOT's own frequency of testing and acceptance procedures. As in other surveyed states, materials quality assurance is based upon at least four levels.

1. The contractor is responsible for QC with this function now being specifically defined in the quality control programs.

2. The Project Engineer has primary responsibility only for materials acceptance and documentation.

3. District laboratories support the PE with acceptance testing of asphalt, concrete, and aggregate. It also approves concrete mix designs and has a geotechnical group that is responsible for exploration, sub-base acceptance testing, and structural foundation testing and acceptance. District laboratories also have a quality assurance group that evaluates project materials records, final materials certification, contractor personnel, consultant personnel, and qualified laboratory facilities.

4. FDOT's state materials laboratory performs acceptance testing of materials where the economics warrant it, or when special expertise is required. The laboratory also performs the testing and the

evaluation of new products, approves asphalt mix designs, tests and accepts asphaltic cement, tests and administers the aggregate program, performs geotechnical testing, investigates subsurface conditions, and performs foundation testing evaluations. An extensive quality assurance program is performed by in-depth inspections of district laboratories, project laboratories, and the final acceptance of state materials for final certification.

Major Materials Acceptance Methods

Concrete and asphalt pavement, structure concrete, sub-base, and aggregates are delivered to projects based on the contractor's personnel running QC tests to assure quality. The requirement that a formal quality control program be submitted and approved has been eliminated. FDOT is shifting to its QC2000 program where contractor quality control tests will be used for acceptance with a lower frequency of verification testing performed by FDOT at the field and district laboratories.

Materials and Research

The mission of our office is to provide the testing, research, inspection, evaluation, recommendations and training in materials composition, use and performance for Florida's transportation system.

Florida DOT

Pre-manufactured Materials Acceptance

Pre-manufactured materials, such as precast concrete, pipe, guardrail, and reinforcing steel, are currently physically tested by FDOT. QC2000 will change FDOT's acceptance role. FDOT's qualified product list includes items such as concrete sealer, admixtures, grouts, rebar splices, and other similar products.

Materials Acceptance Responsibility and Documentation

FDOT's Project Engineers have approval and acceptance responsibility for materials. Final acceptance documentation is compiled by the engineer, and is checked and accepted by the District Testing Engineer's quality assurance group. Final documentation acceptance is performed by FDOT's materials laboratory through a random survey. FDOT performs surveys at 30%, 60%, and 90% of the project's completion, both as a quality assurance function, and to speed the acceptance of the final project documentation.

Personnel, Staffing, Training

FDOT, contractor, and consultant materials personnel are required to be certified through FDOT's CTQP. Each group pays the University of Florida a fee per student. Self-study courses are also part of CTQP, and

FDOT, contractor, and consultant materials personnel are required to be certified through FDOT's CTQP.

FDOT, consultant, and contractor personnel take the courses and are certified through a written examination. While not directly tied to promotions, FDOT personnel with more certifications can be used more effectively and are thus considered first for promotions and raises.

District material laboratory staffing levels vary. An urban district had 72 FTEs, with that district processing $500 million in open contracts. The state materials laboratory has a staff of approximately 160 FTEs.

Local Agencies

FDOT either directly handles the construction administration for local agency projects or the local agency performs its own construction administration by having its construction administration program approved by FDOT. Most local agencies conform to current FDOT construction and materials requirements by using consultants for construction administration.

Construction Quality Management

FDOT has an extensive construction quality management program, which is defined in its Construction Project Administration Manual. In addition to the materials and testing quality assurance functions discussed previously, FDOT's program also defines responsibilities for QA at the project, the district, and the central office level.

FDOT has structured its overall quality management program to generally conform to the Sterling business model. The Quality Initiatives Office provides training in the use of this total quality management model. In addition, this office is responsible for value engineering, alternative contracting, partnering, and quality assurance.

MDOT

Materials Control Concept and Roles

MDOT's approach is developed around standard QC/QA principles. MDOT currently mandates QC/QA programs for concrete and asphalt projects. For other materials, most contractors and suppliers use QC/QA programs. The benefits realized by these contractors and suppliers include lower testing frequencies, less inspection, and more business. MDOT and contractors both realize faster project delivery and improved quality.

MDOT's materials administration structure includes a central laboratory, regional laboratories, and TSCs. MDOT's structure is similar to other states in that its material acceptance has a four-tier structure:

1. Contractors and suppliers are primarily responsible for quality control, including quality control programs, qualified personnel, and certified test results.

2. Project Engineers from the TSC are responsible for certification, acceptance, and approval of all materials on their projects. TSC's may perform gradation tests on fine aggregates. Project Engineers have complete authority on a project. Regional or central laboratory test results are for acceptance with the ultimate acceptance decision by the Project Engineer.

3. Regional laboratories support the Project Engineers by performing acceptance testing on asphalt, concrete, and aggregate, and performing a quality assurance function on project records, contractor quality control programs, and certified suppliers programs. Structural steel materials certifications are reviewed and approved.

4. The central testing laboratory performs acceptance testing of materials where the economics warrant it, or where special expertise is required. The central laboratory approves asphalt and concrete mix designs; oversees certified supplier programs; and performs quality assurance evaluations of regional, contractor, and supplier laboratories. The central laboratory also performs new materials evaluations, develops specifications, and conducts in-house research.

Major Materials Acceptance Methods

Concrete and asphalt pavement, structural concrete, and aggregate generally are delivered under MDOT's QC/QA requirements. The contractor's quality control plans are reviewed and accepted at the TSC level. Contractor test results are used for acceptance and payment if verified against MDOT verification tests. The regional laboratory tests concrete cylinder strengths with the contractor being responsible for delivery of the cylinders to the laboratory. Asphalt cores are taken by the

contractor and are supplied to the engineer for shipment to the laboratory for verification testing by MDOT technicians.

Pre-manufactured Materials Acceptance

MDOT has a general certification program for pre-manufactured materials such as precast concrete, pipe, guardrail, and reinforcing steel that has various requirements for each material based on a supplier's quality control program and demonstrated ability to conform. The certification program includes a probationary period to assure that a supplier's QC program and test results are acceptable. The certification program is not mandatory. Suppliers that are not certified can furnish pre-manufactured materials, but testing by either the region or central lab is then required. Contractors almost exclusively use certified suppliers due to the potential of schedule impacts with uncertified suppliers. MDOT's Internet site includes its certified products list.

Materials Acceptance Responsibility and Documentation

The Project Engineer is responsible for control, documentation, and acceptance of materials. Project Engineers, who have been certified in construction documentation, have finalization authority for their projects. A survey/review is performed on the engineer's documentation. When Project Engineers have not been certified in construction documentation, their project undergoes a complete certification survey prior to finalization. MDOT's construction management computer program includes tracking of materials, quantities, and acceptance. Regions perform the surveys for final certification. MDOT's Central Office is responsible for certification of Project Engineers.

Personnel, Staffing, Training

MDOT's work element program ties training courses to promotional opportunities for its employees. Training and certification in materials areas are generally supplied through industry associations. MDOT and industry supported materials training courses are required for all MDOT, contractor, supplier, and testing laboratory personnel performing materials testing on MDOT projects. Central laboratory testing functions are structured under different sections of MDOT's Construction and Technology Division. Region laboratories include testing and geotechnical functions.

Local Agencies

Local agency projects are required to meet state construction and material requirements. Staffing restrictions have resulted in MDOT limiting or eliminating its role in construction administration of local agency projects. Local agencies administer their projects with MDOT performing a final acceptance inspection to assure specification compliance and to perform FHWA oversight.

VDOT

Materials Control Concept and Roles

VDOT's materials acceptance program is based upon the concept of controlling the materials system, rather than individual project material acceptance. VDOT started its current quality control/quality assurance approach in the early 1980s, and through the years, it has developed confidence in its system-level approach. QC/QA concepts are firmly entrenched in VDOT with both DOT and contractors appearing confident in their roles and responsibilities. VDOT materials acceptance structure includes the four-level approach seen in other states:

VDOT's materials acceptance program is based upon the concept of controlling materials systems, rather than individual project material acceptance.

1. Contractors and suppliers are responsible for the quality control function and have been performing this role for a period of years.

2. The Project Engineer is responsible for quality and acceptance of materials. The Engineer has final documentation responsibilities.

3. VDOT's district laboratories support the project with acceptance testing for concrete (strength) and asphalt, and perform a quality assurance role on materials including documentation. This QA role includes not only the contractor's field testing but also some pre-manufactured materials suppliers located within its district. District labs also approve concrete and asphalt mix designs and perform aggregate quality testing.

4. VDOT's central laboratory is responsible for the state-level quality assurance including training, random surveys, certification programs, materials test result evaluations, specifications, and policy. Additional central laboratory functions can include geotechnical design, site investigation, and district-level acceptance testing for districts depending on its proximity to the central laboratory.

Major Materials Acceptance Methods

VDOT concrete and asphalt pavement, structural concrete, and aggregate are delivered under quality control programs developed by the contractor to assure material quality control. Aggregate is accepted by the contractor's quality control test results. Concrete and asphalt acceptance testing is performed by district field or test lab personnel. Asphalt is accepted under an incentive/disincentive pay structure. Contractor quality control programs are required.

Pre-manufactured Materials Acceptance

Pre-manufactured materials such as precast concrete, pipe, guardrail, and reinforcing steel are accepted under certification programs based on a supplier's acceptable quality control program. VDOT district and central lab personnel assure program compliance by verification testing, random inspections, quality assurance testing, training requirements, supplier QC personnel certification, and testing laboratory evaluation and acceptance. Suppliers are responsible for compliance with specifications and re-certification is required. Some warehouses have certification authority based on their own quality control program.

Materials Acceptance Responsibility and Documentation

The Project Engineer is responsible for project materials certification. A materials book is used to track acceptance. The district testing engineer performs a review of the Project Engineer's certification. Once a month the Central laboratory performs surveys of random project's materials certification. While materials quantities and acceptance are documented, a contractor's payments are not directly tied to the amount of approved materials.

Personnel, Staffing Training

VDOT has an extensive in-house training program that includes nine different training manuals. VDOT and industry have worked to develop the training manuals and combine to perform the training. Contractor, supplier, and private laboratory personnel are required to receive the same training and certification level as VDOT personnel. Certification is required for anyone performing inspection, sampling, and testing on a VDOT project.

Each district has a geotechnical drilling crew and geologist as part of its materials testing division, with the exception of the districts located near the central lab where the geotechnical function is provided by the central laboratory. VDOT's central laboratory includes both materials and geotechnical design and site exploration functions. Current central lab staffing is approximately 80 FTE with approximately 35 FTEs in the geotechnical area. A single district's laboratory table of organization showed approximately 20 FTEs.

Local Agencies

Local agency projects have the same materials requirements, testing frequencies, and acceptance standards as VDOT projects. All VDOT construction administration and materials acceptance testing costs are paid for by the local agency pursuant to contract agreements. Because VDOT is responsible for construction and maintenance of almost all of Virginia's roads, there are few local agency projects.

Construction Quality Management

VDOT's formalized construction quality management program is called the Construction Quality Improvement Program (CQIP). This program performs surveys on about 130 to 150 projects per year covering about 170 construction-related activities. These in-depth project reviews provide data for yearly reports and quantify the percent of specification and construction administration compliance. VDOT has historic data starting from 1988-89 that is used to establish trends and define areas of need for additional compliance, and specifications training. These surveys have additional functions, including some field training, construction personnel training, and data gathering to evaluate where and when additional training or re-training is required. Materials quality management reviews are part of CQIP.

VDOT's formalized construction quality management program is called the Construction Quality Improvement Program (CQIP).

WSDOT

Materials Control Concept and Roles

WSDOT's materials acceptance program is based on controlling the quality of the final product. In three major areas (Fabrication, Asphalt Cement Production and Traffic Control Hardware,) formal QC/QA controls are required of the Contractor as part of an overall Quality Systems Plan, which must be approved and reviewed regularly. In other

WSDOT's materials acceptance program is based on controlling the quality of the final product.

areas, QC/QA controls are neither expressly required nor submitted, but are implicit in the language and tone of the contract. WSDOT's materials testing structure includes the Field Operations Support Service Central (FOSSC) materials laboratory, regional laboratories, and various testing capabilities at the project level. As in the case of all surveyed states, material quality is assured though the following four-level approach:

1. The contractor is responsible for the furnished product with both expressed and implied quality control roles, depending on the type of work.

2. The Project Engineer has acceptance and approval responsibility. Some acceptance testing is performed by project materials personnel including aggregate, subgrade, asphalt density, and acceptance of concrete mix designs.

Washington DOT Materials Laboratory

3. The district (region) materials laboratories perform acceptance testing for asphalt and concrete, and asphalt mix verification. The independent assurance testing role includes responsibility for training under the construction tester qualification program, and on-going random review of personnel to assure sampling, testing, and procedure compliance.

4. FOSSC materials laboratory approves asphalt mix designs; performs geotechnical investigations and designs; establishes acceptable aggregate sources; establishes the Qualified Product List (QPL); and establishes acceptance, control, and frequency of testing. FOSSC also oversees material specifications and the construction tester qualification program.

Major Materials Acceptance Methods

Contractors supply concrete and asphalt pavement, structure concrete, sub-base, and aggregate to WSDOT in conformance with WSDOT specification requirements. Contractor QC testing procedures for asphalt are required by contract. WSDOT performs all acceptance testing with contractor quality control results not factored into payment.

Pre-manufactured Materials Acceptance

Pre-manufactured materials such as precast concrete, pipe, guardrail, and reinforcing steel are accepted based on a combination of WSDOT testing, test witnessing, and certified test data. WSDOT's QPL not only provides a list of certified materials, but also documents additional sampling, required testing, and criteria for approval. Suppliers pay for testing to get their products onto the QPL.

Materials Acceptance Responsibility and Documentation

The Project Engineer is responsible for final documentation and certification on the project. Contractor progress payments are controlled by the quantity of material approved. The Engineer may request a reduced testing frequency based on field testing results and consistency of product. FOSSC randomly performs compliance reviews of projects.

Personnel, Staffing, Training

WSDOT personnel performing materials testing must be qualified under WSDOT's construction tester qualification program. The program includes modules for aggregate, asphalt, concrete, embankment, and asphalt pavement density. Employees may become certified in a module, in an individual test of a module, or even receive an interim certification.

Local Agencies

Local public agencies have adopted WSDOT specifications. Construction management may be performed by WSDOT. A local agency may either perform its own testing, hire a consultant, or hire WSDOT.

Construction Quality Management

There are several sections within WSDOT that are responsible for quality. The Office of Development Services oversees the overall quality effort at WSDOT, including training, Baldrige assessment and the employee satisfaction survey. The Quality Systems Manager, working from the State Materials Laboratory, administers and oversees the Quality Systems Plan for the Lab. The Quality Systems Manager oversees the laboratory accreditation program both in the central lab and

in the six regional labs. The Materials Engineer and the Construction Materials Engineer are in charge of the QA/QC program. These QA/QC reviews cover both material and inspection documentation, and are performed by both the Region Office and Project Office.

WISDOT

Materials Control Concept and Roles

WisDOT's current materials acceptance program is being re-engineered. The re-engineering effort has further implemented decentralization concepts initiated in the early 1990s, and has been influenced by limited manpower, increases in construction program size, and loss of experienced personnel. For many materials, WisDOT has restructured its materials acceptance policies based upon QC/QA concepts. They have a four-tiered materials acceptance system:

1. The contractor/supplier is responsible for quality control, including the development of a quality control program that provides qualified personnel, procedures, equipment, and results.

2. The Project Engineer is responsible for acceptance and certification of project materials. Quality control programs, materials certifications, and documentation are submitted to, and accepted by the Project Engineer.

3. District laboratories support the PE by performing quality assurance on contractor quality control programs, sampling materials if tested by central laboratory, and performing a quality assurance review of a project's materials acceptance.

4. The central laboratory performs testing on materials when district testing would be more expensive, and when materials are unique, or when Specialized equipment is needed. Central lab establishes approved materials lists; evaluates mix designs for asphalt and concrete; manages certification programs for suppliers and testing laboratories; establishes policy requirements for contractor's quality management programs; and performs other quality assurance reviews and functions to assure certification programs, testing procedures, and sampling methods are adequate and consistent.

Major Materials Acceptance Methods

Concrete and asphalt pavement, structure concrete, subgrade, and aggregate are delivered to WisDOT through quality management programs (QMP) that place the responsibility for materials quality control on the contractor. While some materials are currently delivered without the QMP system concept, WisDOT is moving toward QMP for all state projects. The contractor's results are used for acceptance and payment. Current specifications have either disincentives, or have incentive/disincentive pay structures. The general view from the state is that incentive/disincentives would be used more in the future as it appears to yield a better product. Contractors support incentive/ disincentive pay structures.

Pre-manufactured Materials Acceptance

Many pre-manufactured materials such as pre-stressed concrete members, precast concrete, and steel pipe, guardrail, and reinforcing steel are accepted under certification programs based on a supplier's quality management program and state quality assurance. Initially, materials are selected to be certified based on the state's previous testing history of the product. WisDOT materials personnel assure program and materials compliance through verification testing, random inspections, quality assurance testing, training requirements, re-certification inspections, laboratory acceptance programs, and statistical evaluation of contractor tests results.

Materials Acceptance Responsibility and Documentation

Final materials acceptance is the Project Engineer's responsibility. District testing performs documentation survey reviews. The central laboratory performs some random QA surveys. Computer systems for materials tracking are being evaluated but are not yet in full use by WisDOT. Contractor payments are indirectly tied to the quantity of materials approved.

Personnel, Staffing, Training

WisDOT's re-engineered materials acceptance procedures required re-education and re-direction of testing personnel. Training was developed to enhance not just technical understanding, but writing, communication, and computer skills as well. Certification for sampling and testing specific materials is required for anyone responsible for such work on a

An 11 member committee consisting of WisDOT, contractor, consultant and industry representatives was formed to develop the contractor/consultant portion of the Laboratory Qualification Program. The committee combined experience, logic and business principles in assembling a strong centrally-controlled Satellite Laboratory Qualification program that it felt best suited state, contractor and consultant material quality objectives as well as satisfied the federal regulation directive. The committee's goals were to keep the program as simple as possible by avoiding unnecessary complexity, assure uniformity of application statewide and minimize sampling and testing variability through qualified labs and personnel.

Statement taken from WisDOT Web Site

The Highway Technician Certification Program (HTCP) provides material acceptance training, with the program being run through a state university.

WisDOT project. Contractor, supplier, and private laboratory personnel are required to receive the same training and certification as WisDOT personnel. The Highway Technician Certification Program (HTCP) provides material acceptance training. The program is run through a state university. The Department provides construction inspection and non-technical training to its employees.

WisDOT staffs its materials groups with engineers and technicians. The technician series includes five levels. The first three levels are automatic upgrades based on time and capabilities, with the top two levels based upon position need along with technician capability. Materials and geotechnical, design, and site exploration are separate functions at WisDOT. WisDOT has four central office drilling crews that are considered WisDOT's primary source for geotechnical exploration, with consultants used as needed. Current staffing of the geotechnical design and site exploration positions is 20 FTEs while Quality Management (Materials) currently has 21 FTEs.

Local Agencies

Local agency projects are administered in the same fashion as WisDOT projects.

Construction Quality Management

WisDOT does not have a specific office for quality management; however, it believes that QMP fills a partial role for construction quality management. WisDOT also performs materials quality management through its extensive system of assurance reviews of private and state laboratories, producers, and contractors.

Inspection

General

Each of the states surveyed has undergone some form of reorganization in the recent past. These reorganizations all involved decentralization to varying degrees and were motivated by a variety of factors. Among these factors are changes in the size of the construction program, a desire to move decision-making responsibilities closer to the project,

and a desire to make the department more responsive to its customers. With regard to inspection, each of these reorganizations resulted in a move away from the standard practice of full-time inspection on all items.

The central office in each state functions in a support role for the districts/regions, while retaining some oversight and promoting uniformity in contract administration procedures and practices. The comfort level with the re-organization as far as central office personnel are concerned varies, although it seems to increase with the length of time that the reorganization has been in effect. Their concerns focus on the effectiveness of their reviews and on the growing lack of uniformity among the regions.

Personnel at the lower levels, where much of the authority has been shifted, are generally quite comfortable with the reorganizations and their new roles. Most believe that they are now in a better position to be responsive to their customers, and to better serve the traveling public's needs.

Contractors seem to generally favor decentralization but complain about the lack of uniformity between districts/regions. Some go so far as to say that they have included bid factors for similar work because of these differences.

All of the states surveyed have adopted similar philosophies concerning inspection. Each understands that leaner resources mean that some items must go uninspected or partially inspected. Factors influencing decisions on the issue of inspection include risk to the owner/public, the availability of personnel, the ability to adequately evaluate the work at a later date, and the ability and reputation of the contractor performing the work.

leaner resources mean that some items must go uninspected or partially inspected.

All states supplement the inspection staff with consultants or temporary workers; however, Ohio is the only state to supplement its inspection staff with 1,000-hour transfers. States using consultants are comfortable with them in part because many are ex-DOT employees. Another positive note concerning the use of consultant inspectors is the ability to choose among available people and reject or dismiss inspectors who are

All states supplement the inspection staff with consultants or temporary workers; however, Ohio is the only state to supplement its inspection staff with 1,000-hour transfers.

not performing well. On consultant managed projects, most states reported that consultants are sometimes reluctant to make decisions without getting the approval of the DOT representative. This can cause delays in the decision-making process on projects.

Most of the states surveyed have attempted to increase the versatility of its retained staff by increasing the availability of training, and implementing certification or qualification programs. Most have also rewritten specifications to reduce the amount of inspection required and to incorporate QC/QA concepts.

ODOT

ODOT monitors its construction engineering and inspection (CE) costs in an attempt to measure the impact of its reorganization efforts. During the past nine years, ODOT has seen these costs drop from 10.5% of its construction budget to approximately 7% as of June 2000. Reduction of these costs has been a district performance measure, and reduction in staffing levels and tighter control of overtime are among the reasons for the decrease.

ODOT's asphalt concrete specifications have evolved into QC/QA specifications, and resulted in reductions in personnel requirements at plant sites, as well as at the district and central office laboratories. Contractor quality control results in fewer ODOT inspectors performing tests at the site, and frees those inspectors to inspect the placing operations.

ODOT has also developed warranty specifications for asphalt concrete, concrete pavement, bridge deck overlays, superstructure, bridge painting, and micro-surfacing. It is anticipated that as these specifications evolve and become more widely used, the need for full-time inspection will be further reduced.

ODOT uses 1,000-hour transfers (maintenance workers who, among other things, plow snow during the winter) to supplement its engineering and inspection staff. ODOT is currently developing a statewide training curriculum in an effort to enhance the skills and the versatility of its work force.

Quality of Work

Inspection

ADOT

ADOT estimates that 30% of its inspectors are consultants; many of whom are ex-ADOT employees.

ADOT has developed QC/QA specifications for concrete, asphalt, and embankment operations.

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ADOT categorizes its projects by size and type and monitors its CE costs for each category. These costs are used as a performance measure for the resident engineers and the districts. These figures are reported monthly. The Phoenix Construction District uses these monthly reports to manage manpower, predict staffing requirements, and evaluate its Project Engineers.

FDOT

FDOT has recently decentralized even further than it had during an earlier reorganization. Its recent changes, however, have also included steps to develop statewide policies in an attempt to promote uniformity among its districts.

In order to increase the versatility of its workforce, FDOT has developed a formalized training program for all of its inspectors and engineers. FDOT now requires specific training and certification for its inspectors before they can inspect certain items, and both training and experience are linked to career ladder advancement.

FDOT has developed a formalized training program for all of its inspectors and engineers.

FDOT addresses inspection and staffing requirements in its Construction Project Administration Manual. FDOT uses consultants widely, and noted that it is constantly losing inspectors to consultants because the consultants are better paid. In fact, FDOT uses more consultants than any other state surveyed, and FDOT uses them not only for inspection, but also to manage projects—consultants manage 50% of FDOT's projects.

Consultants usually manage larger projects. They are contracted on a project-by-project basis, or sometimes for a group of projects. FDOT has noted that this method of contracting sometimes limits its flexibility, and

it is experimenting with the idea of entering into contracts for consultants to cover a geographic area rather than specific contracts. Other issues noted by FDOT with respect to consultant-managed projects are that they tend to have higher levels of staffing than FDOT-managed projects, and decision-making is often slower presumably due to concerns over potential liability. Contractors in Florida also noted that consultants are often reluctant to make project-level decisions, resulting in the problem being passed along to the next higher level, which usually is an FDOT engineer.

MDOT

MDOT has developed a formalized training program for all of its inspectors and engineers, and has linked this training, plus experience, to advancement.

MDOT uses consultants to both inspect and manage projects. Some of MDOT's consultant inspectors are ex-MDOT employees. MDOT is comfortable using consultants in this role because the inspectors are familiar with MDOT procedures and practices. MDOT noted that when consultants manage its projects, they are often reluctant to use their judgment and take responsibility for decisions concerning the need for inspection. The MRBA noted this same phenomenon.

MDOT developed QC/QA specifications for concrete and asphalt.

In order to reduce inspection costs and decrease the need for MDOT inspection, MDOT developed QC/QA specifications for concrete and asphalt.

MDOT categorizes its projects by size and type, and monitors its CE costs (which it defines to include direct charges only, with no markups) in each of its 33 different categories of projects. On smaller projects, MDOT's CE costs amount to about 8% to 9% of the overall project cost. On its larger projects, CE costs are about 4% to 5% of the overall cost.

VDOT

VDOT relies heavily on consultants to supplement its workforce; currently about 30% of VDOT's inspectors are consultants. VDOT's experience is similar to MDOT's in that they noted that consultants are reluctant to take responsibility for making decisions in the field.

QUALITY OF WORK

Inspection

In order to reduce the need for on-site testing and to better use its staff, VDOT has developed QC/QA specifications for concrete and asphalt.

VDOT has developed QC/QA specifications for concrete and asphalt

VDOT has also experimented with Contractor Quality Control (CQC). This has been used on seven projects, with mixed results. On CQC projects, the contractor is responsible for all testing, inspection, and reporting in accordance with VDOT standards, and VDOT simply monitors the contractor's progress, the test results, the documentation, and performs a periodical QA review. Such an approach minimizes VDOT's involvement. Thus far, however, VDOT reports that it is not completely satisfied with this approach and believes that its success requires a contractor commitment to quality that it has not found on every project.

VDOT uses its Construction Phase Inspection Manual to forecast project staffing requirements. This manual details the inspection frequency and the major objectives of each inspection activity.

VDOT's Statewide CE cost average is between 10% and 12%. VDOT's CE figures include direct charges plus mark-ups for overhead.

WSDOT

WSDOT is the only state among those surveyed that performs all of its inspections with its own in-house, full-time staff. The availability of such resources is explained, in part, by the fact that WSDOT's program size was recently reduced significantly.

WSDOT has an extensive training program for its inspectors, and requires certification or qualification for many inspection activities. WSDOT also links training and experience to a career advancement ladder.

WSDOT has an extensive training program for its inspectors, and requires certification or qualification for many inspection activities. WSDOT also links training and experience to a career advancement ladder.

WSDOT's CE figure includes all expenses required to support a project engineer's office, including direct and indirect payroll expenses, rent, utilities, equipment, supplies, vehicles, fuel, etc. This figure varies widely depending on the nature, size, and location of the project. Current CE rations run from 12% to 20%.

Quality of Work

Inspection

WISDOT

Almost 50% of WisDOT's inspectors are consultants, many of whom are ex-WisDOT employees who have joined the consulting firms in part because they are better paid as consultants.

WisDOT has implemented a Quality Management Program (QMP). This program, which applies to asphalt, concrete (structure and pavement), base and subgrade items, shifts the inspection and testing responsibilities to the contractor. WisDOT personnel are only required to perform QA reviews and tests. This has permitted more efficient use of WisDOT's project staff and greatly reduced the number of inspectors required. District personnel liked the QMP specifications and expressed the opinion that the quality of the work has increased with its implementation.

WisDOT has also let some warranty asphalt projects on two-lane roads.

WisDOT has also let some warranty asphalt projects on two-lane roads. When this specification is used, WisDOT performs minimal inspection. WisDOT has developed QC/QA specifications for concrete and asphalt.

WisDOT assembled a process improvement team to study inspection requirements. This team has developed a Critical Inspection Report

In order to clearly define inspection guidelines, promote uniform inspection standards statewide, and provide staffing level assistance, WisDOT assembled a process improvement team to study inspection requirements. This team has developed a Critical Inspection Report that analyzes 34 different construction operations with respect to the risk assumed by the owner if inspection is not provided. From this analysis, the frequency of inspection and the level of inspection were developed. Although this report was not finalized at the time of our visit, it appears that this methodology and study will provide WisDOT with an excellent management tool to aid in its efforts to reasonably reduce inspection costs.

WisDOT uses CE costs as a performance measure for its resident engineers and districts. As they define CE, it includes direct salaries, mileage, and expenses. Target values are established based upon project size and type. The budget target is established at the start of a project and monitored throughout its duration.

General

In order for state transportation agencies to meet the needs of the traveling public, changes have occurred in the contracting process. Some of these changes have been mandated by the taxpayers of America to meet the growing needs of social and economic growth. For instance, the traditional design-bid-build format for project delivery is very time consuming and may not be able to keep up with the growth in an area. Other changes in the contracting process seem to be driven by the reduction in the size of staff and by technological advances that enable greater productivity.

Regardless of the cause, innovative contracting methods were being used in every state surveyed. FDOT and MDOT were most aggressive with their innovations. FDOT uses some form of innovative contracting on approximately 66% of its projects, and MDOT is using at least one or more of these methods on approximately 50% of its projects.

innovative contracting methods were being used in every state surveyed.

Among the innovative contracting methods used in the states surveyed were design-build, A+B bidding, lane rental, warranty, value engineering, Incentive/Disincentive, bid average method, no excuse bonus, liquidated savings, and lump sum bidding. A brief explanation of each of these methods and an analysis of findings on how the surveyed states have implemented these methods in their construction programs is set forth below.

DESIGN-BUILD

Definition

Design-build (D-B) is a process by which a single entity provides both design and construction under a single contract between the agency and the D-B contractor. D-B is used to accelerate completion of a project by allowing construction to begin before the final design is completed.

Objectives of Design-Build

A. Time Savings: Compared to traditional contract procurement, time is saved when the project construction begins prior to completion of the design. When the design and construction periods overlap, redesign periods and bidding periods are greatly reduced or eliminated.

Design-build brings together designer and constructor to foster creative new ways of advancing innovation on Projects.

Quote taken from Testimony of Rex Huffman speaking on behalf of the Design-Build Institute of America

B. Administrative Savings and Other Benefits:

1. Design-build assigns the design and construction to a single party, allowing some construction work to begin before the final design is completed.

2. Design-build gives singular responsibility (single point of contact for quality, cost, and schedule).

3. Design-build reduces administration and inspection costs.

4. Design-build reduces or eliminates change orders and claims due to errors and omissions.

5. Design-build allows the contractor increased flexibility in the selection of innovative designs, materials, and construction techniques.

6. Design-build provides expertise not available in-house, for example, design and installation of intelligent transportation systems.

7. Design-build-warranty provides a warranty provision that promotes quality/performance during and after construction.

Design-Build Findings

ADOT, FDOT, MDOT, WSDOT, and WisDOT evaluate proposals and award design-build projects by using a two-step process. In the first step the technical proposal is evaluated and given a numeric score. In the second step, the overall rating of a proposal is determined by dividing the price proposed for the project by the technical evaluation score. FDOT and MDOT require that the contractor separately submit technical proposals and pricing proposals. On projects where the DOT has little experience, or where innovative technology is required, ADOT, FDOT, MDOT, WSDOT, and WisDOT, use a technical review

committee to select a shortlist of three to five firms based upon qualifications. Short-listed firms then submit more detailed technical proposals that the review committee evaluates. Finally, the selection committee selects firms based upon an adjusted score.

ODOT uses a one-step, competitive low bid only format to determine the successful proposal. Approximately 15% of ODOT's annual program is done design-build. ODOT's first six pilot design-build projects were let in 1995. ODOT's second pilot program was in 2000 and included 27 projects with a total value of $230 million. ODOT uses design-build when time savings is required.

Stipends are paid by FDOT, ADOT, and WSDOT to short-listed firms that submit detailed proposals. Generally, Value Engineering is not used on design-build projects.

ADOT sometimes uses A+B bidding in combination with design-build when time is particularly critical. The terms of the procurement usually provide that the shortlist technical proposals (3 to 5 firms) become the property of the DOT, and thus ideas contained in these proposals may later be incorporated into the project. ADOT pays a stipend equal to 2% of the proposed contract amount to unsuccessful proposers.

ODOT generally assumes the risk of differing subsurface conditions and third party (utility) coordination problems. Other states transfer all or part of the risk associated with these issues to the design-build contractor. Generally, even when the design-build format is used, right-of-way, environmental clearance, and railroad agreements are done by DOT's.

FDOT attempts to measure the effectiveness of its design-build contracting by measuring contract time, cost savings, and benefits to the public. These measurements are compiled in FDOT's Alternative Contracting Program Preliminary Evaluation, which is prepared by FDOT's Office of Quality Initiatives.

A 1991 evaluation of FDOT's design-build program by the University of Florida generated the following summary of data: 1) average design-build costs were 4.59% greater than the average design-bid-build costs, 2) average design-build total time (from scoping through completion)

was 35.7% less than the average design-bid-build time, 3) average design-build contract change order totals were 1.9% as measured against the original contract price, whereas, average design-bid-build contract change order totals were +8.78%, and 4) 74 percent of the surveyed participants in FDOT's design-build program indicated that the program should be continued with minor changes.

Last year, FDOT awarded three major design-build projects. These include a $72 million replacement project on St. George Island Bridge (Bryant Patton Bridge). All three projects are ongoing. In addition, three prominent bridges (I-4 St. John's River Bridge, Thomas B. Manual Bridge, and Peace River Bridge) are scheduled for design-build contracting by FDOT in FY 2000-01.

Virginia DOT Pocahantas Freeway - Design-Build, Finance & Operate - Privatized Project

A new law passed in 2001 will allow Virginia to do more design-build contracts. VDOT currently only has one design-build project. The only way to propose a design-build project in Virginia is pursuant to the Public-Private Transportation Act of 1995. This allows any private entity to submit an unsolicited proposal to VDOT to build or maintain a project on the highway system.

MDOT presently has a moratorium on design-build projects because it has experienced excessive cost overruns due to a of lack of proper scope definition in its procurements.

WSDOT has only one design-build project. Special state legislative exception was needed for this two step RFQ/RFP process. This project, which is located in Vancouver, began in the winter of 2000-01. WSDOT now has design-build authority for all projects greater than $10 million.

WisDOT has only one design-build project. Special state legislative exception was needed for this two-step RFQ/RFP process. This project, which is located in Milwaukee, began in the summer of 2000.

A+B BIDDING

Definition

A+B bidding is a cost-plus-time bidding procedure. The low bidder is selected based on a combination of the contract bid items (A) and the time (B) needed to complete the project or a critical portion of the project. The contract bid items (A) and the time to complete the project (B) are assigned a monetary value.

Objectives of A+B Bidding

A. Minimize the amount of construction or road closure time.

B. Encourage innovative construction practices and enhance the level of effort put into scheduling.

A+B Bidding Findings

ODOT presently uses A+B bidding frequently on smaller projects that require total road closures. ODOT is also considering the use of something similar to Kentucky's Optional Pavement Warranty, or "A+B-C." In this format, the "A" and "B" portions are the same as above; however, the "C" component involves credit based upon the number of years of optional pavement warranty proposed.

VDOT is also considering the use of an "A+B+Q" method. The "A" and "B" portions are the same as above. The "Q" component involves the quality rating given to contractor's work by the "C-36" report card used by VDOT for such purposes.

WSDOT has recently awarded two smaller projects using this method of bidding. In the first case, A+B had no effect on the bidding and no observable effect on the progress of work. The second, just underway, experienced an award to the second low bidder, who included a smaller number of days.

MDOT has used A+B bidding for several years on a variety of projects and reported that A+B bidding resulted in significant time-savings.

ADOT presently has eight A+B projects, some have an incentive provision in the contract to encourage the contractor to complete even earlier.

FDOT's use of A+B bidding has significantly increased in recent years (FY 1996-97, seven projects; FY 1997-98, thirteen projects; FY 1998-99, twenty projects). Out of these 40 projects, ten had been completed by July 1, 1999. An analysis performed in 1999 compared the completed total bid days, to FDOT's maximum contract time and showed a savings in construction time of 37%. A comparison of total bid days to days used noted an additional 1% decrease in time. On these same projects, FDOT indicated that costs had been successfully maintained. That is, cost overruns as measured by FDOT (present cost totals compared to amount contained in the bid totals) were approximately 4%. This 4% average cost increase on these A+B projects is significantly less than the Florida Transportation Commission's reported average total cost adjustment increases of 14% for all completed projects in FY 1998-99.

In general, contractors and DOTs felt that the A+B bidding technique positively impacted the quality of planning and decision-making by contractors. In addition, most noted that A+B created a pro-active approach for the contractor to accelerate the project time and to achieve the incentive.

Lane Rental Project at Night Over the James River, Virginia

LANE RENTAL

Definition

Lane rental provisions assess the contractor daily, or in some cases hourly, rental fees for each lane, shoulder, or combination of lanes and shoulders closed to traffic during a project. The lane rental fee is typically based on road user costs and daily costs incurred by the agency.

Objectives of Lane Rental

A. Transfer costs incurred by the traveling public to the contractor. Lane rental allows the costs associated with delays, detours, and accident frequencies to be considered in the development of the project schedule. The costs of keeping a lane closed are then

transferred to the contractor by having costs assessed for late openings.

B. Encourages the contractor to use innovation in planning, scheduling, and performing its work to minimize lane/shoulder closures

Lane Rental Findings

All seven of the surveyed states use lane rental on select projects. Formats and formulas varied from state to state.

FDOT has begun to develop a database relating to its lane rental projects. Statistics gathered so far indicate that ten out of FDOT's 17 lane rental contracts have been completed. On those contracts, creative strategies were implemented to reduce lane closures. In fact, a comparison of FDOT's official lane rental days, to the number of lane rental days bid, indicates a 73% decrease in the time lanes were out of service. A comparison of total lane rental days bid to the actual lane rental days reflected a 29% decrease in lane closures. Cost adjustments for lane rental contracts are comparable to the department's overall average cost adjustment increase of 14%.

MDOT uses a variation that it calls a ramp rental. Under this format, the contractor is given an incentive to shut an entire ramp, completely redo it, and open it to traffic within an accelerated time period.

Contractors, in general, reported that they liked the lane rental incentives.

WARRANTY

Definition

A warranty or guarantee contract requires that the contractor guarantee the integrity of its product for a period of time, and makes the contractor responsible for the cost of replacement or repair of deficiencies in its work during that time. Warranties are common with manufactured products. Highway construction warranties, however, are applied to a specific product or work item. Generally, highway warranties provide for a two-to-seven-year warranty period, and cover only those items for which the contractor has full control. Routine maintenance associated with normal wear and tear is not included.

Objectives of Warranty

A. Warranties lower the owner's risk by providing assurance that the contractor will correct early failures that are due to poor materials or workmanship that may have gone unnoticed during construction. This eliminates or reduces costs related to early maintenance.

B. Performance based criteria encourage contractors to choose an optimal product and design.

C. Warranties encourage the development of innovative technologies in materials, equipment, and construction processes.

D. Sureties generally appear to be willing to offer longer-term warranty bonds to a sufficient number of qualified bidders.

Construction Warranty Development Summary: The Michigan Department of Transportation is developing a comprehensive construction warranty program as summarized below. The use of a warranty covering workmanship, materials and/or performance has greatly reduced the inspection and testing requirements on construction projects. For projects including a 2-5 year warranty on the finished product, the total Construction Engineering Costs are typically less than five percent of the contract total. (This compares to construction engineering costs of 10-15 percent on traditional contracts.) This is proving to be a very effective tool in coping with construction field staff reductions.

Statement taken from FHWA Web Site

Warranty Findings

Warranties were most often used on projects or work items that have performance attributes, or failure thresholds, that can be explicitly defined in the specifications and measured in the field.

Work items that were subject to warranty requirements in the states surveyed included:

- Hot Mix Asphalt—ODOT, MDOT, FDOT, and WisDOT
- Asphalt Chip Seals—ODOT, ADOT, and MDOT
- Bridge Decks, Full Depth—ODOT and FDOT
- Bridge Deck, Overlay—ODOT and FDOT
- Bridge Painting—ODOT, MDOT, FDOT, and WisDOT
- Pavement Markings—ODOT, MDOT, and VDOT
- Signs—ODOT and FDOT
- Concrete Pavement—ODOT, MDOT, and WisDOT
- Capital Preventive Maintenance—MDOT

Two states, Ohio and Michigan, had legislative mandates to do a certain percentage of all projects with warranties.

VDOT and ADOT were not in favor of warranties on roadways in part because of enforcement difficulties stemming from the inability of the state to assure that design loads would not be exceeded.

Those agencies that favored the use of warranties agreed that it was important to limit the risk by only asking for warranties on the elements under the contractor's control, and by using on roads with relatively predictable design criteria and stable base conditions. In general, states using warranties have noticed an increase in quality of work performed on warranted items, and contractors that take additional care in performing the warranted work. Statistics concerning the marginal cost of warranties were not available. Also, many of the warranties have yet to expire, so data concerning enforceability is not yet available.

VALUE ENGINEERING

Definition

Value engineering change proposals (VECP) are a cooperative effort that allows a contractor to suggest changes in a project's design or specifications and share in any cost savings that result from the suggestion after the project has been awarded. The cost difference between the original contract amount and the changed contract amount are normally divided equally between the contractor and the owner.

Objectives of Value Engineering

A. Provide an incentive to the contractor to suggest innovative cost or time-saving designs and methods.

B. Generate significant life-cycle cost savings to the owner and the contractor.

Value Engineering Findings

ADOT, WSDOT and FDOT have designated staff specialists to evaluate all VECP's. The goal of these teams is to not only properly analyze proposals, but also to incorporate the new ideas into future plans, thereby only paying for the value engineering once.

ODOT, ADOT, VDOT, WisDOT, MDOT, and WSDOT all use VECP to generate savings of time or money, as determined by the department, without impairing the essential functions and characteristics of a project.

INCENTIVE/DISINCENTIVE

Definition

An incentive provision pays the contractor a daily amount of money for each calendar day a designated portion of the work is completed (and unrestricted traffic is restored) before a target date set forth in the contract.

A disincentive clause assesses a credit against the contract amount for each calendar day the contractor overruns the target date set forth in the contract for the completion of the designated portion of the work.

Objectives of Incentive/Disincentive

A. To significantly shorten the actual time that the contractor's work creates a restriction upon traffic flow in the work area.

B. Minimize inconvenience to the public on projects where severe traffic delays are predictable.

C. Encourage innovative scheduling and planning by the contractor.

D. Discourage poor scheduling and planning by the contractor.

Incentive/Disincentive Findings

All states surveyed use some form of I/D based on interim milestones or total contract time. ADOT, in order to promote a positive partnering atmosphere, usually does not include a disincentive.

It was reported that contractors generally react favorably to this format and are more conscientious about shifting crews and wrapping-up work in order to maximize the incentive dollars they earn. FDOT reported

that 35 contracts have been awarded using the I/D technique. On 16 of these projects that have been completed, days used compared to official contract days reflected an 8% time increase; however, this statistic compares favorably to the average on all FDOT projects, where there is a 28.9% increase in time. Similar results occurred with respect to cost. That is, final actual cost totals for completed projects using I/D was 6% greater than the original bid totals; however, this is less than half of the total cost adjustment on all FDOT projects, which averaged an increase of 14%.

BID AVERAGE METHOD

Definition

Bid Average Method (BAM) bidding is best used where there is ample competition in the project area. When three or four bidders participate, the bid closest to the average is selected. When five or more contractors bid, the low bid and the high bid are excluded, and the bid closest to the average of the remaining bids is selected. If there are any irregularities in the bid, the bid is thrown out, and the next closest to the average is selected.

Objectives of Bid Average Method

A. Get the contractor to bid a true and reasonable cost for a project.

B. Minimize claims and costs overruns.

Bid Average Method Findings

FDOT is the only state that has used this technique. They used it primarily on smaller projects (i.e., mowing contracts). FDOT reported that this method actually accelerated two out of the three projects that have been completed so far. Only four FDOT projects (three completed) have used this technique. The intent of having contractors bid a more realistic cost, thereby minimizing cost overruns, has borne results, as these contracts have only overrun by 4%. FDOT felt that BAM bidding is preferable when a “low bid” is anticipated to be a significant problem, such as can be the case when inexperienced or unsophisticated contractors bid on small maintenance projects.

NO EXCUSE BONUS

Definition

No excuse bonus is paid when a contractor completes a project within a specified time frame regardless of any and all unforeseen conditions. These bonuses are tied to a "drop-dead" date (time frame) that is either met or not met. Unforeseen conditions, weather delays, and other issues that normally extend contract time, do not extend a no excuse target date. If the target bonus date is not met, the contractor will not receive the bonus.

Objectives of No Excuse Bonus

A. Shorten the construction time that would normally be required to perform the work.

B. Motivate efficient construction to complete by a date certain.

C. Eliminate delay claims relating to the target date.

No Excuse Bonus Findings

FDOT and VDOT are the only states where this technique is used. FDOT reported that some contractors were reluctant to devote additional forces or otherwise expend additional money in an attempt to meet a target bonus date if unforeseen conditions might result in its efforts being a waste of money. Sixty-three projects have been awarded by FDOT using the no excuse bonus technique, with 16 completed contracts. This is the most widely used alternative contracting method used by FDOT. A comparison of FDOT's official days to days used reflects an average 2% decrease in time. Actual final cost totals increased 6% over the original bid totals. Four out of sixteen contractors failed to achieve bonuses. Bonuses awarded totaled just over $2.8 million.

VDOT has one project using a no excuse bonus. This project involves the reconstruction of I-95/I-495 interchange at Springfield and it has a $10 million no excuse bonus.

LIQUIDATED SAVINGS

Definition

Liquidated savings is the opposite of liquidated damages. This alternative contracting technique does not require input from the contractor during the bidding and award process, as the liquidated savings amount is fixed by the DOT. Typically, a cap is fixed by establishing a maximum aggregated liquidated savings.

Objectives of Liquidated Savings

A. Encourage contractors to finish projects early.

B. Realize administrative cost savings because of the time savings.

Liquidated Savings Findings

FDOT is the only state using this technique. Contractors have generally reacted favorably to this incentive when scheduling their crews. This is the only incentive technique that ties an incentive to allowable contract days (i.e., time extended due to weather, changed conditions, etc.). In January 1998, FDOT changed its specifications for A+B, I/D, and lane rental to tie the incentive to the original contract time, without time extension allowances, other than for catastrophic events. Based on 10 completed liquidated savings projects, time was reduced by 1% from the original contract time; whereas, a comparison of days used to present days shows a 20% decrease. Final cost adjustments on contracts using liquidated savings were 11%.

LUMP SUM BIDDING

Definition

Lump sum bidding allows the department to put together the design package without providing quantities. The contractor is required to calculate quantities and develop a lump sum bid, as opposed to bidding unit prices on individual pay items with quantities provided.

Objectives of Lump Sum

A. Reduce quantity overruns due to errors in quantity calculations.

B. Reduce contract administration costs associated with quantity verification and measurement.

Innovative Contracting

C. Make the contractor take a closer look at the project prior to bidding.

Lump Sum Findings

FDOT is the only state among those surveyed that is currently using this technique. The contractors take more risk in developing a bid, since the bid is based on their own calculations. The low bids received on these FDOT projects have averaged 9% higher than the official contract estimate. This technique has grown in popularity in northeast Florida and continues to be used experimentally in other FDOT Districts.

Partnering

General

The idea of partnering is alluring to all. Yet, even at ADOT, where partnering has been established and a part of its culture for many years, some field personnel cling to the notion that partnering favors the contractor more than the DOT. Regardless, experience of those states surveyed suggests that, to be effective, partnering must be supported from the top down, and the changing of skeptical attitudes takes training, time, and plenty of feedback.

ODOT

ODOT intends to formalize its partnering process on construction projects during 2001.

ODOT intends to formalize its partnering process on construction projects during 2001. Some districts use two-day facilitated work sessions at the start of a project, but such practices are not standard.

When used by ODOT, the partnering process includes a workshop agenda, facilitated by either in-house or outside (90%) facilitators. The workshops last one or two days. Work groups address project specific issues, and agree upon a process for escalating decision-making. A charter is developed and signed. Third parties are involved.

The informal criteria used by ODOT to determine the types of projects to be partnered include large projects, complex projects, and projects that have a high impact upon the traveling public.

ODOT does not maintain a separate historical database for partnered projects. A system designed to permit ODOT to maintain comparative statistics is under development. ODOT does maintain records that note the number of claims, projects completed on time, projects completed within budget, and complaints. Also, ODOT's C95 contractor evaluation form is likely to capture data that is relevant to assessing the effects of partnering.

The industry's perspective on partnering is mixed. Some smaller contractors are not supportive of partnering initiatives.

When used by ODOT, partnering has generally been reported to be successful. The opinions of project personnel are mixed regarding the benefits of formalized partnering. Some claimed to practice informal partnering on all projects. Most reported that partnering was particularly beneficial on projects with third party partners (railroad, local utilities, etc.). However, these observations are only anecdotal because ODOT has not quantified the benefits of partnering yet.

OCA representatives indicated that attitude dictates whether or not partnering is successful. OCA supports partnering as long as all parties are committed to it. OCA believes that partnering is best accomplished with good communication between the parties in the field, at the job site level. OCA believes that formalized partnering is not necessary if good communication is maintained on the job.

ADOT

Partnering was implemented by ADOT in 1992, following a pilot program in 1991. Senior managers in ADOT now assert that partnering has resulted in a fundamental cultural change in the way its business is conducted.

ODOT team on ADOT rural district Site visit.

ADOT's partnering specification allows the contractor to choose to enter into a partnering relationship. The specifications for all projects include such partnering provisions. Smaller, less complex projects conduct abbreviated workshops. Two-day workshops are offered on larger projects for stakeholder buy-in as required. Partnering training is provided to all new ADOT hires.

ADOT's partnering process typically consists of the following: 1) selection of one of a variety of workshop models of various lengths, 2) development of, and agreement upon, an issue resolution and issue escalation process, 3) an evaluation process, called the Partnering Evaluation Program (PEP), that ADOT has developed, and 4) a project close-out process that highlights lessons learned and provides feedback to the project staff.

ADOT also regularly offers partnering education classes that include the following topics: 1) introduction to partnering, 2) how to conduct a partnering workshop, 3) how to make partnering work in the field, 4) leaders guide to issue resolution, 5) leading in a partnering environment, and 6) mediation courses.

Arizona DOT Bridge at Roosevelt Lake

ADOT has made it clear that it expects all project teams to participate in partnering. ADOT employees are expected to conduct themselves as a partner. The Contract Administration Staff has been informed that ADOT expects partnering to be applied as the DOT business practice in administering contracts**.** Partnering is a systemic part of ADOT culture with respect to Contract Administration.

Statistics provided by ADOT for projects completed between July 1991 and June 2000 is as follows:

- 829 completed projects.
- 8.7% average time Savings (11,102 Contract days saved).
- $24.3 million in construction engineering savings.
- $8 million in construction value engineering savings.
- 3% project budget overruns.
- Total of only 2 arbitrated construction claims since 1994.
- Partnering Evaluation Program (PEP) yields lessons learned, which are then discussed with the design staff and used to minimize recurrence of such problems.

The Arizona AGC fully supports partnering with ADOT. Larger contractors believe and follow partnering concepts at the mid and senior management levels. Field personnel do not always understand the value-added benefits of partnering, and as a result, field employees will sometimes try to gain an unfair advantage. Nevertheless, partnering is the way ADOT conducts business.

Rank and file ADOT employees interviewed during the survey reported mixed feelings with respect to the benefits of partnering. Some field personnel indicate that their jobs are made easier by partnering. Others feel that partnering is just a "give away" program, and see no great benefit to the state. There is a fairly widespread perception among ADOT's field level personnel that ADOT partners, but the contractor benefits from the effort more than ADOT. In an effort to provide more feedback to its field personnel and improve their attitude toward partnering, ADOT has instituted a procedure whereby issues decided at upper levels are written up with an explanation of the basis for the decision. This write-up is then returned to the project level.

Partnering by ADOT has resulted in:

- Establishment of a Partnering Office replacing the Claims Office. Prior to 1992, ADOT had a Claims Office.
- Fewer claims. At the onset of partnering, ADOT had 60+ outstanding claims totaling $40 million. Since 1992, only 2 cases have escalated to arbitration.
- Overall, final construction costs including incentives, change orders, force accounts, negotiated settlements, etc. have remained at or below 110% of the original bid amount.
- Projects continue to be delivered ahead of schedule (approximately 95% are delivered on or ahead of schedule.)

ADOT's partnering staff includes five, full-time employees in the Central Office in the Partnering Office, and its partnering budget is $565,000 annually, which is 0.5% of the overall construction budget.

Arizona AGC believes that partnering works on ADOT projects when upper management is committed to it. Because of partnering, claims do not exist, and paperwork has decreased because contractors do not have to document every detail. Contractors know that issues will be resolved through partnering. One contractor noted during our visit that its younger staff, hired since partnering commenced, would not know how to prepare a claim in Arizona, which illustrates how well partnering works. Arizona AGC expressed the opinion that the implementation of partnering is a five-year process because it takes that long for people to become used to it and for all parties to develop trust. Trust is the most important factor in

One contractor noted during our visit that its younger staff, hired since partnering commenced, would not know how to prepare a claim in Arizona, which illustrates how well partnering works.

partnering. Contractors believe that their best deal is cut at the project level; however, they also understand the need to escalate issues if a problem is not getting resolved. Typically, contractors do not escalate an issue until it threatens to affect the progress of the work.

FDOT

Major and complex FDOT projects contain partnering provisions as part of the contract documents. Partnering is at the contractor's option. For smaller and less complex FDOT projects, informal partnering is optional for both the contractor and FDOT.

FDOT District 3 site visit to bridge replacement project.

Bid items are established to cover the cost of the facilitator and other aspects of the kick-off meeting. The partnering specification contains the bid item listing. Consultants are also using partnering concepts to resolve project issues. Approximately 50 FDOT projects per year are partnered.

When used, FDOT's partnering process typically includes a workshop that is either a one-half day session for contractors familiar with partnering, or a two-day workshop if the parties prefer. Topics to be covered include relationship building and business issues including the development of an escalation ladder. During this workshop a charter is also developed and signed by all parties.

It was reported that formal partnering is not necessary for contractors that have a good long-term relationship with FDOT.

FDOT kept records on the number of projects partnered in the early 1990s to see if the concept was gaining in popularity. Once partnering became routine, record-keeping was discontinued. There are no formal partnering performance measurement methods in place; however, if a partnered project is successful, partnering is typically mentioned as contributing to its success.

FTBA members predominately favor partnering due to the improved human relations, and rarely decline an opportunity to partner. Partnering is considered by FDOT to be a contract management tool.

PROGRESSIVE PRACTICES

Partnering

FDOT experienced an adversarial relationship with contractors in the late 1980s, and partnering has served as a tool to improve business relationships.

Rank and file FDOT employees have mixed feelings with respect to benefits/usefulness of partnering; however, most FDOT personnel are supportive.

Senior managers at FDOT assert that the benefits of partnering include:

- Contractors are more willing to submit complete and accurate paperwork relating to extra compensation.
- More effort is expended in anticipating problems and resolving them before they adversely affect the progress of the work.
- Responses by both FDOT and contractor project personnel are more prompt.
- Decisions are made at the appropriate levels in accordance with the escalation ladder.
- Because of open communications, concerns and issues are discussed in advance of the work, when the opportunity to mitigate the impact of those issues is greatest.
- There are fewer claims, better communication, and improved relationships.

ODOT team on FDOT rural district Site visit.

The following is a description of the issue escalation process that FDOT typically implements. Within the contractor's organization, issues flow up from Foreman to Project Manager to Project Director. Within FDOT, issues flow from Inspector to Project Engineer to Resident Engineer to District Construction Engineer or Operations Engineer (Claims Review Board) to District Secretary. At each level of escalation, the contractor and FDOT personnel who could not resolve the issue must escalate the issue together and each make a presentation regarding the issue to the persons at the next level. Non-agreement on problems that are about to cause project delays are escalated immediately.

DRBs are occasionally used by FDOT. When they are used, they are project specific and established and managed in accordance with contract

provisions. The use of regional DRBs is being considered by FDOT. Florida courts may require mediation prior to litigation.

FTBA believes that the escalation ladder is a good way to resolve disputes and noted that partnering is only successful when both sides are committed to it.

FTBA believes that the escalation ladder is a good way to resolve disputes and noted that partnering is only successful when both sides are committed to it.

MDOT

MDOT Gathering data at a TSC

Partnering has been used by MDOT since 1991. Currently, MDOT's typical partnering process includes a one-half day workshop. When partnering was first introduced ten years ago, two-day workshops that focused primarily on team building were the norm. The goal of the workshop now is to focus on project specific activities and issues in an effort to avoid future conflicts. The workshop agenda focuses on issues, concerns, and barriers to open communication. A partnering charter is developed and agreed upon. The charter includes action steps, mission statements, goals and objectives, and an issue resolution/escalation process. All stakeholders sign the charter as a commitment to partnering.

large, complex projects greater than $2 million are partnered.

Generally large, complex projects greater than $2 million are partnered; however, smaller projects that have high public impact, or that are complex, may also be partnered upon request of the contractor or MDOT. Partnering also occurs on projects where consultants play a major role or where improved relations between MDOT and the contractor are desired.

MDOT has not instituted any formal partnering performance measurements.

A majority of the contractors feel that partnering is beneficial and that it allows for the mutual establishment of goals, promotes open discussion of major project-related issues, and provides an issue resolution process. Partnering also helps to clarify the roles and responsibilities of project personnel.

As in other states, rank and file MDOT employees reported mixed feelings with respect to partnering. MDOT senior managers favor partnering. Benefits of partnering include fewer project level conflicts, fewer claims, and improved teamwork.

MRBA believes that MDOT's partnering initiatives have been successful, yet notes that MDOT's program is less formal than other states. MRBA also noted that the success or failure of a partnering program is dependent on the receptiveness of all of the involved parties.

VDOT

Partnering is not regularly required by VDOT. VDOT independently selects the projects to be partnered.

ODOT team at Pocahantas Freeway Project.

The partnering process typically starts with a one or two-day workshop with facilitators (ice breaker). At this workshop, work groups address designated issues which may vary from project to project. An escalation process is defined, and a charter is prepared and signed.

Large, complex, and urban projects are most likely to be partnered.

Performance measure methods have not been established by VDOT.

Generally, the industry and VDOT personnel are supportive of partnering initiatives. Some field level VDOT employees feel that the contractors benefit more from partnering than VDOT.

when objectives are clearly understood, and when participants communicate openly, partnering is successful.

VRA noted that when objectives are clearly understood, and when participants communicate openly, partnering is successful. It believes that when partnering includes subcontractors and utilities the benefits to the project are even greater. Contractors also noted that in order for partnering to be successful, the emphasis must come from the top, and the decision-makers must be empowered.

WSDOT

Partnering has been used by WSDOT for several years and consultants are available to facilitate initial sessions. Some projects contain provisions requiring partnering, and other projects may be partnered at the discretion of the project staff, WSDOT, and the contractor jointly.

WSDOT's partnering process includes a one or two-day session that focuses on interpersonal relationships, communication skills, and dispute

resolution training. During this session, the parties also discuss and plan the project work with special emphasis on the most challenging aspects of the work. This session culminates with the preparation of a partnering agreement.

ODOT team on WSDOT urban district Site visit.

WSDOT does not employ special performance measuring methods on partnered projects.

Benefits of partnering that were enumerated by WSDOT include a 90% reduction in the frequency of claims since 1990, timely completion of projects, and more value engineering proposals.

WSDOT has entered into a formal partnering agreements with various trade and industry organizations.

Washington State AGC supports partnering and noted that a task force of small working groups meets three times a year with WSDOT personnel to discuss contracting issues.

WISDOT

WisDOT's districts use partnering voluntarily. Partnering is regarded as an optional contract administration tool to meet the needs of the project.

When WisDOT uses partnering, the process includes the use of a facilitator to conduct a one-day workshop. The goal of the workshop is to adopt a charter. Work is performed in one large group, and an evaluation process is developed to monitor adherence to the charter.

Generally large, complex projects are partnered; however, smaller projects with high public impact or compressed schedules may also be partnered.

Currently, WisDOT has compiled no discrete database for partnered projects. Such records were maintained from 1992 to 1995 when WisDOT first initiated its use of partnering.

PROGRESSIVE PRACTICES

Partnering

Performance measures for all WisDOT projects include completion times, budget, and construction quality. Reviews indicate that partnered projects yield higher performance scores in each of these areas.

Rank and file WisDOT employees have mixed feelings with respect to partnering. Informal partnering is reportedly used as good business practice; however, in dispute situations, there reportedly is very little emphasis placed on partnering. Nevertheless, senior managers in WisDOT identify the benefits of partnering to include:

- More projects completed within time and budget constraints.
- Faster and more economical problem solving.
- Improved working environment.
- Fewer claims.
- Non-adversarial resolution of claims when they do occur.

Contractors are supportive of partnering initiatives. They believe it works when all parties are committed to it. WisDOT and the contractors associations meet yearly to discuss issues, with technical meetings occurring quarterly. On many job sites the contractor and WisDOT meet with local businesses and residents to discuss the progress of the job and to hear concerns from the community, thereby extending the partnering approach even to those who are not parties to any contractual agreement.

ODOT team at G/I-94 Interchange Project.

BEST PRACTICES

Our research team has attempted to bring a high degree of objectivity to the task of identifying the Best Practices to be implemented by ODOT. During the process of analyzing the findings made during our survey and distilling them into this list of Best Practices, we applied a number of screens or filters designed to point us in the direction of those practices that yield the highest return. The screens were a series of questions that delved into whether or not the practice had certain beneficial characteristics, including:

IMPACT ON QUALITY—Does the practice result in a better product for the customer? How is the quality of the product or the quality of the service to the customer improved by this practice?
EFFECTIVENESS—Do we know that the practice is effective? How? Does it achieve what it is designed to achieve? Has the DOT that uses the practice attempted to measure its effectiveness? Has there been enough good data collected to make that measurement reliable?
COST/BENEFIT—What are the direct and indirect costs associated with implementing this practice? What are the direct and indirect benefits that flow from implementation of the policy? How are these costs and benefits measured?
USER SUPPORT—Can we realistically expect to implement this practice in our state? Are there legal impediments to its implementation? Are statutory changes required? Does it seem likely to be opposed by unions, contractors, or other important constituencies in our state?
COMMONALITY—Are most of the other states using this practice? Has their experience with it been positive?
UNIQUENESS—Is the practice unique? Or, is it really just a slight variation of another long-standing practice? Is it just an old practice with a new name?

These screens were applied to the construction contract administration practices of each of the seven state DOTs that were surveyed, including ODOT. The following list of construction contract administration practices have been identified as Best Practices for ODOT as a result of that process.

From ODOT's perspective, some of these practices are already in use. Some may be implemented by merely "tweaking" its current way of doing business. Some will require a fundamental change in ODOT's historical approach to the construction and maintenance of its roads and

bridges. Based upon the survey and analysis, it is believed that each will result in better quality roads, better service to the users and others affected by construction, and lower overall construction costs.

BASIC ORGANIZATION AND PROCEDURES

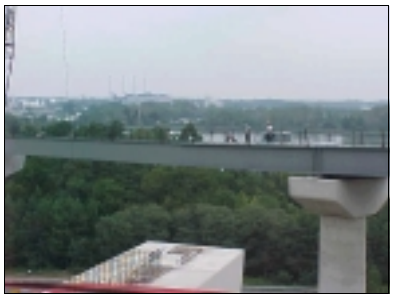
Organization and Staffing

1. *Create a core project staff with flexible skills and transparent boundaries.* Six of the seven states surveyed had been through significant reorganizations in recent times that had, among other things, resulted in the loss of a disproportionate number of its more experienced engineers and inspectors. In some cases, this was due to early retirement packages that, in effect, targeted the most experienced employees. In other cases, this was due to an increased use of consultants, and the attrition caused by DOT employees leaving the DOT to go to work for the consultants, who offered higher pay. As DOTs have moved toward doing more with less, it has become clear that reduced staffing levels are going to mandate that core engineering and inspection staffs have a wider variety of skills, and be willing to work in wider geographic areas than previously had been the norm. This can be achieved through expanded training programs and cross-training.

2. *Continue to use ODOT's "Thousand-Hour Transfer Program" in lieu of consultants for inspection, and enhance the program to ensure sufficient participants.* ODOT's 1,000 hour transfer program uses ODOT employees who work as maintenance workers during the winter months to work as inspectors during the peak construction season. ODOT believes that the chief benefit of this program is that it permits them to reduce their need to hire outside consultants to perform various construction-related functions by using personnel already on its payroll.

TRAINING

3. *Offer an expanded Training Curriculum that focuses on work elements.* WSDOT and FDOT each have extensive training curriculums for engineers and inspectors. MDOT uses a Work



VDOT Pocahantas Freeway Project.

Element Program for inspector and technician advancement. ODOT intends to borrow from each of these programs as it develops its own training curriculum.

4. *Require certification for certain tasks, and re-certification as necessary.* Concrete, bituminous, aggregate, and density testing and inspection represent such fundamental and critical aspects of road construction that the benefits of certification, and periodic certification renewals, far outweigh the cost of administering a training regimen designed to help assure the highest quality standards in these areas. Other areas, such as those dealing directly with personal safety (e.g., radiation safety) or the safety of the traveling public (e.g., managing a traffic safety plan), also demand a higher level of focus and training.

5. *Tie the Training Program to a career ladder.* The efficient management of the construction administration process requires experience, technical training, and a unique mix of interpersonal skills. Passing grades in key courses is an appropriate way to measure proficiency in critical technical areas, and therefore should be considered one of the prerequisites for career advancement. Because of the importance of experience and interpersonal skills, however, passing grades should not be the sole determining factor.

COMPUTERIZATION

6. *Continue to use ODOT's CMS software. Enhance, as necessary, to implement future documentary and procedural changes.* ODOT's CMS software generates progress reports, payments, and monitors the testing and quality assurance process. Thus, it is as versatile as any encountered during the surveying process. If and when changes in QC/QA practices and other procedures are implemented, these changes will need to be reflected in future updates of the program.

7. *Continue to enhance the Website as a source of valuable and current information.* Continue to develop ODOT's website to stay current with industry's movement towards 100% electronic contract administration.

DOCUMENTATION

8. *Continue to use ODOT's Contractor Prequalification and Evaluation process.* Objectivity and accountability are essential to fairly evaluate a contractor's ability to bid work. ODOT's procedures for evaluating contractors at the end of a project require that the project engineer list, in writing, specific examples to support any inferior rating. The contractor is then given an opportunity to appeal such a rating.

MDOT Concrete Pavement Resurfacing project.

9. *Eliminate the need for a Change Order prior to payment when plan quantity is exceeded.* Minor variations in quantities are virtually certain to occur on construction projects of any size. The benefit of the checks and balances that are a part of the change order process are outweighed by the documentary burden that accompanies such minor changes. Given that the checks and balances are maintained as a part of the finalization process, this interim burden can be eliminated with little risk.

10. *Establish a Contingency Line Item for use by the project engineer for minor changes encountered while the work is being performed.* States using a contingency reported favorably on the practice, noting that it eased documentation requirements, empowered project engineers to resolve matters efficiently, speeded up payment, and permitted early and final resolution of numerous small, otherwise troublesome matters.

11. *Establish a statewide Documentation Review Process to enhance constructability, uniformity, and quality.* Two of the states surveyed sought to minimize bid contingencies by performing formal constructibility reviews as part of its pre-sale procedures, and two others reportedly enhanced constructibility by making sure that its staff worked on both design and construction. Statewide uniformity of post-sale documentation was addressed in several states by means of a central office review of projects at various phases during a project. Those states reported both improved uniformity and more efficient project closeout often resulted from these efforts. It was felt that the added cost of the additional central office staff would be offset by lower contingencies and less troublesome closeouts.

Basic Organization and Procedures

12. *Continue to process progress payments with no retainage on a bi-monthly basis.* ODOT's standard practice for some years has been to pay contractors 100% of the amount earned, with no retainage withheld. This practice not only results in improved cash flow for contractors (and reportedly lower bids), but it also eases the administration of contracts and the monitoring of DBE and other subcontractor payments as well. If a particular problem with the quality or the progress of the work occurs, ODOT may invoke contract provisions that permit it to withhold contract dollars sufficient to protect itself from loss.

Contracting Practices

Specifications

13. *Implement a written policy for revising the specifications modeled on FDOT's process (Policy Topic No. 630-010-001-9), and model the process similar to MDOT and VDOT with standing committees covering functional areas, and an Executive Committee for final approvals.* Specifications need to change regularly to keep up with technological advances, product changes, and lessons learned on prior projects. A written policy that defines the process for revising the specifications seems certain to facilitate the specification updating process. The establishment of standing committees with specialized expertise to focus on one of the standard specification sections and be responsible for reviewing revisions to that specification section likewise will facilitate the process. An executive committee with authority to make all decisions regarding implementation of the revised specifications will provide the desired oversight of this critical function.

14. *Develop a policy for tracking plan notes and seek more uniformity in bid packages by implementing a bid package errors and omissions review prior to advertising.*

PROJECT SCHEDULING

15. *Expand the use of CPM schedules as tools for managing projects and analyzing claims.* Many of the incentive/disincentive type of innovative contracts are reportedly successful in reducing the overall time used to complete a project, in part because the project team focuses on ways to sequence and execute the work in the most time-efficient manner. In order to prepare a good CPM schedule for any project, a project team must focus on the planned durations, sequences, and relationships between activities on a project. The target here is shorter overall project durations achieved through enhanced planning and management practices.

16. *Develop CPM scheduling expertise in Construction Administration to serve as a resource for project engineers.* It is recognized that scheduling expertise cannot simply be mandated. Resources must be made available to assist in the enhancement of scheduling skills. While certainly valuable and necessary, software program tutorials and abstract training are not likely to be enough. These resources need to be supplemented by someone with real, hands-on experience and expertise as project engineers develop their skills and their confidence in scheduling techniques.

CHANGE ORDERS/CLAIMS AVOIDANCE/ANALYSIS TECHNIQUES

17. *Develop and implement a constructability review modeled on the "Plan Review" process used by MDOT.* Project costs can be dramatically impacted by a design that fails to take constructability issues into account. Claims can result from reasonable contractor expectations for construction that a particular design did not accommodate. A policy that requires a detailed plan review by the project engineer, and construction and maintenance personnel, while the project is still in the design phase, can identify and eliminate many issues before a project is advertised.

18. *Improve the focus and effort put into Geotechnical Design and Subsurface Investigations.* Differing site conditions are among the most common cause of claims. More and better subsurface

investigations prior to beginning work on a project can help reduce the frequency and severity of such claims.

19. *Adopt a contractual formula approach to Home Office Overhead claims similar to that implemented by FDOT.* Commerce benefits from predictability. Settlement of a dispute is less likely when a contractor believes that it is entitled to a substantial recovery for home office overhead, but the owner thinks that such a claim is overstated or without merit. Also, each side of the dispute is likely to spend more money hiring experts to articulate and advocate their position. Contractually specified formulas, such as those drafted by FDOT can do away with the uncertainty related to the calculating of costs and improve the likelihood of dispute resolution.

20. *Establish policies and procedures designed to encourage the forward pricing of Changes Orders.* It seems that no one likes to use force account, or time and materials pricing, yet many are afraid of getting "taken" if they agree to forward price changes. To overcome this fear, encouragement of forward pricing must come from the top down. WSDOT reported using forward pricing extensively, especially in time-related situations involving accelerations and/or extensions of time, and were pleased with the fact that the practice seemed to eliminate the basis for subsequent claims relating to those issues.

21. *Implement the Use of Disputes Review Boards on Select Projects.* The use of Disputes Review Boards on projects where the risks cannot be clearly defined, is a proven method to address the issue of risk allocation in an effort to mitigate the impact that claims can have on a project. FDOT is piloting a program that establishes multi-project, district-wide Disputes Review Boards. The goal is to find a more efficient and cost effective process for resolving disputes.

22. *Continue the use of ODOT's claim specification process, including the publishing of the Claims Digest to inform all stakeholders and promote uniformity.* Early identification and analysis of potential changes on claims is mandated by ODOT's standard specification. The notice requirements permit the parties to review potential claim

situations while mitigation measures may still be available. When ODOT resolves a claim, the resolution is written up and published so that both project engineers and contractors can see how ODOT's contract will be interpreted. Understanding how ODOT interprets its specifications is a benefit to contractors as it lends predictability to the bidding process.

MAINTENANCE OF TRAFFIC

23. Pilot Basis: *Use the "Indiana Lane Merge" system of moving traffic through work zones, as used by MDOT.* Well in advance of a construction zone, the traffic is merged into the right lane(s) eliminating the typical bottleneck that occurs when the public waits until the last minute to get into the merged lane(s). This only works with police enforcement preventing the public from using the empty lane(s) to pass the merged traffic. By always moving traffic to the right and snaking it back to the left if necessary, MDOT has eliminated driver confusion as to which lane they need to get into.

24. Pilot Basis: *Require both the contractor and ODOT to have ATSSA-Certified traffic supervisors at work zone sites at all times.* To demonstrate ODOT's commitment to the safety of the traveling public and the personnel working on its projects, it believes that the parties responsible for maintenance of traffic should be certified by ATSSA. This highlights the significance and increases the level of professionalism needed in these important positions.

25. Pilot Basis: *Designate a public relations person within each district to develop a Public Relations Plan for each significant project.* Model that role on ADOT's Transportation System Management (TSM). ADOT forms committees on every significant project to go out into the communities for public relations. TSMs are working meetings where all of the parties involved with a project discuss policy and schedule and how to report that to the community. TSMs meet once a month; and each TSM can cover more than one project. TSMs communicate on three levels—the local level with people and businesses immediately adjacent to the project; commuter or regional level with people traveling through the project; and the global level with television, radio, and newspaper announcements.

CONTRACTING PRACTICES

26. *Include "business signing," as used by FDOT, in the Maintenance of Traffic Plans and Specifications.* FDOT installs temporary signs at the entrance to all businesses within a project work zone. This helps to minimize the impact a project can have on the flow of customers to businesses within a work zone by reducing driver confusion in locating the entrance to the business. As a public relations tool, installing these signs demonstrates FDOT's commitment to minimizing the effects its projects have on the local communities.

27. *Continue to maintain a minimum of two lanes of traffic in each direction at all times on Interstates.* Maintaining two lanes of traffic on interstates helps to reduce the impact of construction on the traveling public. FDOT requires that the same number of lanes remain open through work zones as were open prior to construction.

28. *Continue to use off-peak work hours.* All of the states visited use off-peak work hours on its projects where working these hours reduce the impact the construction has on the traveling public.

QUALITY OF WORK

MATERIALS/QUALITY MANAGEMENT

29. *Continue to use ODOT's Quality Control/Quality Assurance approach to Asphalt, and adopt similar approaches for concrete, aggregate, and sub-base materials.* ODOT accepts the contractor's test results for asphalt, if the contractor's QC/QA plan has been accepted by the central laboratory, and if the test results for the asphalt have been verified by ODOT testing.

30. *Continue to use and expand a program for the acceptance of manufactured materials through a materials certification program based upon the manufacturer's quality control results.* ODOT central laboratory accepts a manufacturer's sampling, testing, and certified data if the manufacturer is part of ODOT's plant sampling and testing program. ODOT maintains a list of approved products. Contractors almost exclusively use program suppliers to avoid sampling and testing delays. Accordingly, manufacturers are

generally limited in the amount of work they can perform if they are not part of this program.

INSPECTION

31. *Establish a Process Improvement Team to analyze inspection requirements and identify "critical inspection items" similar to WisDOT and VDOT's inspection programs.* WisDOT assembled a process improvement team that studied inspection requirements. The team developed a Critical Inspection Report that analyzed 34 different construction operations with respect to the risk assumed by the owner if inspection was not provided. From this analysis, the frequency of inspection and the level of inspection was developed for these "critical items". The identification of the "critical inspection items" will enable ODOT to effectively manage its inspection efforts thereby reducing its inspection costs.

32. *Reduce documentation requirements associated with inspection and testing.* Eliminate some of ODOT's verification sampling and testing, and rely instead on contractor and manufacturer QC/QA documentation for acceptance and payment. This will reduce the amount of redundant documentation.

PROGRESSIVE PRACTICES

INNOVATIVE CONTRACTING

33. *Continue Pilot Programs using Warranty and Design-Build contracting formats.* Warranty projects seem to be an appropriate corollary to the trend toward placing more responsibility for QC/QA on contractors. The practicality of enforcement of warranty provisions, however, has yet to be fully tested in practice and in the courts. Similarly, the pace of development and the desire to be more responsive to the needs of the traveling public seem to demand the shortening of the time between identification of a project and its completion. Design-build contracts seem best suited to meet these demands on time sensitive projects where the public is impacted.

34. *Develop an alternate contracting program, similar to FDOT's, which uses innovative contract management methods designed to encourage the contractor to use creative means and methods to save time, improve quality, and serve the customer better.* Through this program, pilot the use of innovative contracts such as A+B bidding, no excuse bonuses, lump sum contracts, A+B–C bidding, liquidated savings, lane rentals, and incentive/disincentive. These methods entail multiple objection. They include easing the inconvenienced suffered by the traveling public, promoting quality, and simplifying administration of contracts (lump sum). As in the case of FDOT, it is important to establish benchmarks to measure the success of these methods.

35. *Expand the use of Value Engineering and establish a procedure for reporting its use, so that this year's Value Engineering ideas make it into next year's plans and specifications.* All states seem willing to pay for better ideas. The purpose of these procedures is to make sure that the state pays for these ideas only once.

PARTNERING

36. *Model a Partnering program around ADOT's program, recognizing that commitment to Partnering must come from the top down, and that it will likely take several years before a true cultural change in the industry takes place*. Claims and litigation create animosity and hinder the willingness of the parties to communicate freely and openly. Partnering tries to do the opposite. ADOT reports that its Partnering initiatives have essentially eliminated claims, have kept total contract expenditures including incentives, change orders, force accounts, negotiated settlements, etc. at or below 110% of the original bid, and resulted in 95% of its projects being delivered on or ahead of schedule. Yet, it seems that old ways die hard, and half-hearted attempts to implement partnering are ineffective.

37. *Use FDOT's dispute escalation method*. If an escalation ladder is simply a way to get a problem off of one's desk, it is more likely to be misused or overused. If the party that has been unsuccessful in resolving a claim is required to present his case to his supervisor, a different mindset may be present.

POTENTIAL BEST PRACTICES FOR FURTHER STUDY

This additional category lists those practices that seem to have the potential to be "Best Practices," but either have not been in effect long enough to know whether or not they have been effective, or the Team has not collected enough information during this survey to thoroughly understand the practices.

It is ODOT's intention to review these practices further with the designated representatives from the host DOTs to determine whether or not these practices meet the criteria to be designated a "Best Practice".

ADOT safety program—inspect every project and fill out safety checklists. ADOT is proactive in how it addresses safety on its projects. Every ADOT employee is involved with two safety training programs including the statewide Supervisor's Training for Accident Reduction Training (START), and the district-wide, 40-hour, safety-training course, with an 8-hour annual refresher course. Safety is also a performance measure used when evaluating an individual's performance. It is also a component in ADOT's Performance-Based Incentive Pilot Program.

Contractor safety plans are required to be submitted at all preconstruction conferences and are reviewed by ADOT safety personnel. Safety is also required to be a topic for discussion at all project progress meetings. ADOT performs quarterly safety inspections of every project. During these inspections, ADOT uses an Onsite Project Safety Inspection Program Checklist that was developed to evaluate each project's safety performance.

VDOT's Safety Office. Similar to ADOT, VDOT is proactive in how it addresses safety issues on it projects. It is involved in both VDOT and contractor safety compliance. VDOT also offers extensive training for both its employees and contractor employees. VDOT will stop work if conditions are unsafe.

Manpower Planning Program. ADOT has developed a program to evaluate each project's staffing requirements and whether its various projects will be staffed with ADOT personnel, consultants, or a mix of the two. ADOT can also assign personnel to projects outside of that individual's district if needed.

Performance-Based Incentive Pilot Program is a pilot program where every month each member of the ADOT project team can earn up to $100 in incentive pay based upon that project's overall performance. The personnel performance measure is made up of four components—project manager's report, safety, progress payments, and customer service. This program had only been in effect for eight months at the time of our visit; however, after initial skepticism, it was reported that ADOT's employees were very receptive to it.

ADOT's Partnering Evaluation Policy (PEP). All ADOT projects are evaluated on a monthly basis for quality, communication, issue resolution, schedule, and teamwork. Projects can also be evaluated based upon five project-specific categories. Everyone on a project including the ADOT staff, consultants, contractors, subcontractors, suppliers, etc. are responsible for filling out PEP forms on a monthly basis. The information is then entered into a sequel server from the project, and the results are summarized. Feedback is given to all of the project participants, and projects that receive a score of below 2.5 for three or more months are designated as needing help.

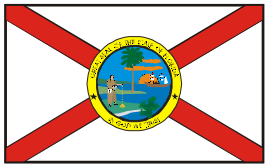
Investigate master agreements or other methods to better manage utility relocations. FDOT has begun to develop master agreements to better manage coordination of utility company relocation work. MDOT's Real Estate Division is responsible for, and has been successful in, obtaining compensation from utility companies through project-specified agreements to offset delay damages incurred by the state.

VDOT's use of Zipper Barriers for MOT. Zipper barriers are typically Jersey-type barriers that can be moved easily. These barriers can be moved during the day when there are a limited number of lanes available to accommodate rush-hour traffic. During the morning commute, the barriers can be positioned to permit traffic to move along a particular lane or lanes in one direction. During the afternoon commute, the barriers can be repositioned to allow traffic to move along the same lane or lanes in the opposite direction.

CONCLUSION

You have probably heard the expression "There's more than one way to skin a cat." Well, let us assure you that the team conducting this survey now knows with absolute certainty that "There's more than one way to build a road!"

The Team witnessed first-hand that American ingenuity is alive and well in the transportation industry across the United States. The variety of practices, the willingness to share experiences, and the eagerness to hear about the experiences of others gave ample testimony to whole-hearted, on-going efforts to achieve excellence by the Departments of Transportation and the industries serving them.



The rate at which construction practices change is rapid, and seems to be accelerating. These changes do not come without the pain of an occasional error. But an occasional error does not seem to be dampening the transportation community's zest for trying out new and, hopefully, better ways of building and maintaining its roads and bridges. This is true regardless of whether the change in question deals with technological, contractual, or administrative aspects of road and bridge construction.

This report identifies and describes a wide variety of practices. The Team has analyzed these practices as objectively as possible to come up with a list of best practices for its client, the Ohio Department of Transportation. The survey team strongly believes that implementation of these best practices will yield more cost-effective ways of designing and building safer, better quality roads and bridges in shorter timeframes, and with less inconvenience to those using those facilities, as well as those affected by the construction activities.

Given the pace of changes in the industry, the survey team also recognizes that some of the best practices set forth herein are likely to become out-dated in the relatively near future. Therefore, our final recommendations are that the transportation industry continue to support studies such as these and continue to be willing to freely and candidly share information and experiences with one another.

ACKNOWLEDGEMENTS

Knowing that the road-building industry bombards its members with survey after survey, the Team tried to be sensitive to the possibility that the selected host states may have been less than eager to answer yet another survey. Without exception, however, the Team members were met at each state with boundless enthusiasm, endless cooperation, and gracious hospitality. The Team extends a well-deserved thank you to all of those who gave their active support to this study for their time, insight, and selfless participation.

The professionalism and hospitality displayed by each state to the Team during its visits flows from the top down. The Team recognizes Mary Peters, ADOT Director, Thomas F. Barry, Jr., FDOT Secretary, James R. DeSana, MDOT Director, Charles D. Nottingham, VDOT Commissioner, Sidney Morrison, WSDOT Secretary of Transportation, and Terrence Mulcahy, WisDOT Secretary for making their people available, and for opening their doors to receive us.

Recognition also goes to the designated contact person(s) and their staffs from each host state who orchestrated many of the details of our visits, obtained answers to our questionnaires, scheduled and organized personnel to be available for interviews at specific times, and organized the various trips and interviews at the districts and jobsites we visited across six states. Accordingly, the Team would like to thank Ron Williams, ADOT; Greg Xanders, FDOT; Phil Lynwood, MDOT; Frank Gee, VDOT; Rudy Malfabon and Ron Howard, WSDOT; and Gary Whited and Mark Woltmann, WisDOT.

The Team would also like to acknowledge the Arizona Associated General Contractors, the Florida Transportation Builders Association, the Michigan Roadbuilders Association, the Virginia Roadbuilders Association, the Washington State Associated General Contractors, and the Wisconsin Transportation Builders Association who provided objective and constructive insight and opinions on the contract administration practices of the various state DOTs.

There are many in Ohio who provided help in identifying topics and questions to pose to the other states such as Fred Frecker from Flexible Pavements, Inc., Don Mader of the Consulting Engineers Council of Ohio, John Paxton of The Ohio Ready Mixed Concrete Association and Pat Jacomet from The Ohio Aggregates & Industrial Minerals

Association. We acknowledge their valuable contributions. We also appreciate the support received from Division Administrator Leonard Brown of FHWA and his tremendous staff, Bob Wright for assisting us in our planning and Andy Blalock and Mark Vonder-Embse who alternated on the site visits. Without their support and insight the study certainly would not have been so successful. Jim Hauenstein from the Ohio Civil Service Employees Association provided insights from a union perspective that added a great deal to our report. Lastly, we truly appreciated the cooperation and support of Clark Street and Michael Miller from the Ohio Contractors Association. Mike Miller attended all the state visits providing comments, questions and other intangibles from a contractor's perspective. He was also responsible for organizing the trade associations and contractor representatives from the other states. Their interviews often proved to be the liveliest of all. The contractor perspective certainly was not overlooked in this report due largely to Mike's involvement. We thank you all.

On behalf of the Ohio Department of Transportation and the entire Survey Team, we gratefully acknowledge the extensive contributions made to this study by the study's project manager, Julie Brogan of the Ohio Department of Transportation. Julie's abilities were continuously on display throughout this project. With coordinating skills unmatched, insights perceptive and patience inexhaustible, she led us well. She was truly our catalyst, our scheduler and our source of energy, as well as a substantive participant on our team. For all of that and for the other myriad roles she played and the endless duties she performed we thank her.