

nical and administrative staffs that have been built up over the years and can furnish a broad range of capabilities. The newer systems, conversely, usually do not have such capability and would have to hire in-house staffs, necessitating a break-in and "learning curve" period to achieve effectiveness. In any event, time, cost, and design coordination still prevail as governing factors in tailoring the consultant forces to be engaged. This usually militates for achieving a "unity of effort" (i.e., a qualified consultant organization to take on the responsibility for program administration and planning, design, and construction management).

The author has observed and has been directly involved in major transit projects in which different philosophies have been employed. For example, in Baltimore, when the Metro was constructed, a variation of the multiple consultant philosophy was employed. At Bay Area Rapid Transit, on the other hand, the single consultant philosophy was used. Both projects were successful.

The author believes that the single consultant philosophy produces better results. It appears that the interests of the client are better served by having the same consultant responsible for managing both design and construction. The owner gets the product he desires with fewer problems and with less effort required on his part. It must be recognized that this is one point of view and that there will be just as many people who believe the opposite as who agree with this view.

The important thing is that it is possible to obtain a high level of quality in construction by using consultants, provided that the responsibility and the authority to carry out that responsibility are given to the consultant. Anyone who has been involved in large projects encompassing both new construction and the rehabilitation and improvement of

existing facilities knows that the handling of new construction is immeasurably easier than handling the rehabilitation and improvement of existing facilities. This is natural because the rehabilitation and improvement of existing facilities must be done while operations at the facilities are maintained. However, the differences are largely a matter of degree and do not mean that consultants cannot or should not be used in either case.

In conclusion, it is emphasized that the control of construction quality on public construction is largely dependent on ensuring that the quality desired is incorporated in the design and the contract documents as a first step. This is necessary because the construction will undoubtedly be performed under contracts awarded on a low bid basis, with the construction geared to what has been specified in the contract. The construction manager must assure that the desired quality is achieved. He can do this when what is desired is well delineated in the contract documents. He can also ensure that the same quality is achieved if there are changes required as the contract progresses. When general consultants are necessary on a project, and on most large projects they probably are, either one of the philosophies described previously--separate consultants for various functions or a single consultant for all functions--may be followed. A number of people who advocate either of these philosophies will be found, but it is believed that there is some advantage in having a single general consultant responsible for all aspects of large projects.

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Contracting Practices and Payment Procedures

ROBERT B. NEWMAN and FREDERICK D. HEJL

ABSTRACT

A summary of National Cooperative Highway Research Program (NCHRP) Project 20-7, Task 23, is presented. The full report is available from TRB. The project evaluated nine selected topics concerning highway contracting practices and payment procedures. The topics include alternate bids, turnkey projects, incentive and disincentive provisions, retainage, documentation, methods of measurement, partial payments, payment for materials in storage or on hand, and acceptance and final payments. Included are recommendations for improving agency practices in these areas and a discussion of how agencies may apply these recommendations to their own operations.

A summary of the findings and conclusions of NCHRP Project 20-7, Task 23, is presented. The Agency Final Report for NCHRP Project 20-7, Task 23, "Contracting Practices and Payment Procedures" is available from TRB. The opinions and conclusions expressed or implied are those of the investigators and are not necessarily those of the sponsors of the research.

RESEARCH OBJECTIVES

Procedures for documenting quantities and payment for contract work require substantial amounts of agency personnel time often resulting in delayed payments. Improved contracting procedures and methods of determining reasonably accurate pay quantities could result in economic benefits to both public agencies and contractors and lower overall

highway and transportation construction costs. A second benefit could be an improvement in the adversary relationship that sometimes develops between the public agency and the contractor.

The objective of this research was to develop guidelines for improving contracting practices and payment procedures that could result in reduced overall construction costs for highway and transportation construction operations.

METHODOLOGY

The research was conducted through a literature search of published material on contracting practices and by personal contacts with agency and contractor personnel. Individuals from support industries and associations were also contacted to obtain additional information. The following table gives the number of agencies and organizations along with the number of individuals contacted during the course of the project. Most personal contacts included structured interviews.

No.	Agency/Organization	No. of Individuals
21	State highway agencies	28
3	Other agencies	9
6	Contractors	6
14	Associations	14 ^a
2	Suppliers	2
1	Consultant	1

^aInvestigators also attended association meetings when it was impractical to obtain attendance records or when records were unavailable.

Nine topics were selected for detailed analyses. The information on each topic was reviewed and evaluated. Recommendations and guidelines were prepared to assist agencies in making improvements. These nine topics are

- Alternate bids,
- Turnkey projects,
- Incentive and disincentive provisions,
- Retainage,
- Documentation,
- Methods of measurement,
- Partial payments,
- Payment for materials stored or on hand, and
- Acceptance and final payment.

The findings and recommendations for each topic are presented in this paper. The investigators' observations and discussions of the findings leading to the recommendations are included in the Final Report.

Essentially all the improvements recommended are already in effect in at least one agency. These practices were identified and evaluated as offering solutions to some of the contractors' and agencies' problems.

ALTERNATE BIDS

Alternate bids for various optional construction methods or materials types are used to reduce overall construction costs by allowing contractors the latitude to select the option that is most cost-effective for their operations.

Findings

Although their use varies widely among states, alternate bids are most commonly used for culverts, base

courses, pavements, bridge pilings, bridge deck repairs, and complete bridges. Most states that allow alternate bids typically use them on two or three of these items.

The FHWA requires alternate designs on major structures and has also encouraged the use of alternate bids on minor structures and other items as a cost-saving measure (1).

The major advantage of alternate bids is the potential for cost savings. This method allows contractors to weigh the relative costs of material, labor, and equipment for the various options and base their bids on the one that is the most cost-effective (2).

Although almost everyone agreed that alternate bids do result in lower bids, it was not possible to document the actual savings in the states that have used this technique.

Recommendations

Agencies should take advantage of alternate bids on projects for which they are appropriate. Guidelines for selecting such projects or bid items are

- Use alternate bids for materials whenever possible to take advantage of current market conditions.
- Define the evaluation criteria in the contract special provisions or supplemental specifications. Be specific so there will be no question about substitution of materials or how bids will be evaluated for award. If the life-cycle costs favor one alternative over another, explain how that benefit will be factored into the evaluation process.
- Group small structure projects, especially those with similar designs, to take advantage of increased scale for potential savings. It is likely that forms may be reused and that workmen will be more efficient on the second and third bridge.
- Alternate bids offer the most potential for savings on major structures. The options in materials and types of construction as well as the size of the project present many opportunities for contractors to develop innovative procedures to reduce their bids.
- Do not use alternate bids when evaluation criteria cannot be well defined. A better choice in this case might be to include a value engineering clause in the contract to encourage contractors to propose alternates after the contract is awarded.
- Consider the contractor's costs in evaluating alternates, obtaining quotes, and preparing bids as well as the design costs. Alternate bids for materials may be cost-effective even on small projects--alternate designs may not be.
- Do not use alternate bids when it is obvious that one alternative is clearly better than another.

TURNKEY PROJECTS

Turnkey projects are defined as those for which both design and construction responsibilities are assumed by the contractor. These projects allow contractors to participate in design in an effort to reduce costs and expedite construction.

Findings

Little use of the design-construct concept has been made in highway and bridge construction although it

has been used in building construction for years. Recently a few states have awarded contracts for design and construction of bridges and other states are considering the concept (3).

Savings in Time

One of the objectives of the design-construct concept is to reduce the time required to get projects under construction. Most conventional projects are advertised 3 to 4 weeks to allow contractors time to prepare bids. An additional 3 to 4 weeks are needed for contractors and their design consultants to prepare preliminary designs. Typically another 2 months are required after award for preparation of the final design plus 30 days for review.

So far, savings in time have not been realized.

Quality of Design

All of the agencies interviewed spent more time checking these designs than was normally spent checking conventional designs, including those prepared by consultants hired by the agency. Because the designs were intended to meet the minimum criteria, agency personnel believed that all calculations had to be thoroughly checked to ensure that all criteria were met. These designs were generally closer to the minimum criteria than are conventional designs.

Savings in Cost

Because the design-construct concept has been used so little, cost trends have not been established. A definite saving could be documented in only one state (2).

Recommendations

Use of the design-construct concept is gradually increasing despite the reluctance of many agencies and contractors. This concept is not a panacea. It would not be cost-effective for all projects, particularly those for which there is only one logical design. The concept is, however, a good management tool for projects for which various combinations of materials or construction procedures are available to meet the need.

Suggestions for making the best use of design-construct bids include

- Review the minimum design criteria to ensure that they are correct and up to date, so the resulting designs will be acceptable.
- Spell out criteria to avoid controversy in evaluating preliminary designs and to reduce agency time in checking designs.
- Provide for two-stage design procedures--a preliminary concept design with only enough detail to estimate quantities and a final design prepared only by the successful bidder--to reduce design costs.
- Select projects in which innovations will be likely to pay off.
- Group several bridges, especially those with similar solutions, to take advantage of multiple use of designs.
- Avoid small, "Mickey Mouse" projects.

Agencies contemplating letting design-construct projects should review the applicable laws to be

certain the concept is not prohibited. In some cases, state laws will have to be revised to take advantage of turnkey projects.

INCENTIVE AND DISINCENTIVE PROVISIONS

Incentive and disincentive provisions are clauses in a construction contract that are intended to influence the contractor's actions and efforts. There are several different areas in which incentive and disincentive clauses can be applied, but addressed here are only the provisions regarding the completion of a project (a) on or ahead of schedule, and (b) at or better than the minimum acceptable quality standards.

Findings

State highway agencies routinely include in their contract documents clauses that affect project completion. A few agencies also include provisions dealing with project quality on specific bid items. Most provisions are disincentives--sticks instead of carrots.

Project Completion

All highway agencies specify the contract time allowed in the contract documents. Contract time is normally long enough to permit average contractors to complete the work. Shorter time might limit competition. On a few projects, agencies need expedited schedules for early completion because of emergencies, traffic problems, or committed opening dates. Assessment of liquidated damages is the most prevalent method of encouraging completion within contract time. Payment of bonuses is used infrequently when early completion is desired.

Liquidated Damages

Most highway agencies have developed a schedule of liquidated damages based on contract dollar amounts that is included in their construction standard specifications. The values in the schedule apply to every contract unless superseded by special provisions. Liquidated damages are intended to cover the additional engineering and inspection costs incurred because of any overrun in time. Some agency personnel believe user costs should also be considered.

Bonuses

Highway agencies are less comfortable with awarding bonuses to contractors as an incentive for early completion of projects. Some states forbid it by law. The few agencies that do pay bonuses do so only on projects of an emergency nature, on projects that disrupt businesses, or on projects that are an extreme inconvenience to the traveling public. Most agencies that have used bonus clauses have applied them on only one or two projects.

The FHWA published in the June 13, 1984, edition of the Federal Register (49 FR 24374) a notice of rescission of regulation concerning bonus payments. It had been FHWA policy before that time to not participate, directly or indirectly, in any part of a bonus to the contractor for early completion of a project. However, the results of an FHWA-initiated study under the National Experimental and Evaluation Program showed that the use of bonus (incentive and disincentive) provisions was a valuable construction

tool and was cost justified. It is believed that the bonus provisions will be used mainly on 4R and bridge reconstruction projects, where analysis shows such provisions to be in the public interest, with lesser use on other types of projects.

Contractors favor the use of bonuses. Those interviewed were successful in collecting awards on projects with bonus clauses. Most believe that if they are to be assessed liquidated damages for late completion, they should be given the opportunity to earn bonuses for early completion.

The contractors and the highway agencies in favor of awarding bonuses believe that the amount assessed for liquidated damages should equal the amount awarded for bonuses.

Project Quality

For certain bid items, some highway agencies include in their specifications incentive and disincentive clauses regarding quality of end product.

Concrete Pavement

The major emphasis has been on thickness of concrete pavements, where only disincentives--a reduction in payment is specified for thickness deficiencies--were found. Payment reductions are generally stated as percentages of the contract unit price and range from 0 to 50 percent. In all cases, pavement must be removed and replaced if the deficiency exceeds the maximum tolerance.

Base Course

The only bonus provision found for quality involved base course thickness. One state's specification provides for either an increase or a decrease in payment for base course depending on the actual average thickness compared to plan thickness. The maximum payment is 105 percent. There is a minimum thickness tolerance as with concrete pavement.

Recommendations

Recommendations for the use of incentive and disincentive clauses are as follows:

Short Term

- Continue using liquidated damages on all construction contracts as a tool to encourage contractors to complete projects on schedule.
- Use bonus clauses only on projects that cause excessive inconvenience to the public or have a high daily cost to the user or agency.
- The amount of the bonus award should equal the amount assessed for liquidated damages.

Long Term

- Investigate and evaluate through other research the procedures used by state highway agencies in developing a schedule of liquidated damages.
- Investigate further the feasibility of using bonus payments to encourage contractors to complete projects in advance of contract time limits; focus on the type of projects and the cost-benefit ratios involved.
- Conduct further research on the use of incen-

tive clauses when adjusting pay quantities for quality of workmanship to develop specifications that not only reduce the payment to the contractor for delivering a product below the desired quality standards, but that also reward the contractor for delivering a superior product.

- Continue to search for additional pay items to which bonus or payment reduction clauses can be applied based on the quality of the finished item.

RETAINAGE

Retainage is the withholding of a predetermined percentage from the contractor's regular progress payments to provide leverage for the agency to ensure that work is completed and to provide a reserve to cover inadvertent overpayments, potential liquidated damages, and claims against the contractor.

Findings

Current Retainage Percentages

The amount retained varies widely among states--from 0 to 10 percent of progress payments. The current practices of highway and transportation agencies in all 50 states and the District of Columbia were reviewed. The effective percentages retained are shown in Figure 1. (The AASHTO guide specifications recommend 10 percent of the first 50 percent.)

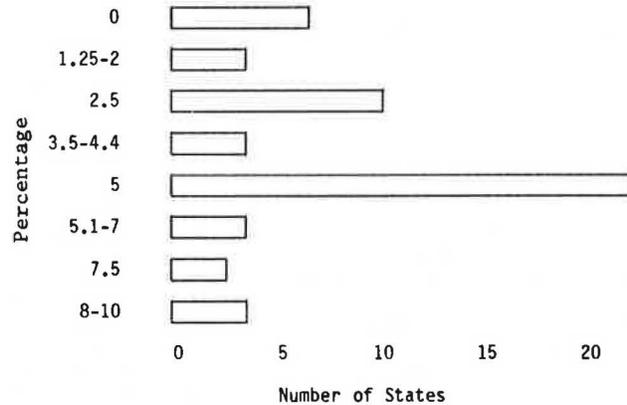


FIGURE 1 Retainage practices.

Several states have recently eliminated retainage from their specifications. Representatives of some of these states expressed the opinion that the purposes of retainage could be achieved in other ways, in particular through bonding procedures, and that elimination of retainage should reduce the contractor's costs.

Interest on Retainage

The cost to contractors of borrowed money has become more significant during this period of high interest rates. To ease this problem, many states have provisions to

- Allow contractors to deposit securities (5) or other collateral in lieu of retainage and receive the interest, or

- Put retained funds in escrow accounts on which interest is earned by the contractor.

Retainage Versus Mobilization

Of the 45 states that regularly withhold retainage, all but four deduct retainage from the contractor's initial earnings.

It is recognized by most states that contractors need operating capital in the early stages of a project--so much so that many states have a pay item for mobilization to help provide working capital. It appears that retainage applied to the first half of the contractor's earnings, particularly when retainage is 10 percent, tends to negate the advantages of the mobilization payments.

Retainage to Satisfy Claims

In most states, almost anyone can submit a claim against the contractor. In some states, payment of retainage is held up until the contractor pays the claim or proves the claim invalid.

Release of Retainage

When a contract nears completion or is completed and accepted, some states reduce the amount of money retained. Any reduction in retainage requires written permission of the surety. Unsatisfied claims and potential liquidated damages are normally considered when contractors request reductions in the amount retained.

Contractors' Viewpoint

Contractors are far from unanimous in their opinions on retainage.

Interview Results

Most of the contractors interviewed favored elimination of retainage. However, a significant number preferred to have retainage withheld. The view varied somewhat depending on whether their experience was as prime contractors or subcontractors.

Prime contractors believed that retainage provided them with some protection in case the agency overpaid work items done by subcontractors. Prime contractors also indicated that having their cash tied up in retainage was an incentive to complete the project so they could receive all their money.

Subcontractors who favored retainage believed that retainage provides a reserve to ensure that money is available to pay for their services when prime contractors get into financial difficulties. Some material suppliers favored retainage for the same reason.

The length of time some agencies take to release retainage after all work is completed and accepted was reported to be a problem. A subcontractor who performs work, such as clearing and grubbing, in the early stages of a project must wait until final acceptance before receiving all the money retained.

Bonding Companies

Sureties favor retainage because it reduces their risks. Any money retained is available to offset potential losses if a contractor defaults. Sureties

prefer that retainage be taken from the initial contractors' earnings so that more money will be available early in the contract.

Although bonding companies prefer retainage, rates for bonds are the same for projects without retainage as for those with retainage. Representatives speculated that rates might increase if no retainage became the predominant practice.

Recommendations

Any recommendations concerning retainage will be controversial because the various interested parties are each affected in a different way. The investigators attempted to look at retainage from the point of view of the highway agency as representative of the owners--the general public.

Recommendation 1

It is recommended that retainage practices be adopted that provide for

- No retainage as long as the contractor's progress is satisfactory,
- 10 percent retainage to be withheld whenever the contractor's progress falls more than 10 percent behind schedule,
- Any retainage withheld to be retained until the contract is completed, and
- Adoption of a method for quantifying the contractor's progress.

Recommendation 2

When agencies elect to withhold retainage, it is recommended that all retainage be withheld from the last 50 percent of the contractors' earnings.

Recommendation 3

When retainage is withheld, it is recommended that provisions be made for the contractor to be credited with interest on the retainage, either by depositing securities in lieu of retainage or by depositing retainage in interest-bearing escrow accounts.

DOCUMENTATION REQUIREMENTS

Documentation includes all the project-related paperwork required to be completed and submitted by the contractor and the highway agency during the construction phase of a project. It is a recorded history of a highway or bridge construction project.

Findings

The basic project documentation for all contracts consists of items such as inspector's daily reports, diaries, survey notes, and test reports. On Federal-Aid highway contracts, some additional reports must be completed.

Both contractor and highway agency personnel cited problems with documentation requirements. The contract provisions applicable to equal employment opportunity (EEO); weekly wage statements and payrolls; and record of materials, supplies, and labor are the only ones requiring documentation from the contractors.

Equal Employment Opportunity

The current Federal-Aid contract provisions require each contractor and subcontractor to complete and submit an annual EEO report on any Federal-Aid projects exceeding \$10,000. A separate report must be completed for each Federal-Aid contract or subcontract to show the work force on the project during the last payroll period preceding the end of July (6,7).

Contractors questioned the necessity of completing a separate EEO report for each Federal-Aid project and for each agency with which they have a contract. They suggested that an EEO certification procedure could replace the current job-by-job reporting. The contractors contend that once a contractor is a certified EEO employer, the reporting of employee distribution on individual Federal-Aid highway or bridge projects should not be necessary.

Weekly Wage Statements and Payrolls

A contractor is currently required to submit weekly a certified copy of all payrolls to the state highway department engineer (6). The contractor must also make the records available for inspection by authorized representatives of the state highway department, the FHWA, and the U.S. Department of Labor. In addition, these representatives must be permitted to interview employees regarding their wages during working hours on the job. Wage rates must also be posted on the project where employees have access to them. Some contractors periodically include copies of the wage rates with pay checks.

The purpose of the procedure is to ensure contractor compliance with the provisions of the Davis-Bacon Act: that all employees are classified properly and are paid at least the specified minimum wages for their duties.

The contractors contacted contend that the procedure involves a duplication of effort that is unnecessary and costly and that creates friction between contractor, employees, and investigators.

Few violations were cited by those interviewed in this study.

Record of Materials, Supplies, and Labor

Contractors formerly were required to complete and submit a Statement of Materials and Labor Used by Contractors on Highway Construction Involving Federal Funds (Form PR-47) on nearly all Federal-Aid contracts.

Submission of Form PR-47 is now required only for contracts of more than \$500,000 (6). This change eliminated about 60 percent of the projects for which this form was required.

Contractors interviewed for the study questioned the usefulness of Form PR-47. They are unaware of the use made of the information submitted and, therefore, doubt that the form has any value at all. Consequently, most are not conscientious in completing the form. The accuracy of the data is suspect. State personnel also questioned the usefulness and accuracy of the data collected on these forms.

Data from PR-47s are used primarily to compile highway statistics for use by economists, highway planners, industries, manufacturers, and suppliers. They use the data for economic impact studies and resource needs projections.

Project Source Documents

State highway personnel criticized the excess amount

of documentation required by the FHWA on Federal-Aid projects. The FHWA has few specific requirements regarding source documentation. The general policy is to allow every state to develop its own documentation procedures subject to FHWA approval. The concern of FHWA is that the procedures ensure quality construction and accurate determination of the completed work quantities and that the procedures be uniformly applied throughout the state. This is confirmed in the Construction Manual for Highway Construction published by the American Association of State Highway and Transportation Officials.

Recommendations

Equal Employment Opportunity

It is recommended that consideration be given to revising the procedures for monitoring contractors' compliance with Equal Employment Opportunity Programs. An EEO certification program such as that suggested by the contractors instead of separate certification on each project is one alternative. Development of this alternative would require additional research.

Weekly Wage Statements and Payrolls

The following recommendations are made for reducing the cost of monitoring contractors' compliance with the Davis-Bacon Act:

- Eliminate wage rate interviews entirely.
- Eliminate the requirement that contractors submit copies of their weekly payrolls to the state highway representative. Retain the requirement that the contractor maintain his payroll files for a period of years.
- Continue to require that wage rates be posted on the projects or be included with paychecks periodically to inform employees of their rights.
- Continue to investigate any complaints received.

Changes in the regulations for monitoring the Davis-Bacon Act and perhaps in the Act itself would be required to implement these recommendations.

Record of Materials, Supplies, and Labor

It is recommended that the FHWA use sampling techniques to collect the information furnished on Form PR-47. A small sample of projects would yield more accurate and reliable information. By sampling, all projects, including those costing less than \$500,000, could be included in the statistics while the amount of work involved would be reduced and accuracy would be improved.

Project Source Documents

State highway agencies should examine closely their source documentation requirements. Recommendations include the following:

- Highway agencies should evaluate their documentation forms and reports, using a technique called "flow charting," for redundancies and usefulness. Flow charting involves tracking documents and their copies from origin to ultimate use. The objective is to graphically outline who gets each copy, what use they make of

it, and what would happen if they did not get the copy and then to determine the need for the document and the copies.

- Highway agencies should adopt the practice of not copying or summarizing any information that is not absolutely necessary. Every time information is copied or summarized, there is a chance for error, and copying and summarizing are time consuming.

METHODS OF MEASURING PAY QUANTITIES

The methods of measuring pay quantities involve ascertaining and documenting the units, length, area, volume, or weight of work completed satisfactorily as a basis for making partial and final payments to the contractor. The method selected for each work item must provide for an equitable and timely reimbursement to the contractor for work done, provide assurance to the agency that quantities were incorporated in the work, and encourage the contractor to perform quality work.

Findings

Units of Measurement

Units of measurement serve two purposes. They provide a basis for contractors to prepare bids for easy comparison by the agency and for payment of partial and final estimates.

Methods of Measurement

Some agencies have developed methods of measurement that require extensive field and office work. Others have simplified their procedures and documented them for easy reference.

Recommendations

Units and methods of measurement should meet these guidelines:

- Be simple and easy to measure, compute, and document;
- Provide equitable payment for actual work accomplished;
- Expedite determination of quantities for partial and final payments;
- Encourage contractors to perform quality work;
- Facilitate the bidding process;
- Minimize negotiation of prices for changes;
- Take advantage of commercial lengths of materials;
- Eliminate deductions for minor embedded items; and
- Take advantage of plan quantities instead of remeasuring all items.

It is recommended that agencies analyze units and methods of measurement to meet these guidelines. It is also recommended that agencies document approved methods of measurement and make that documentation available to all agency personnel and contractors.

PARTIAL PAYMENTS

Partial payments, sometimes called progress payments, are installment-type payments to highway and bridge contractors. Each installment represents work

completed satisfactorily, as documented by project engineers and inspectors. The objective is to avoid depleting contractors' working capital and thereby to decrease the cost-of-money factor attributable to highway and bridge construction programs.

Findings

Promptness in making payments, payments for overrun quantities, payment frequencies, and quantities included in partial-payment estimates were cited as significant problems. Promptness and overrun payments were cited more often than frequencies and quantity estimates; all four are discussed.

Promptness

All contractors recognize the need for time to prepare progress estimates and process partial payments. They are concerned only about unusually lengthy time allowances plus long delays when allowances have elapsed.

Nationwide Problems

Various associations of contractors, subcontractors, consultants, and suppliers lobbied the U.S. Congress for legislation requiring prompt payment of invoices submitted to federal agencies (8,9). The Prompt Payment Act, which became effective as of October 1, 1982, primarily provides interest payments (15.5 percent per year) on late payments. Until it went into effect, 39 percent of all government bills were paid late. Federal agencies are now making strong efforts to pay on time and avoid interest costs.

The associations are now lobbying state legislatures to pass comparable statutes (8,9). Fifteen have enacted such laws and 12 of them provide interest penalties for late payments. Fourteen more legislatures are expected to take up comparable bills during 1983. These findings and other writings indicate that the problem is nationwide.

Twenty-five states encourage prompt payment through regulation policies, directives, and guidelines of various kinds--further indicating widespread concern. Twelve of the 25 stipulate 30-day limits and two provide interest on late payments (10).

"Prompt" Defined

Fourteen of the 42 states listed encourage prompt payments without indicating what the term means. The promptness standard in the remaining states ranges from 25 days to 180 days, with 30 days the dominant allowance.

All state highway and transportation departments contacted for this report said that they pay contractors within 3 weeks. On the other hand, contractors are complaining about delays of up to 6 weeks.

One state is now "cutting checks" within 2 days compared with its previous 21-day average. Project personnel enter quantity data through district and residency computer terminals. (Residency offices located farthest from district headquarters--about half--are equipped with terminals.) The department, instead of the state treasurer, writes the checks. Another state reduced its average payment time from 35 days to 6 using manually prepared estimates.

Interest Payments

Most states agree with the idea that interest should

be paid if payments are late. A few favor late payments because departments earn interest on moneys until they are paid out.

When it installed its accelerated-payment procedure, the state mentioned earlier estimated annual savings of \$9.5 million in interest contractors were paying on their operating funds. Interest rates have dropped from between 19 and 20 percent to about 13 percent since then, bringing the amount closer to \$6 million. The department expects to see those savings reflected in lower bids, thereby permitting additional construction undertakings.

Direct Deposit

None of the states are known to provide direct-deposit options--payments by state governments directly to contractors' bank accounts to speed up payments.

Effective October 1, 1983, payments on contracts with the FHWA may be made by the Treasury Financial Communications System instead of by Treasury check. Payments can be made to virtually any financial institution in the country through a computer-to-computer link.

Payment for Increased Quantities

Delayed payment for increased quantities was cited as a major problem to contractors.

Regulations on partial payments for overrun quantities vary from no payments above plan quantities without approved change orders, to payments for up to 120 percent of plan quantities, to no limitations.

States that limit payments to no more than previously authorized quantities do so to avoid overpaying contractors and to discourage project engineers from making too many revisions in project designs without obtaining approvals. Zero overrun policies are not foolproof with respect to overpayments; obviously, overpayments on underrun items can be a similar problem.

In most states, the project engineer has to explain any significant changes in quantities used from those planned--both overruns and underruns. Some require explanations to be included in final-estimate documentation.

Frequency

The AASHTO guide specifications suggest monthly payments. Of the 32 states sampled, 26 make monthly payments. Of them, nine allow semimonthly payments when contractor earnings exceed certain amounts. All contractors interviewed prefer semimonthly schedules for cash-flow reasons.

Quantities Included for Payments

Each state sets specific cut-off dates for making progress estimates. All work completed satisfactorily before the cut-off date not previously paid for is included in the current estimate.

Certain individual project engineers advance the cut-off dates for preparing the estimates but submit the estimates on scheduled dates. In short, they hold back a few days on quantities to be included for payment, primarily to increase the estimate-preparation time.

Cut-Off Date

Some states stagger the cut-off dates to level procedural work loads and reduce processing times. Identical dates apply statewide elsewhere.

One state with a biweekly schedule pays for work done in even-numbered counties one week and odd-numbered ones the next. Another with a semimonthly schedule expects resident engineers to stagger the cut-off dates to level the work loads at the district office.

Recommendations

It is recommended that states improve their partial payment procedures so that contractors receive their checks as soon as possible after the end of the estimate period. On the basis of the results cited previously, it is reasonable to expect the estimate to be completed, checked, and submitted for check processing within 5 to 6 days after the close of the estimate period.

It is recommended that states adopt a policy of allowing payment of up to 120 percent of plan quantity before change order approval to reduce the delay in payment for minor increases in quantities.

It is also recommended that monthly payments be adopted with provisions for semimonthly payments when the contractor's earnings are greater than \$15,000 in the middle of the period.

States should establish staggered cut-off dates for partial estimate periods to better balance the workload and reduce the time required to process payments.

PAYMENT FOR MATERIAL STORED OR ON HAND

Almost all state highway agencies pay for materials delivered or stored but not yet incorporated into the work with their regular partial payments. The objective of paying for delivered or stored material is twofold: (a) it assists contractors in lowering their capital outlay requirements and in maintaining a positive cash flow and (b) it ensures availability of materials on construction projects, particularly when shortages in materials from suppliers are likely to occur.

Findings

Storage requirements and the submission of proof of material ownership by the contractor before payment were cited as significant problems by highway agencies and contractors. Both are discussed.

Storage Requirements

In-State Storage

All states show a willingness to work with the contractor regarding in-state storage of nondestructible materials. The general rule is to accept material for payment as long as it is stored in an area approved by the contracting agency--usually the fabricator's yard for prestressed items or structural steel and in the vicinity of the project for other items.

Out-of-State Storage

Usually the only materials stored out-of-state that are paid for are fabricated structural steel or prestressed concrete items--large items that can be erected directly from the truck to save handling. Most states do not address out-of-state storage in their standard specifications; some of these states have "at suitable site" phrases in their standard

specifications to cover the possibility of out-of-state storage on special projects. A few specifications specifically disallow paying for materials stored out-of-state.

FHWA Policy

The FHWA, on Federal-Aid projects, requires only that the materials be delivered by the contractor at the project site or another designated location in the vicinity of the project. If the item requires fabrication, the FHWA allows off-site stockpiling; it does not distinguish between in-state and out-of-state storage (4).

Proof of Ownership

State highway agencies differ in their thinking about proof of ownership. Documented proof of contractor ownership of stockpiled materials required by states varies from certified invoices detailing the contractor's costs to certified paid invoices to bills of sale and legal title documents.

FHWA Policy

Present FHWA policy on partial payment participation for stockpiled materials on Federal-Aid projects states that the material must have been purchased by the contractor (4). States have the option of accepting either delivery notices or paid invoices.

Contractors' Views

Contractors expressed dissatisfaction with the paid invoice requirement of some states. They felt unpaid invoices documenting the amount of material delivered and stored should be sufficient for partial payment purposes.

Payment Procedures

Inconsistencies were found among the state highway agencies in their payment procedures, specifically in regard to the basis of payment and the minimum payment allowed for stored materials.

Basis of Payment

The majority of the states reviewed base partial payments for materials on hand on actual invoice or delivered cost to the contractor; 10 of these states pay up to 100 percent of the cost to the contractor. Four of the surveyed states pay a percentage of contract unit prices. The rest of the states use dual payment schedules depending on the type of material being delivered or stored.

Minimum Payment

Fourteen of the states have a minimum value for the material to be delivered or stored in any pay period before a contractor is authorized payment. The values range from \$500 to \$10,000.

Recommendations

Recommendations for payment for materials produced

or purchased for a project but not yet incorporated into the work include the following:

- Payment for materials originating from a supplier should be based on actual invoice costs plus transportation charges not to exceed 90 percent of the contract price. (Some portion of the contract price should be reserved to cover installation costs.)
- Payment for contractor-produced materials should be based on a preset percentage of the contract prices so the contractor and the agency do not have to document production costs. The preset percentages should be set individually for each type of material typically produced.
- Payments for materials should be treated the same as payments for work performed by subcontractors. The contractor should be required to certify that he has paid his suppliers and subcontractors before he receives his next partial payment.
- Material should be required to be stockpiled on the project or other approved site--including out-of-state locations.
- Legally sound ownership requirements for materials stored out-of-state should be established.
- Minimum payments should be the same as partial payments.

ACCEPTANCE AND FINAL PAYMENT

This topic includes project acceptance, determination of final quantities of work completed, documentation of compliance with contract requirements, and final payment to the contractor. These steps ensure that the project is completed satisfactorily and the contractor is paid promptly for work actually completed.

Findings

The major problem identified with acceptance and final payment procedures is the time required to complete all of the procedures. Acceptance and final payment can be divided into the following areas:

- Final acceptance,
- Quantity determination and documentation, and
- Contractor forms submission.

Each of these areas requires time and contributes to the problem of prompt final payments.

The time required to complete all these steps and issue the final payment after final acceptance ranges from 45 days to 12 months in the states reviewed.

Final Acceptance Procedures

The authority and responsibility for final acceptance of completed projects is assigned at different levels of management--engineer, district construction engineer, district engineer, or head office--and the FHWA area engineer must make a final inspection.

Contractors complained that getting a final "punch" or check list of work to be done to complete the project was a problem. Each level of inspection added to the list after all items previously identified had been taken care of.

Another problem cited was the timing of the acceptance. Apparently, there is often a considerable

delay after clean-up is completed before the project is finally accepted.

Final Quantity Determination

Computing and documenting final quantities generally require the most time. Some of the reasons for the amount of time needed were discussed in the methods of measurement section.

Following the Blatnik investigations, documentation of pay quantities became a major concern. Elaborate checking procedures were established in attempts to ensure that only work actually performed was paid for. Multilayered checking procedures were implemented. In many states every pay quantity was computed and checked at the project level, checked at the district office, and checked again in the head office. All of this checking delayed payments. Contractors as well as state employees accepted the fact that it took a long time to complete final estimates.

In an effort to expedite final payments, most states now check final computations piecemeal throughout the project. As individual work items or portions of items are completed, project personnel compute and check the quantities. These computations are then checked by district or head office reviewers for accuracy and compliance with plans and specifications. In some states the reviewers check every calculation; in others they spot check--more of a procedure or process check. In either case, any errors or omissions are called to the attention of the project engineer for correction.

In the review, the adequacy of test reports is checked to ensure that material incorporated in the work is in substantial compliance with the specifications.

Contractor Submissions

All states require contractors to furnish specific documentation before making final payment. They require that the following documents be submitted before final payment is made:

1. Statement of consent of the surety;
2. Affidavit from the contractors that all obligations and debts on the project have been satisfied, or a list of those not satisfied;
3. Written notice that there is no request for time extension or adjustment in payment, or written notice requesting adjustments with appropriate justifications; and
4. Any other documents such as Form PR-47 or labor compliance information.

Most states reported some difficulty in getting contractors to submit Form PR-47 promptly. Their only alternative is to withhold final payment until it is received.

Recommendations

It is recommended that final acceptance procedures be developed that include

- Acceptance by district or area engineer,
- Provisions for precompletion reviews to develop one complete "punch" list, and
- Time limits for making final inspections.

Final quantity determination procedures should be

improved so that final payments can be made within 60 days following final acceptance.

Provisions should be made for payment of interest on any moneys not paid within the 60-day period, provided all contractor submissions have been received.

CONCLUSIONS

Some highway agencies' contracting practices and payment procedures increase contractors' operating costs unnecessarily. The cost of money (interest) is a legitimate component of all contracting costs--whether or not contractors borrow operating capital. Payment practices that delay payments, either partial or final, increase contractors' operating costs. All costs must be recovered if contractors are to remain in business.

Conversely, any reduction in contractors' operating costs can be passed on to the agency in the form of lower bid prices. The key is competition. If there is sufficient competition for agency work, decreased costs will result in lower total costs.

Agencies should establish a reputation for prompt payment, fair treatment, decisiveness, and uniformity of inspection requirements. That does not mean being lax in enforcing compliance with the plans and specifications. In the long run, quality construction is more economical. It does mean improving those practices that increase contractors' costs unnecessarily.

The purpose of this paper is to motivate agencies to review their contracting policies and payment procedures to identify any improvements that should be made. It is suggested that ad hoc panels be established to conduct the evaluations, recommend improvements, develop implementation plans and schedules, and implement changes.

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