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COST PLUS INCENTIVE FEE FOR CONSTRUCTION CONTRACTS.(U)

DEC 80 M J O'CONNOR, G E COLWELL

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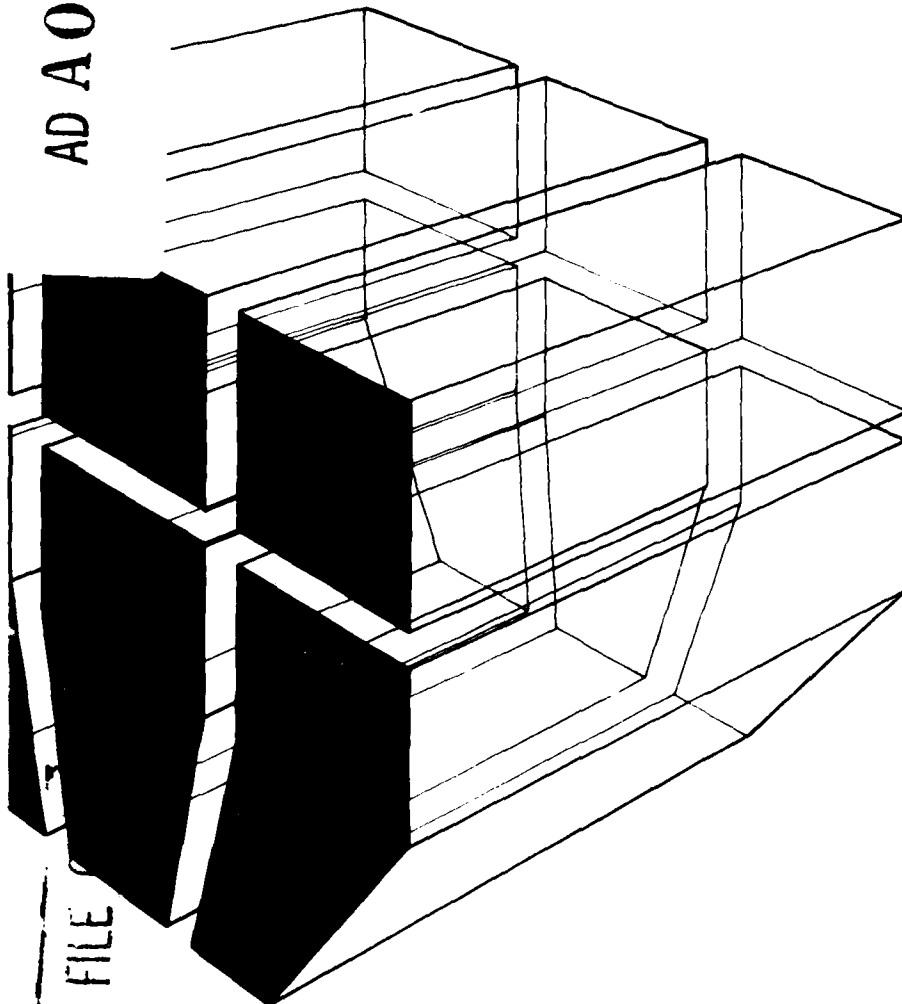
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LEVEL II

COST PLUS INCENTIVE FEE FOR
CONSTRUCTION CONTRACTS

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by
M. J. O'Connor
G. E. Colwell

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Block 20 continued.

This report recommends use of the CPIF contract type whenever circumstances allow, because when compared with other available alternatives, it provides the potential for significant reduction in total project cost without increased administrative effort.

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FOREWORD

This investigation was performed for the U.S. Army Engineer Division, North Atlantic, under Intra-Army Order NEPO-79-1032. The Division Engineer was MG B. L. Lewis.

This investigation was performed by the Facility Systems Division (FS), U.S. Army Construction Engineering Research Laboratory (CERL). CERL personnel directly involved in the study were Mr. Michael J. O'Connor and Mr. Glenn E. Colwell.

Mr. E. A. Lotz is Chief of FS. COL L. J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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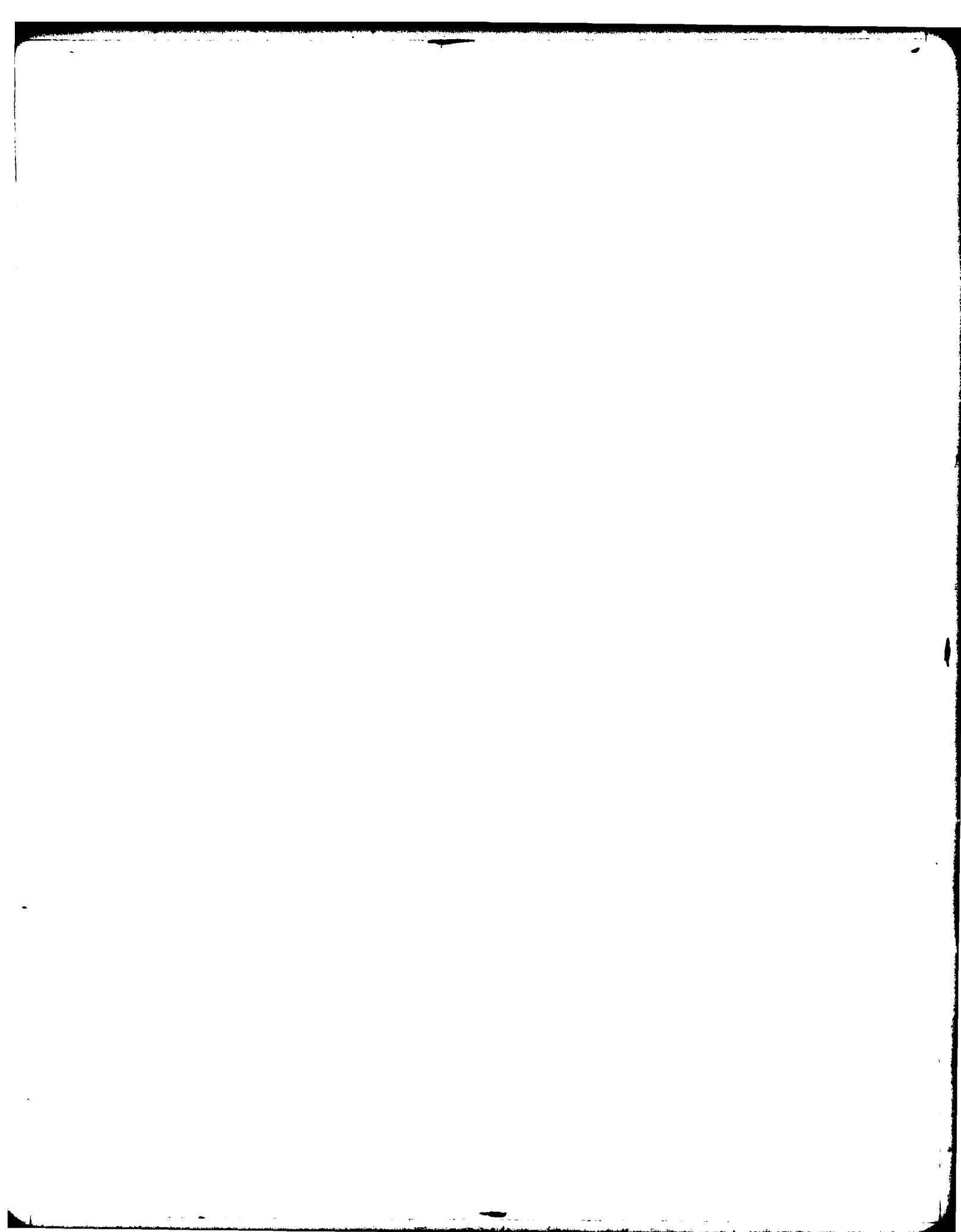
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COST PLUS INCENTIVE FEE FOR CONSTRUCTION CONTRACTS

1 INTRODUCTION

Background

The U.S. Army Corps of Engineers awards thousands of construction contracts each year. Consequently, the Corps has a vested interest in insuring that contract specifications meet project needs and that each job is given to a contractor who can complete all the project requirements in a timely manner. According to the *DAR Manual for Contract Pricing*, "Sound procurement requires use of the right contract type. The best, most realistic and reasonable price in the world (for the particular requirement at hand) may turn sour if the contract type is wrong."¹ Current regulations (DAR) provide for the development of contract arrangements to meet the specific needs of any procurement action. Therefore, the project must be analyzed carefully to decide what type of contract is applicable and what variations of that type may be effectively used to complete the project most efficiently. Successfully matching contract provisions to procurement objectives requires not only knowledge about the job, but also thorough understanding of the applicability and limitations of contractual options.

There are three basic types of "cost reimbursement" contracts:

1. Cost Plus Incentive Fee (CPIF)
2. Cost Plus Award Fee (CPAF)
3. Cost Plus Fixed Fee (CPFF)

These contract types are listed in the order that they are preferred as a vehicle for effectively controlling construction costs and scheduling. DAR 3-405.4, .5, and .6 define the criteria for the applicability of each contract type.² The DARs also caution against settling for a CPFF contract (unless CPFF criteria actually apply) merely to avoid the extra effort required to develop CPAF or CPIF contract structures.

When CPIF has been determined as the appropriate contract type, available options must be examined and

methodology must be recommended for structuring the contract to optimize contractor management of the program objectives. Guidelines must be developed that procurement personnel can use to evaluate available contract options and contract content alternatives.

Objective

The objective of this study is to provide an overview of the various types of cost reimbursement contracts, particularly the Cost Plus Incentive Fee (CPIF) contract, explain the benefits of using CPIF, and provide guidelines useful to Corps of Engineers procurement personnel in structuring and negotiating CPIF contracts for maximum effectiveness.

Approach

Army regulations, guides, literature, and other information pertinent to cost reimbursement construction contracts were surveyed. First, an overview of cost reimbursement contract types was made (Chapter 2). Next, the elements and interrelationships of Cost Plus Incentive Fee contracts were examined and recommendations for structuring were suggested (Chapter 3). Finally, suggestions on improving negotiating strategy were proposed (Chapter 4).

2 COST REIMBURSEMENT CONTRACT TYPES

Cost Plus Incentive Fee (CPIF) (DAR 3-405.4)

Description³

The cost plus incentive fee contract is a cost-reimbursement-type contract with provision for a fee which is adjusted by formula in accordance with the relationship which total allowable costs bear to target cost. Under this type of contract, there is negotiated initially a target cost, a target fee, a minimum and maximum fee, and a fee adjustment formula. After performance of the contract, the fee payable to the contractor is determined in accordance with the formula. The formula provides, within limits, for increases in fee above target fee when total allowable costs are less than target costs, and decreases in fee below target fee when total allowable costs exceed target costs. The provision for increase or decrease in the fee is designed to provide an incentive for maximum effort on the part of the contractor to manage the contract effectively.

¹ *Defense Acquisition Regulation (DAR), Manual for Contract Pricing (ASPM No. 1)* (Department of Defense, 1969).

² *Armed Services Procurement Regulations (DAR)* (Department of Defense, 1969).

³ *Cost Plus Incentive Fee Contracting, DAR 3-405.4* (Department of Defense, 1 July 1976).

Application⁴

The cost plus incentive fee contract is suitable for use primarily for development and test when a cost-reimbursement type of contract is found necessary in accordance with DAR 3-405.1(b), and when a target and a fee adjustment formula can be negotiated which are likely to provide the contractor with a positive profit incentive for effective management. In particular, where it is highly probable that the development is feasible and the Government generally has determined its desired performance objectives, the cost plus incentive fee contract should be used in conjunction with performance incentives in the development of major systems, and in other development programs where use of the cost and performance incentive approach is considered both desirable and administratively practical. Range of fee and the fee adjustment formula should be negotiated so as to give appropriate weight to basic procurement objectives. With regard to the cost incentive provisions of a contract, the minimum and maximum fees and the fee adjustment formula should be negotiated so as to provide an incentive which will be effective over variations in costs throughout the full range of reasonably foreseeable variations from target cost. Whenever this type of contract, with or without the inclusion of performance incentives, is negotiated so as to provide incentive up to a high maximum fee, the contract also shall provide for a low minimum fee, which may even be a "zero" fee or, in rare cases, a "negative" fee.

Incentives

A portion of the fee earned depends on the contractor's effectiveness in managing costs and on his* adherence to the project schedule. The contractor's motivation is influenced by the cost incentive share ratio and the cost/time trade-offs established for the contract.

Expected Price

The expected price (completed contract cost plus fee) for a CPIF contract is less than that of a CPFF contract, since a CPIF provides the contractor additional cost control incentives. The price difference between a CPIF and CPFF contract depends on the negotiated terms and how greatly the incentive(s) motivate the contractor.

⁴DAR 3-405.4.

*The male pronoun is used throughout this document to represent both genders.

Administrative Effort

In the pure CPIF contract, the contractor's performance is evaluated based on objective data after the work is completed. Consequently, after the contract is signed, a CPIF requires no more Government administrative effort than a CPFF; in fact, the CPIF may involve less effort, because the contractor will be more diligent in cost and schedule control in order to earn a higher fee. This relieves the Government of having to exercise such close surveillance of the contractor's management activities.

Cost Plus Award Fee (CPAF) (DAR 3-405.5)

Description⁵

The CPAF contract is a cost reimbursement type of contract with special fee provisions. It provides a means of applying incentives in contracts which are not susceptible to finite measurements of performance necessary for structuring incentive contracts. The fee established in a CPAF contract consists of two parts: (1) a fixed amount which does not vary with performance, and (2) an award amount, in addition to the fixed amount, sufficient to provide motivation for excellence in contract performance in areas such as quality, timeliness, ingenuity, and cost effectiveness. Award fee may be earned by the contractor in whole or in part. The amount of award fee to be paid is based upon a subjective evaluation by the Government of the quality of the contractor's performance, judged in the light of criteria set forth in the contract. The number of criteria used and the requirements which are represented will differ widely from one contract to another. Therefore, when determining criteria and rating plans, the using activity should be flexible and select a plan which will motivate the contractor in a positive way to improve performance. Evaluations are furnished to the contractor to afford him an opportunity to comment on the evaluation findings. The decision that award fee has been earned is based on the reports of performance made by the Government personnel knowledgeable with respect to the contract requirements. This decision is a unilateral determination made by the Government not subject to the Disputes clause of the contract.

Application⁶

The CPAF contract is suitable for:

1. Level of effort contracts for performance of services where mission feasibility is established but measurement of achievement must be by subjective evaluation rather than objective measurement.

⁵Cost Plus Award Fee Contracting, DAR 3-405.5 (Department of Defense, 1 July 1976).

⁶DAR 3-405.5.

2. Work which would have been placed under another type of contract if the performance objectives could be expressed in advance by definite milestones, targets or goals susceptible of measuring actual performance.

Incentives

Part of the fee earned by the contractor depends on his effectiveness in meeting performance criteria in areas such as quality, cooperation, cost control, and adherence to schedule. The contractor's motivation is influenced by the cost incentive share ratio, the cost/time trade-offs established, and the confidence he has that the Government will fairly evaluate his performance and award fee payments accordingly.

Expected Price

The expected price (completed contract cost plus fee) for a CPAF contract is less than that of a CPFF contract and more than that of a competitively bid Firm Fixed-Price (FFP) contract. The amount of difference between a CPAF and a CPFF depends on how well the incentives motivate the contractor, and the amount of mutual cooperation when the Government evaluates the contractor's performance.

Administrative Effort

The CPAF contractor's performance is evaluated subjectively at intervals during the job. Experience has shown that the effort required of the evaluators differs widely among jobs. However, it is generally agreed that a properly structured and administered CPAF contract requires no more administrative effort than an *equally well* administered CPFF contract.

Cost Plus Fixed Fee (CPFF) (DAR 3-405.6)

Description⁷

The cost plus fixed fee contract is a cost reimbursement type of contract which provides for the payment of a fixed fee to the contractor. The fixed fee once negotiated does not vary with actual cost, but may be adjusted as a result of any subsequent changes in the work or services to be performed under the contract. Because the fixed fee does not vary in relation to the contractor's ability to control costs, the cost plus fixed fee contract provides the contractor with only a minimum incentive for effective management control of costs.

⁷Cost Plus Fixed Fee Contracting, DAR 3-405.6 (Department of Defense, 1 July 1975).

Application⁸

The cost plus fixed fee contract is suitable for use when:

1. A cost-reimbursement type of contract is found necessary in accordance with 3-405.1(b)

2. The parties agree that the contract should be fee bearing

3. The contract is for the performance of research, or preliminary exploration or study, where the level of effort required is unknown; and where measuring achievements in contract performance does not lend itself to the subjective evaluation required in CPAF contracts

4. The contract is for development and test where the use of a CPIF is not practical.

Incentives

The fee is fixed and therefore is neither increased nor decreased, regardless of the actual cost or time required to complete the work; therefore, there is no incentive for the contractor to manage costs effectively. Rather, there is only a slight incentive for completing the job, since this would free the contractor's resources for other jobs.

Expected Price

The very fact that the CPFF contract type must be used instead of the CPAF means that the level of effort required of the contractor is unknown, that the contractor's performance cannot be measured, and that the final cost of the job cannot be estimated accurately. The expected price of work performed under a CPFF contract is historically higher than the negotiated price, and higher than the same work performed under CPAF or CPIF contracts.

Administrative Effort

The very reasons which make the use of a CPFF contract necessary also require the Government to monitor the contractor's activities closely, and to participate in project management. The Government must provide the missing incentive for effective planning and execution of the work; thus, to obtain the same degree of cost effectiveness, the administrative effort required for a CPFF contract is greater than for either a CPAF or CPIF.

⁸DAR 3-405.6.

Summary

Although the competitively bid Firm Fixed-Price (FFP) type of contract is preferred for construction, some projects must be started before the scope of the work is well enough defined for FFP. In these cases, the cost reimbursement contract type is appropriate.

The CPFF is least desirable because of the lack of contractor incentive and because the Government must expend considerable effort to monitor the contractor's operations. Some procurement packages require the CPFF contract, but it should be used only when use of the CPAF or CPIF is impossible.

The CPAF is preferred to the CPFF, because it provides positive motivation for effective management by the contractor, thereby reducing the project's expected price, while not increasing the Government's administrative effort.

Likewise, the CPIF is preferred to the CPAF because it provides positive motivation to the contractor, the contractor's performance is evaluated objectively, and the Government's administrative effort is reduced, all of which reduce the expected price of the project.

The contract type used must be tailored to the type of procurement involved. For example, some cases may require the inclusion of an "Award Fee" feature within a CPIF structure. Use of hybrid contracts is encouraged, if the situation is appropriate. The right contract type for a particular job is one that is most likely to produce the desired results, is equitable, and can be negotiated.

3 CPIF ELEMENTS

Cost Incentive

One benefit of the CPIF contract is that the contractor is offered incentives to manage costs effectively. The key to contractor motivation is the arrangement and value established for target cost, target fee, maximum fee, and share formula. These elements are interrelated, so they must all be considered and structured as a unit. Target cost and target fee are the most logical starting point, but the approach used to develop the overall structure is flexible. Any approach is satisfactory that conveys the Government's desired objectives to the contractor for all of the elements (Figure 1).

Target Cost

1. *Definition.* Target cost means all of the following

a. The project cost at which the contractor earns the target fee.

b. The cost which represents a 50/50 chance (based on currently available information) of being either more or less than the actual cost. (This cost should not be confused with the possible magnitude of such overrun or underrun.)

c. The cost standard, negotiated with the contractor, from which his effectiveness in controlling costs will be evaluated.

2. *Relationship to Government Estimate.* It is unreasonable to expect that the negotiated target cost will, or necessarily should, be the same as the Government's estimate. The uncertainties which made the cost reimbursement type of contract appropriate also produce a wide range of possible costs for the project. The range can be calculated by estimating the *highest and lowest probable costs*, using the Government estimate as the benchmark. Obviously, the target cost must be within this range.

3. *Range and Distribution of Cost.* The range and distribution of cost, relative to the target cost, varies with contract type (see Figure 2). As Figure 2 indicates, under an FFP contract, the contractor's bid will likely reflect an amount that he is quite certain will not be exceeded, say 95 percent certain, since he must bear 100 percent of any cost overrun; conversely, under a CPFF contract, the cost of overruns is borne 100 percent by the Government, so the contractor will risk nothing by agreeing to a target cost which has an equal probability of overrun or underrun. The CPIF contract falls between these two extremes, with a greater probability that actual cost will be less than the target cost. The odds favoring the actual cost being less than the target cost increase as the contractor's share of the savings realized increases. Figure 2 shows that the distribution curve is not symmetrical, which, for this example, reflects the assumption that under a CPFF contract, the magnitude of probable cost overrun is about twice as great as the magnitude of probable underrun. All available information should be used when developing a range and distribution chart for the project. These elements are necessary for analyzing the effects of different target cost/target fee combinations and the range of incentive effectiveness during negotiations.

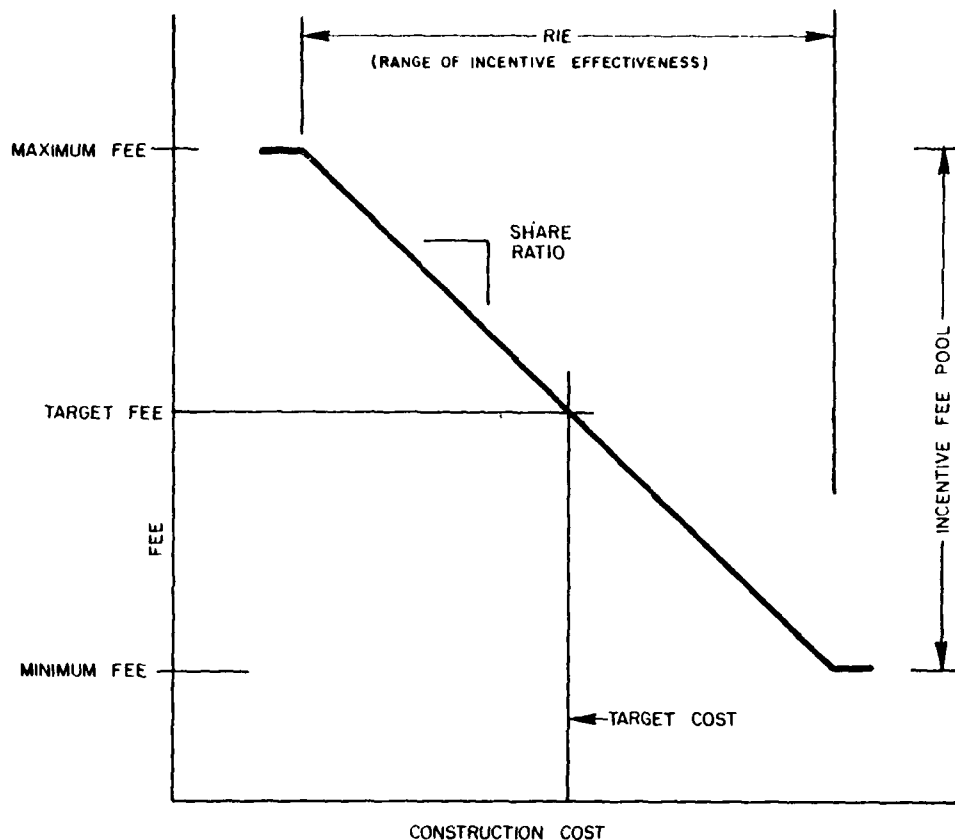


Figure 1. CPIF cost incentive structure.

Target Fee

1. *Definition.* The target fee is the sum of the minimum fee plus the incentive fee the contractor will earn for achieving a specified level of performance at the target cost.

2. *Relationship to Target Cost.* Figure 1 shows target cost residing in the center of the range of incentive effectiveness (RIE). This is an idealistic situation seldom found in reality. It is more likely that the negotiated target cost will tend toward the high end of the probable construction cost range (see Figure 3). When this occurs, procurement personnel should consider that the target fee must also be coordinated with the target cost in order to maintain incentive effectiveness over all or as much of the RIE as possible.

3. *Compensation for Risk Taking.* In the FFP contract, the contractor is responsible for essentially all of the risk factors. Conversely, in the CPFF contract, the Government assumes essentially all of the risk. A portion of the profit markup allowed on the FFP contract compensates the contractor for accepting the risks. However, the amount is never enough to prevent the contractor from experiencing some loss if all the uncertain events capable of producing an economic loss occur. In order to remain competitive, the contractor will budget for contingencies only the amount needed to prevent him from experiencing catastrophic loss. In the CPFF, the contractor does not assume the construction risks, so the fee should not include any compensation for it. However, under a CPIF contract, the contractor assumes some risk and the fee should include

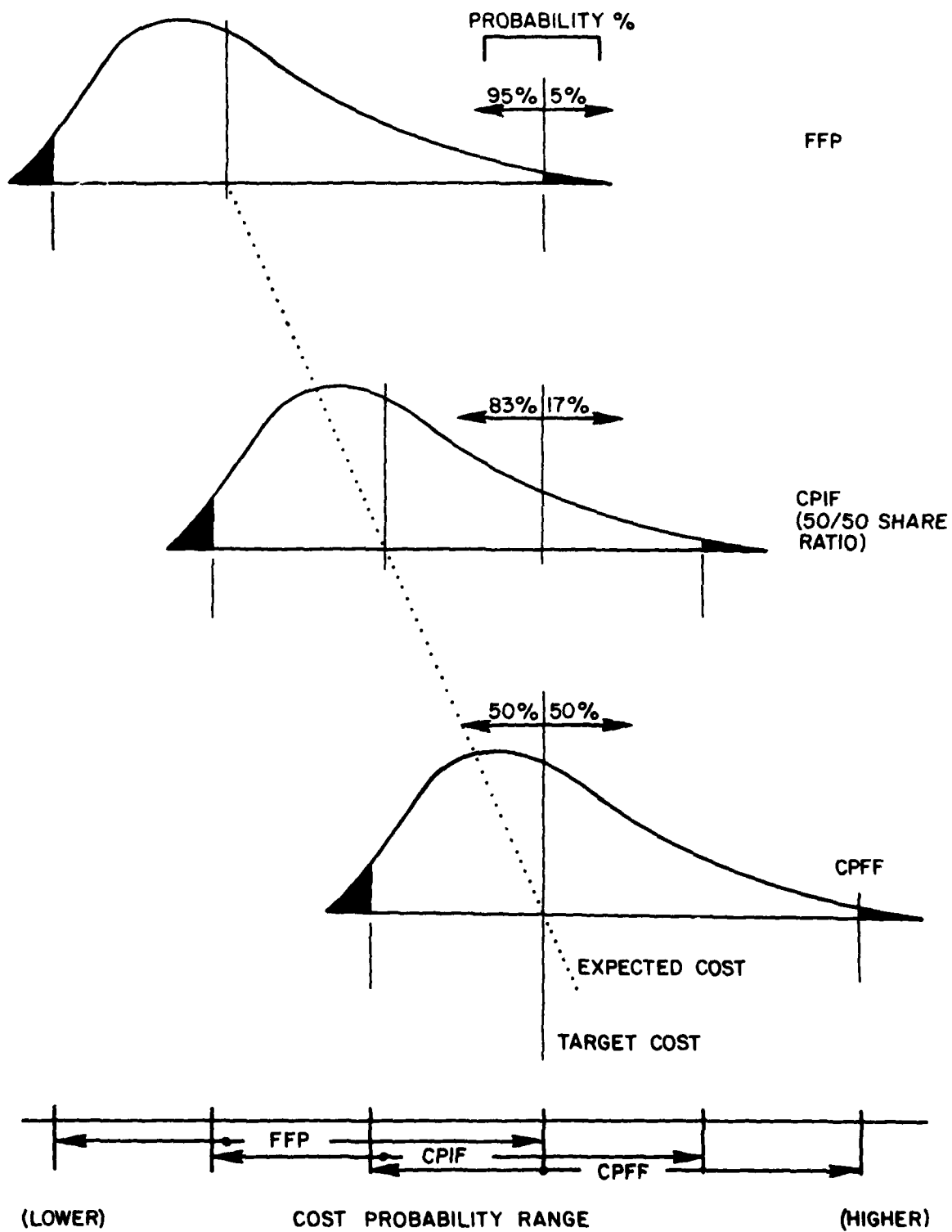


Figure 2. Cost probability range.

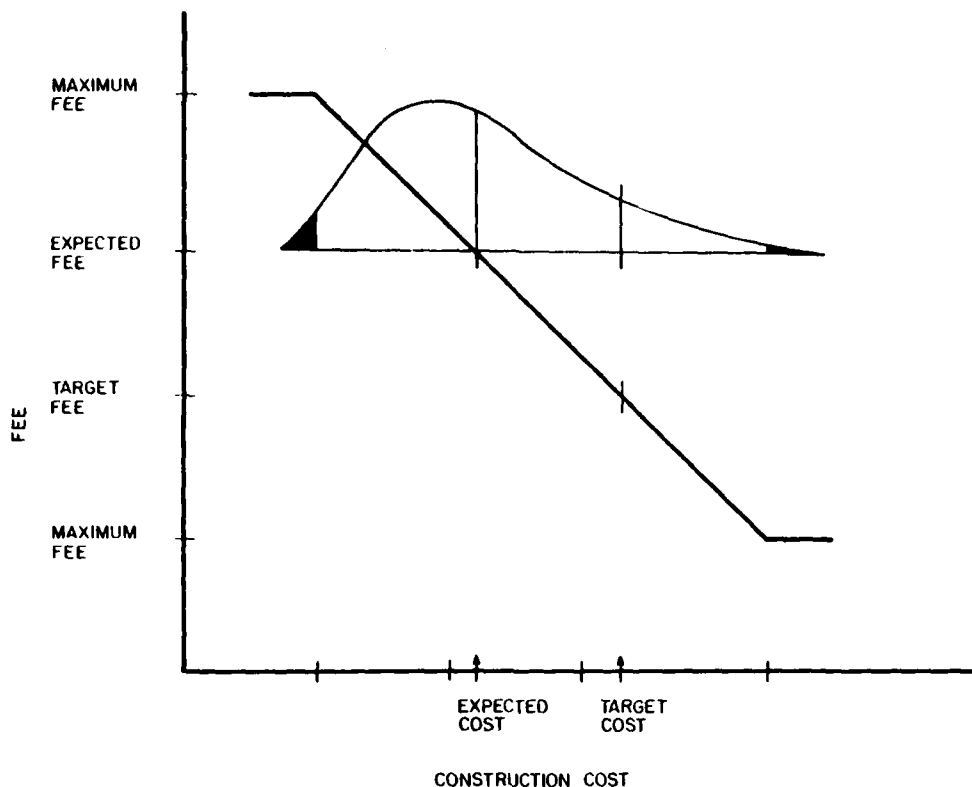


Figure 3. Relationship of probable cost distribution to the range of incentive effectiveness (RIE) (50/50 share ratio).

an allowance for it. The amount of risk exposure assigned to the contractor under CPIF is directly proportional to the share ratio. A CPIF contract with a 50/50 share ratio means that the contractor's share of the risks is 50 percent, while a 60/40 share ratio means that the contractor's share of the risks is 40 percent, and so forth. The fee in a CPIF contract should reflect the risks assumed by the contractor, which are not only in proportion to his share of the share ratio, but also to the proximity of the negotiated target cost to the expected cost. It will be easier to maintain expenses within a higher target cost, so the fee should be lower.

Maximum Fee

1. *Definition.* The maximum fee is the sum of the minimum fee plus the incentive fee that the contractor earns for maintaining a specified performance level and achieving maximum cost reduction.

2. *Limitation.* The maximum fee shall not exceed the limitation stated in DAR 3-405.6(c)(2), which

presently amounts to 10 percent of the estimated cost of the contract, exclusive of the fee.

3. *Relationship to Range and Distribution of Costs.* In Figure 3, the CPIF cost distribution curve shown in Figure 2 has been placed on a cost incentive chart to show the relationship between the two. The cost distribution extremes define the limits of the share ratio line. Until some numbers are placed on Figure 3, the range of incentive effectiveness fully covers the range of probable costs. This is a desired, but not always attainable goal. In Figure 4, dollar quantities have been added to the chart. For maximum cost performance, the contractor will earn a \$22,000 fee; however, 10 percent of the target cost is \$17,300, and it is illegal to make a commitment for a fee that exceeds this amount. Figure 5 shows one way to correct this problem; i.e., leaving everything else unchanged, the maximum fee is set at \$17,300, and this figure dictates the corresponding minimum construction cost. There

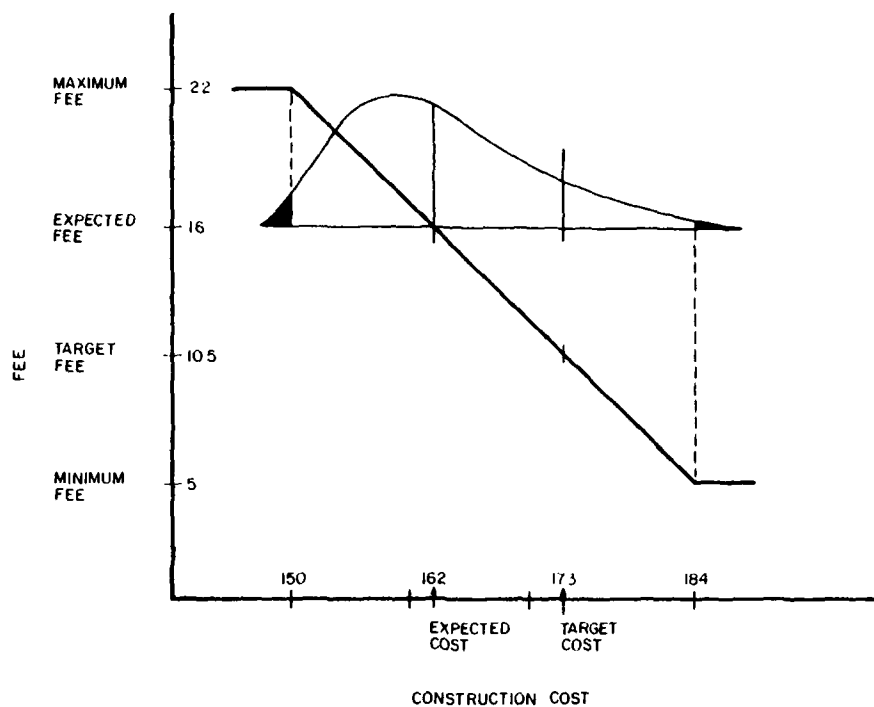


Figure 4. CPM (50/50 share ratio).

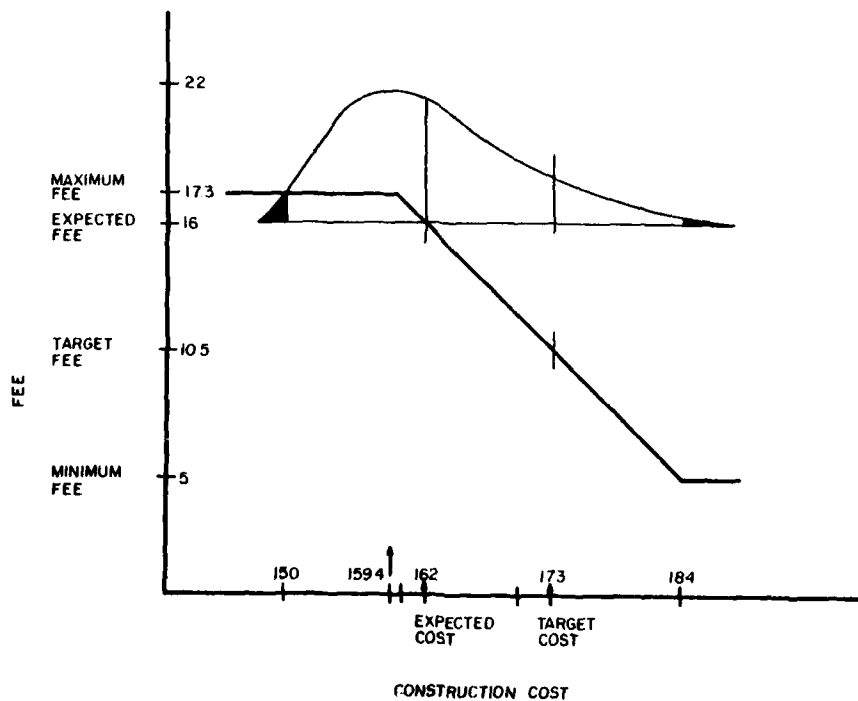


Figure 5. Incentive to avoid excessive maximum fee.

are cases where this technique may be appropriate, but it is by no means the only or best alternative available. The main objection to this method is the loss of incentive which occurs in this example at costs below \$159,400, when it has already been established that the job could be completed for \$150,000. Techniques for structuring CPIF contract cost incentives to avoid such pitfalls are discussed in the "Share Formula" section below.

Minimum Fee

1. *Definition.* The minimum fee is the amount that the contractor will be paid, regardless of performance.

2. *Relationship to FF Under CPFF.* Since the target cost/target fee point represents average contractor performance, and the minimum cost/maximum fee point represents excellent contractor performance, then the maximum cost/minimum fee point represents poor contractor performance. The potential for the contractor to earn a larger fee for better performance should likewise be balanced with the potential to earn a smaller fee for poor performance. The CPIF minimum fee should be in balance with the total incentive structure, and should not be more than the fixed fee would be if a CPFF contract were used.

3. *Relationship to Range and Distribution of Costs.* In the example provided in Figure 4, the minimum fee of \$5000 is earned when construction cost is \$184,000, which coincides with the maximum probable construction cost. As with the maximum fee/minimum construction cost combination, the minimum fee/maximum construction cost combination ideally occurs in the area indicated by the distribution curve. The differential in fee from minimum to maximum and the cost amounts represented by each can be varied with different share ratios and other cost and fee factors. Fundamentally, however, the minimum fee/maximum cost and the maximum fee/minimum cost points should fall on the share ratio line between and as close as possible to their respective ends of the cost distribution curve.

Share Formula

1. *Definition.* The share formula is the ratio by which the Government and the contractor share the construction cost savings achieved under a CPIF contract. The ratio is expressed, for example, as 60/40, with the Government's share shown first. Typical ratios used range from 50/50 to 80/20.

2. *Effect on Incentives.* Figure 6 superimposes other share ratios on the example shown in Figure 4, using target fee/cost as a common point. This shows the effect

on minimum and maximum fees that different share ratios have, and as stated previously, the larger the contractor's share of the savings, the greater his incentive to save will be. Consequently, from the standpoint of incentive, the 50/50 ratio is best; however, as shown in this example, it severely reduces the range of incentive effectiveness in order to avoid exceeding the 10 percent maximum fee limitation. Therefore, in this case, another ratio that better spans the entire range of probable cost should be used. Figure 7 shows the result of using a 70/30 ratio. Ratios in excess of 50/50 (i.e., 40/60, 30/70) are usually not recommended, because most situations in which they might work would presuppose a very narrow range of probable costs, which would make the use of the ultimate incentive contract the FFP (share ratio 0/100) very feasible.

3. *Broken Share Lines.* There is no rule requiring the share ratio to remain constant from minimum fee, through target fee, to maximum fee. Share ratios may differ for different segments of the cost probability range if that type of arrangement is needed to convey the Government's objectives. However, simplicity and straightforwardness are more effective than oversophistication. The structure may be theoretically correct, but ineffective as a vehicle from which the contractor (and the Government) can confidently formulate plans of action for maximum return on investment. The structure should be kept as simple as possible; share formulas that are not straight lines are not simple, particularly when the fee must be reevaluated to reflect later changes in the scope of work.

Range of Incentive Effectiveness (RIE)

The RIE has been compared to the range of probable costs in previous discussions. The RIE is the range of construction costs occurring between the minimum fee and the maximum fee, and hopefully it will also cover the entire range of probable costs. Figure 5 shows the loss of a significant portion of the probable cost range because of maximum fee limitations. Negotiating a minimum fee that covers the full range of probable costs may sometimes be difficult, if not impossible. As the cost distribution figure shows, the probability of the cost actually occurring decreases as the upper and lower extremes are approached, so some truncation of the range of probable costs can occur without having ill effects on the incentive structure. In fact, even a badly truncated RIE leaves some incentive for the contractor to perform well, and such incentive is not present in a CPFF contract. Outside the RIE limits, the CPIF contract incentives become inoperative, or equivalent to a CPFF contract. To minimize truncation,

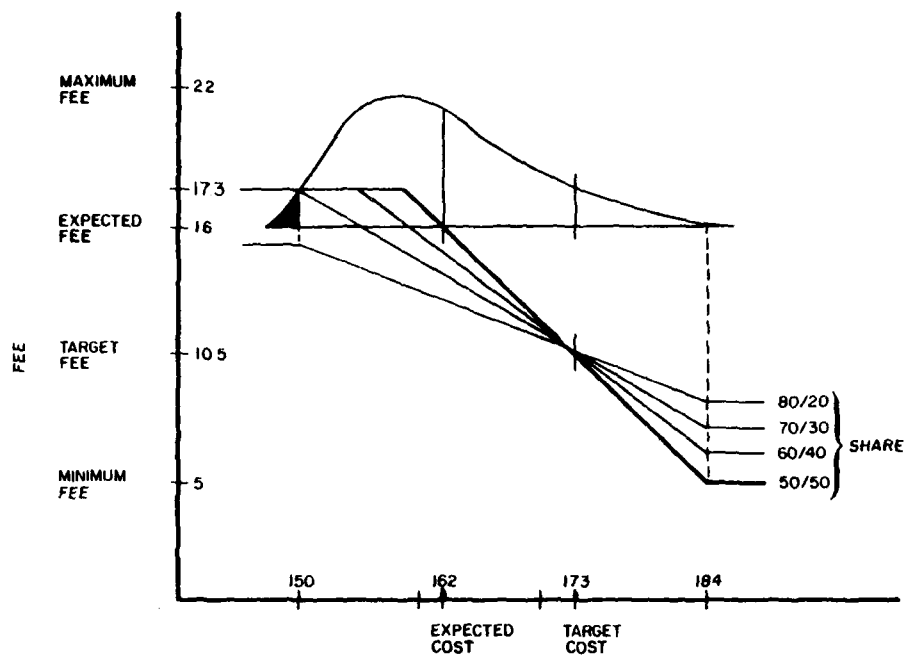


Figure 6. Effect of different share ratios.

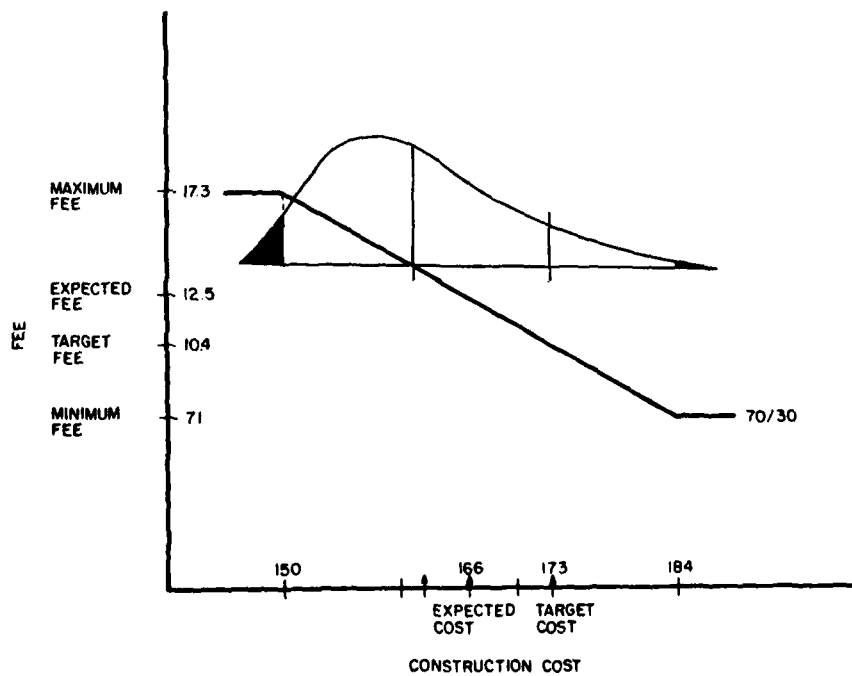


Figure 7. Effect of 70/30 vs 50/50 share ratio on RIE.

the share ratio that implies an RIE that most nearly coincides with the probable cost distribution should be selected, and the values and relationship of maximum, target, and minimum fees and costs should be arranged to produce the best results. Figure 8 shows a "last resort" CPIF cost incentive structure for the example shown in Figure 7. This is not the optimum solution, but it is preferable to using a CPFF in which the fixed fee is the same as the indicated target fee. Figure 8 shows that the minimum fee coincides with the target fee; the share ratio of 70/30 has been selected to yield the largest RIE, with the maximum fee occurring at an attainable cost saving. When comparing this structure to a CPFF with a \$10,500 fixed fee, it appears that the contractor would prefer the CPIF, since the CPIF offers him the potential to earn a larger fee, without the risk that it will be reduced because of substandard performance. The Government also prefers the CPIF contract, because it offers the potential for lower total project costs if the contractor responds to the incentive. In this case, neither party has anything to lose, but does have the

opportunity to gain something. A CPIF structure like the one shown in Figure 8 is far from ideal for either the contractor or the Government. It only demonstrates the CPIF's potential, even when negotiations fail to produce a mutually more beneficial structure.

Schedule Incentive

1. *Value of Time.* Most construction projects specify a definite completion date, or some interim beneficial occupancy date and a final completion date. The Government must establish the importance it places on timely completion of a job and assign a dollar value to it. The progress schedule will be planned so that various stages of the work are completed by specific dates, and the project cost estimate will be based on that time-frame. Since the consequences of not meeting the established dates will vary widely among projects, the dollar value established for finishing on time will also vary widely. This is true for both CPIFs and FFPs; procurement personnel must know the value of timely completion and inform the contractor of this amount.

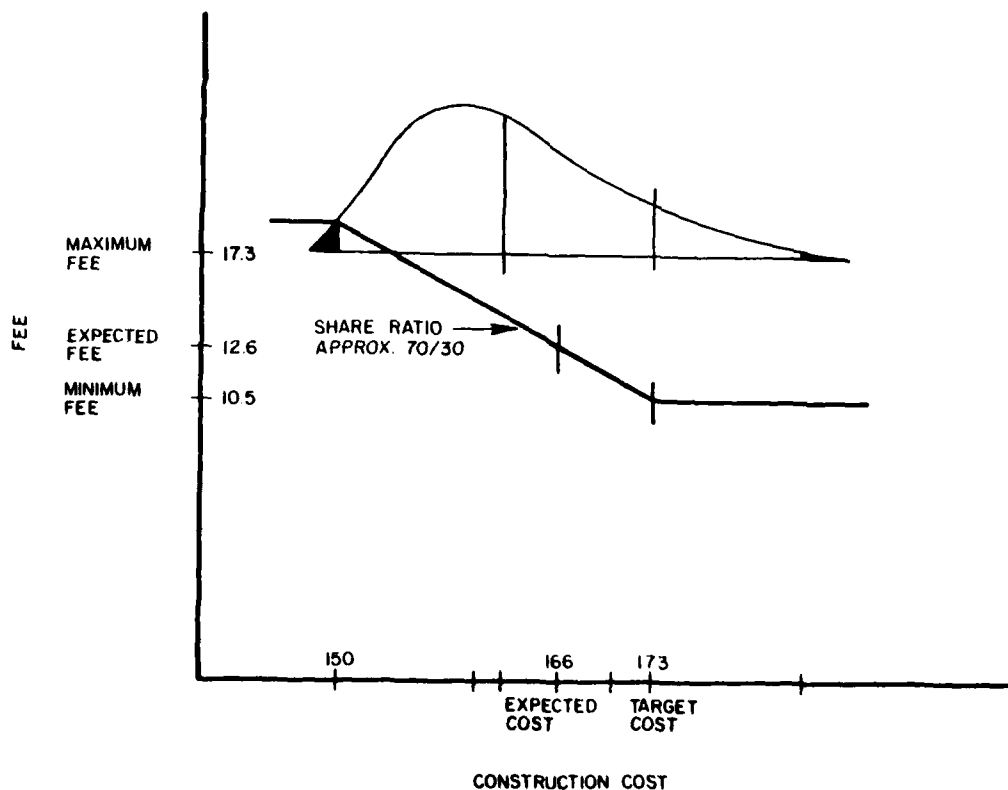


Figure 8. "Last resort" cost incentive structure.

2. *Reducing Cost vs. Saving Time.* In a CPFF contract, the contractor does not risk losing money if the job is not completed on schedule; he always receives the same fee. However, in an FFP contract, the contractor has assumed the risks of timely completion and must decide how much money he can allocate to timely completion in view of the liquidated damages he will incur if the job is not completed on time. Similarly, under C PIF, the structure contains a cost/time trade-off ratio. This ratio is developed by comparing the potential cost reduction fee earnings to the penalty for late completion. For example, with a share ratio of 50/50, the fee increases \$10,000 for each \$20,000 saved; if the time penalty is \$10,000 per day, then the contractor must choose whether to complete the job one day late or spend \$20,000 to complete it on time. Either way, the contractor's financial consequences are the same; however, if he can recoup the day by spending only \$10,000, he will have saved \$5000. The key to a good C PIF schedule incentive is selecting a cost/time trade-off arrangement that accurately depicts the Government's objectives, and then letting the contractor make the daily decisions required to fulfill the Government's objectives and his own profit objectives concurrently.

3. *Schedule Penalty.* The uniform method of penalty assessment (see Figure 9) has the advantage of simplicity, and is therefore preferred unless there is an overriding need to use some other method. There are limitless variations of graduated and compounded methods which can be used when the situation requires this additional sophistication. For example, when more than one milestone must be met, a graph similar to Figure 9, including values, would be developed for each date to compute a time penalty.

4. *Limit of Penalty Effectiveness.* Under an FFP contract, the contractor must pay for any assessed liquidated damages from his earnings. Likewise, under a C PIF contract, he must pay time penalty assessments from his incentive fee earnings. Since the contractor earns an incentive fee for reducing construction costs, the amount which may be extracted for late completion is limited to what the contractor has earned in excess of the minimum fee.

5. *Cost/Schedule Incentive Interface.* It should be obvious that for construction work, a cost incentive without a counterbalancing schedule penalty is unrea-

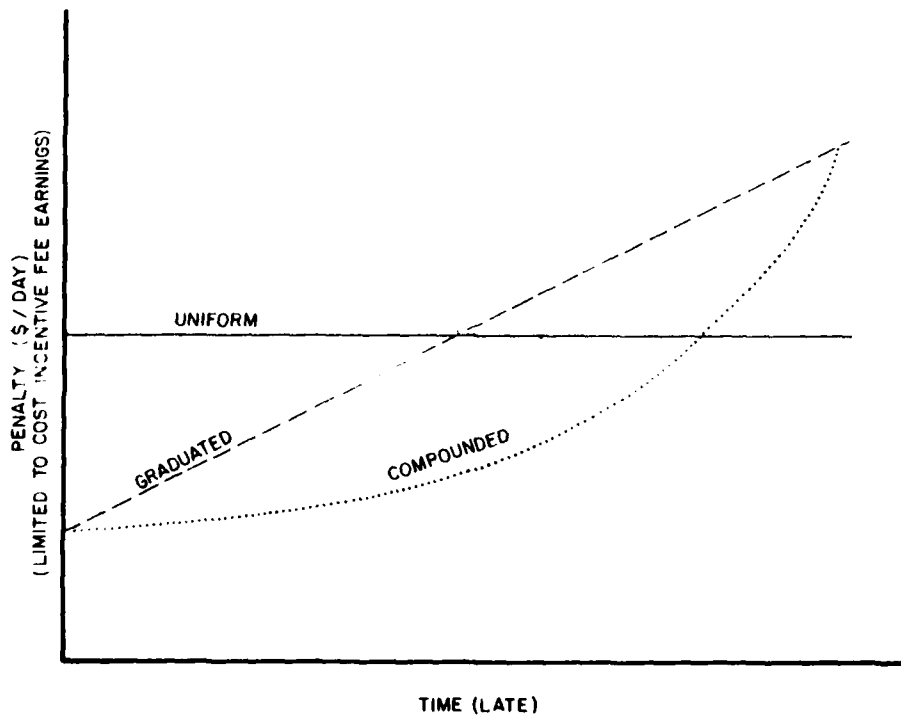


Figure 9. Uniform method of penalty assessment.

sonable. The contractor would concentrate entirely on cost saving and would have little incentive for completing the job on time. Conversely a schedule incentive without a counterbalancing cost incentive would not produce the desired outcome unless the objective was to complete the project as quickly as possible with no consideration of excessive costs. Both construction cost and the value of time must be accounted for in an equitably structured CPIF.

Multiple Incentive

So far, construction cost and time have been discussed as factors to be considered in structuring a CPIF contract. While these are the indispensable ingredients of a contract, they are not the only considerations, although they do lend themselves to after-the-fact, objective performance evaluations. Other elements, such as cooperation (which encompasses many factors) and administrative procedures, cannot be evaluated objectively. Subjective evaluation is the keystone of the CPAF contract, but a CPIF may include some CPAF elements. The subjectively evaluated features may either be rated periodically (using an agreed-upon methodology) and partial payments made at these intervals, or

they may be given a final rating (based on periodic evaluations) and payment made after the project is completed. Tables 1 and 2 outline a suggested evaluation procedure for subjectively evaluated elements. Any amount set aside for this type of fee payment must be included when calculating the maximum fee allowed by DAR. The evaluation criteria must apply for the life of the contract, and the weights assigned the various elements must not be altered. Any variation would be unfair to the contractor, as well as counterproductive for the Government.

4 NEGOTIATIONS

Negotiating a CPIF contract probably requires more skill than any other type of contract. A CPIF has more variables to be considered, and their interrelationship prevents settling them individually; rather, the entire package must be considered. This does not mean that CPIF negotiations will necessarily consume an inordi-

Table 1
Cooperation Award Rating Elements Description

Rating Element	Description*
Communications and Authority	Adherence to contractually established lines of communication and authority. Recognition of the Corps as the only entity authorized to administer the contract.
Responsiveness	Prompt reaction to technical direction, response to requests for proposals on change orders, and updating schedule to reflect current planning.
Reporting	Timeliness and accuracy of recurring and special reports. CQC test reports are factual and complete.
Post J.O. Cooperation	Accomplishment of post J.O. work efficiently with minimum interference to other activities. Provide assistance to user as feasible.
Cooperation With the Other DCC	Exchange of equipment, manpower, and information on design and construction techniques, etc., to the mutual benefit of the DCCs and the Corps. Initiate rapport with the other DCC to avoid repeating the same mistake on both jobs.

*These descriptions are not intended to be all-inclusive. They merely provide examples of the type of activities to be considered under each rating element. However, if additional factors will be added, care must be taken to avoid duplication of the same factor in more than one element, thereby placing the contractor in a position of double jeopardy or double reward.

Table 2
Performance Evaluation Report

Rating Element	Evaluation*					Score	Element Factor Rating
	0.00 Poor	0.25 Fair	0.50 Good	0.75 Very Good	1.00 Excellent		
Communication & Authority	Habitually attempts to circumvent prescribed procedures.	Occasionally violates prescribed procedures.	Usually works within the authorized organizational structure.	Always works in compliance with established procedures.	Always complies with established procedures. Seeks ways to improve efficiency within the system.		x .30
Responsiveness	Always very slow to comply and schedule always outdated, with severe prodding.	Usually slow to comply and/or schedule outdated, with much prodding.	Usually prompt to comply and schedule usually current, with much prodding.	Always prompt to comply and schedule always current, with some prodding.	Always prompt to comply and schedule always current, without prodding.		x .30
Reporting	Always late, incomplete, and inaccurate.	Usually late, incomplete, and inaccurate.	Usually on time, complete, and accurate.	Always on time, complete, and accurate, with some prodding.	Always on time, complete, and accurate, without prodding.		x .30
Post J.O. Cooperation	Minimal cooperation; refuses to provide assistance.	Usually cooperates; avoids providing assistance.	Usually cooperates and provides assistance when requested.	Always cooperates and provides assistance when requested.	Always cooperates and voluntarily provides assistance.		x .30
Cooperation With Other DCC	Avoids cooperation, even when asked.	Usually cooperates when asked.	Always cooperates and occasionally takes the initiative.	Always cooperates and often takes the initiative.	Always takes the initiative in providing and getting full cooperation.		x .30

*Interpolate as necessary

NOTE: Ratings of "Poor" or "Excellent" require supportive data and/or justification.

Overall Rating

Rating this period	award fee	(\$)	Amount
No. of Partial Payments	x pool (\$)	=	Earned this Period

nate amount of valuable time, but only that procurement personnel require more knowledge to negotiate a CPIF.

Before attempting to negotiate a CPIF contract, the Government must have developed a structure that both satisfies its own objectives and provides the contractor equitable return for his efforts. In addition, the Govern-

ment must have developed enough alternative structures to respond to anticipated contractor counterproposals. Furthermore, the Government must have such intimate knowledge of the CPIF methodology that the effect of a wide variety of individual changes can be quickly assessed for their impact on the overall effectiveness of the incentives. Finally, the Government must have a negotiating strategy.

Government strategy usually involves generating three positions: (1) the best agreement that can feasibly be expected, (2) the agreement offering the best balance of Government/contractor equitability, and (3) the worst arrangement the Government would accept. For this strategy to have creditability, none of the positions that would be accepted would hurt either the contractor or the Government. The aim is to maintain fairness and equitability in all cases; conveying this message to the contractor can save time that otherwise might be spent trying to resolve vastly different positions taken merely because neither party trusts the other.

5 CONCLUSIONS AND RECOMMENDATIONS

This report has provided an overview of various types of cost-reimbursement contracts.

The benefits of CPIF contracts are:

1. They provide the opportunity for lower total project cost.
2. They allow the Government to relax its administrative participation in contractor procurement and planning activities.
3. They provide the contractor with incentive to manage effectively.
4. They do not increase the Government's administrative cost.

Guidelines useful to the Corps procurement personnel in structuring CPIF contracts for maximum effectiveness and in contract negotiating strategies are contained in Chapters 3 and 4.

It is recommended that CPIF be used in lieu of CPFF whenever conditions permit.

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Cost plus incentive fee for construction contracts / by M. J. O'Connor, G. E. Colwell. -- Champaign, IL : Construction Engineering Research Laboratory ; Springfield, VA : available from NTIS, 1980.
21 p., 27 cm. (Technical report, P-118)

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