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CONTRACTUAL ARRANGEMENTS

A CONSTRUCTION INDUSTRY COST EFFECTIVENESS PROJECT REPORT

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I

SUMMARY

Research on the CICE Project found many factors that influence the cost of projects. While others are more visible, contractual arrangements also have a significant impact on these costs. These arrangements establish the "rules of the game" for a construction project. Yet many owners fail to perceive the significant savings they can achieve through a more astute approach to developing the rules by which their time and money will be expended. Information from a sample of major owners and contractors indicates that many owners could achieve cost savings of more than five percent in most projects through improved contracting techniques.

It is of primary importance that project managers recognize the concept of risk management. By risk we mean the possible negative impact of events which may occur during the course of a project. They must understand risk accountability and how to transfer and/or share risk. The owner must assess the general risks along with any peculiarities related to the specific project. Then he must determine rationally which risks his organization has the experience and capability to assume. The owner can then develop a contracting strategy to match his objectives and resources with those of the contractor.

In assessing the type of contract to be used, one usually must make trade-offs between cost and time. A fixed-price contract generally keeps costs within a predetermined budget, but the total project time is usually longer because reasonably complete definition of the project's scope and most of the design are required before such a contract can be awarded. Conversely, a cost-reimbursable contract requires greater owner participation to control costs but can be awarded earlier. There are also numerous variations and combinations which ownermanagement may want to consider.

Some owners use incentive clauses in an effort to achieve better contractor performance. Incentives can be used for the purpose of reducing cost, improving schedule, or ensuring emphasis on other performance objectives such as safety and quality. Incentives should be reasonably simple and manageable. Incentives based on man-hour targets generally meet this criteria and can be used to help control costs.

When an owner's contracting plan has developed to the point of decision about the principal contract features, it is essential that good communications be established with the contractor in order to assess the contractor's experience and capability to assume and control risks. In arriving at a contract, both parties should recognize each other's goals and capabilities. Owners should avoid dictating preferential contract language through superior bargaining power. This creates an adversary relationship between the owner and contractor, a poisoned atmosphere that can jeopardize the owner's objectives for the project.

Other CICE reports have addressed many individual risks in the construction process. This study addresses the ways that contractual arrangements can affect almost all risks to a large or small degree. Contract language is the means by which many of the recommendations contained in other CICE reports can be implemented.

Owners are reminded that the most successful contracts have one fundamental characteristic in common: thoughtful and meticulous preparation by the owner *before* the contract is let. It is crucial that all elements of the owner's organization who have impact on a project be represented in the planning so that all constraints and tradeoffs are considered and the resulting strategy best fits the owner's aims.

II

STUDY OBJECTIVES

The goal of the study team was to provide owners with ways to improve cost-effectiveness through better contractual arrangements.

Specific objectives of the report are to:

1. Emphasize contract planning as part of the initial project planning process, with special attention to what needs to be considered in the contract execution.
2. Report on items that should be considered in choosing a contracting strategy.
3. Provide analysis of types of contracts and methods of contracting which can be used to meet selected strategies.
4. Provide a means for assessing the risks in contracting, using the principles of risk management.
5. Identify the criteria and procedure for contractor selection, incorporating Objectives 1 through 4.

III

INTRODUCTION

Contractual arrangements in construction are becoming increasingly more involved, with the potential for significant added costs to owners and contractors. Project complexity and the changing and increasingly costly legal and insurance environment are major reasons for owners to consider whether better contractual arrangements are possible. Contracts, of course, must be made early in the life of a project. To do this and simultaneously provide for the risks of uncertainties while gaining improved productivity and innovation are major challenges for both owners and contractors.

Risk is defined as the possibility of loss or injury. On construction projects, risk usually means the possibility of financial loss. In addition, however, it can mean delay in schedule and a resultant

loss of market, a loss of desired quality of construction or the physical and financial loss resulting from accidents and injuries. Both parties should approach contracting with the aim of meeting their respective goals, recognizing the interests of the other, and allocating responsibility for risks in accordance with the ability of each to control or minimize that particular risk.

The owner of any construction project has three goals: the most economical (not necessarily the cheapest) cost, specified quality, and completion on schedule. These goals are not always fully attainable in any one contract, so compromise is usually necessary to achieve a combination of objectives deemed most important. The contractor obviously wants to make a profit on the contract, but studies indicate that he may well have other goals; for instance, reducing his liability exposure on the project and satisfying such long-term needs as survival, growth, a greater share of the market, even prestige.

Allocation of risk must follow definable principles. Literature on the subject shows that risk allocation should be based on the degree of control over the incidence of a cost liability, the potential profit or return from proper risk management, incentive provisions to perform the contract more effectively, and the relative ability of the parties to protect themselves against risks. Naturally, risk is a two-way street. Exposure to economic loss is balanced by possible extra gains through proper risk management.

IV

HOW STUDY WAS MADE

Individual study team members' experience was used to construct a sequence of operations for the contracting process. The team prepared position papers on the major portions of the study based on member experience and research. The analysis of cost liabilities was arrived at through consensus of the team members.

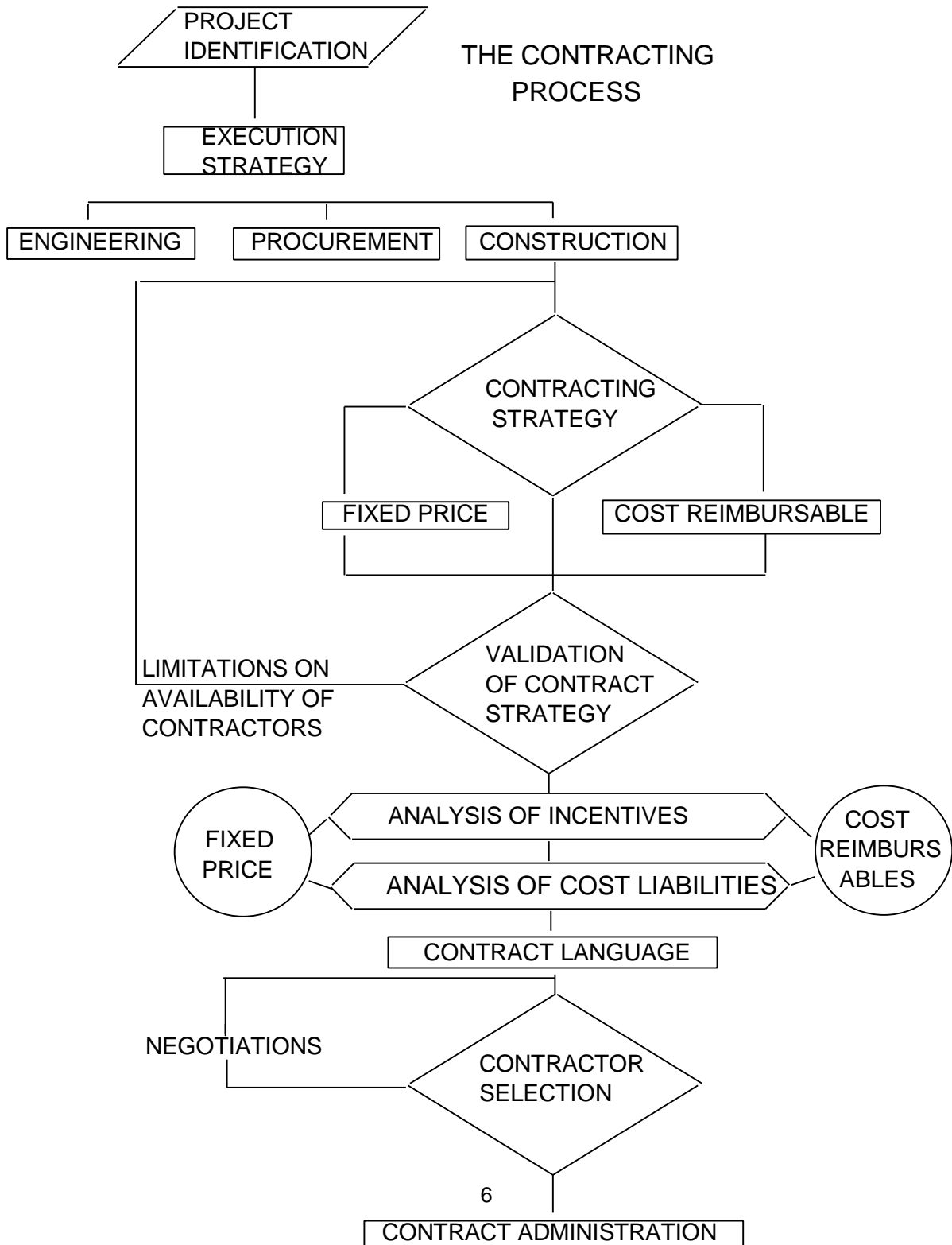
The underlying philosophy of this report is that the contract should provide the means to manage and allocate risk. The contracting strategy needs to be build around the recognition of the relationship between contract terms and conditions and accompanying risks and cost impacts. The type of contract and specific language should flow from this analysis.

The contracting process was defined in eight steps:

1. Execution Strategy: The decision-making process that determines how the project will be executed, including the owner's internal management capabilities as opposed to those available through contracting.
2. Contracting Strategy: The decision-making process to determine what type contract or contracts are required to meet the owner's objectives considering the advantages and disadvantages of each contract type.
3. Validation of Contractor Capability: The determination as to whether adequate contracting capability of the desired type exists.
4. Analysis and Selection of Any Incentives: Decisions about appropriate types and methods of establishing contract incentives.
5. Analysis of Cost Liabilities or Impacts of Risks: The determination of probable liability and cost impact to the contracting parties of the incidence of specific risks.
6. Contract Language: The preparation of contract language which recognizes principles of risk sharing and makes proper allocation of risks.
7. Contractor Selection: The principles and procedures of contractor selection.
8. Contract Administration: The general rules of equitable contract management.

Figure 1 is a flow diagram of this contracting process.

FIGURE 1



V

FINDINGS

Construction contracts, involving millions of dollars and the fortunes of large enterprises, can be drawn in a great variety of forms, depending on the aims and supervisory capabilities of the owner and the ability and financial resources of the contractor. The most successful contracts have at least one fundamental in common: thoughtful and thorough preparation by the owner *before* the contract is let.

Execution Strategy

The essential decision in execution strategy is whether to contract and to what extent. Before deciding how a project will be executed, an owner must develop, through engineering studies, the basic project parameters. This starts with the identification of the type facility, the required operational date, desired project life, reliability, necessary supporting facilities, and a preliminary cost estimate. From this information, a statement of the Scope of Work and a preliminary work sequence can be developed for use in preparing a bid package.

A prerequisite for achieving the best contract is the owner's commitment to thorough project planning. It is crucial that all of the owner's project related organization is represented in the planning so that all constraints and trade-offs are considered and the resulting strategy best fits the owner's aims.

Contracting Strategy

Once an owner decides to contract, he can pick from a wide variety of single or multiple contracts. There are two fundamental classifications: the fixed-price, in which the contractor has primary cost responsibility, and the cost-reimbursable, in which the owner shares in cost-responsibility. Variations and combinations of these two basic types can be formed, depending on the degree of risks assumed by either party¹.

The three objectives of cost, time, and quality must be analyzed and placed in some priority, since trade-offs will probably be necessary in deciding what type of contract is to be used. If the owner wants the contractor to assume responsibility for controlling cost within a predetermined budget,

¹ See Appendix A for a list of the requirements, applicability, and characteristics of fixed-price and cost-reimbursable contracts and their variations.

a fixed-price contract should fill the role. However, the total project time is usually longer with this type of contract because the project drawings and specifications must be more complete before bids are solicited. Cost control must be balanced against the need for speed—an increasingly important item if borrowed funds are being used to finance construction in an era of lofty interest rates. In the cost-reimbursable contract, it is more difficult for the owner to predict his final cost, but shorter construction schedules can usually be achieved. The schematic drawing in Figure 2 illustrates the wide range of schedule trade-offs that owners must consider in formulating their contracting strategy. The owner can also specify particular quality objectives or other performance goals desired. Under either type of contract, the level of quality must be established through the specifications.

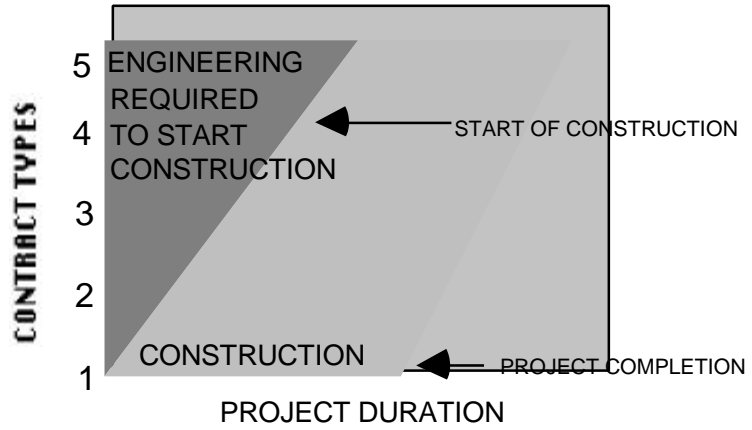
In addition to the owner's goals, the contractor's objectives should be considered. On long-term projects, for example, a contractor has extreme difficulty in operating with a fixed-price contract in periods of high inflation. On the other hand, if there is vigorous competition for work, for economic or other reasons, fixed-price contracts may be readily accepted by contractors—and bid prices should be lower. Such a situation, however, can lead to severe contract-execution problems because the contractor has high risk with low profit potential. The owner's goal of winning a commitment for lower contract costs must always be weighed against the risk of not achieving one or more of the overall project objectives.

Fixed-Price Contract

The fixed-price contract is considered to be the best incentive for the contractor to control costs and thereby enhance productivity. However, there are some significant owner considerations involved in its adoption and implementation. The owner must accept the responsibility for providing a complete contract, which includes the scope, the overall schedule, the desired quality of construction, and the adequacy of site condition.

FIGURE 2

PROJECT SCHEDULE DURATION
vs
TYPE OF CONTRACT



- 1 COST REIMBURSABLE W/% FEE
- 2 COST REIMBURSABLE W/FIXED FEE
- 3 TARGET PRICE
- 4 GUARANTEED MAXIMUM PRICE
- 5 LUMP SUM FIXED PRICE

Once a fixed-price contract is awarded, the owner loses direct projectmanagement control to the contractor; however, it is in the owner's best interest to maintain some degree of influence through contract administration, inspection, and monitoring contract performance.

A potentially serious imperfection in the fixed-price contract is the inordinate liabilities that an owner may place on the contractor for risks which the owner does not care to assume². A contractor will attempt to provide contingencies for "normal" risks, but owners should realize that requiring contractor liability or indemnification for certain risks over which the contractor has little or no control is counterproductive. The contractor will be faced with extreme financial loss or the loss of bidding competitiveness depending on his decision to gamble on certain risks. This subject is discussed further in section on Analyzing Cost Liabilities.

Several variations of the fixed-price or lump-sum contract are possible.

1. Unit price: Probably the most common variation is the unit-price contract, in which the actual quantities installed determine the price of each bid item. The contract is bid on the basis of estimated quantities. The quantities are often difficult, if not impossible, for the owner to estimate accurately before the contract award. Obviously, the owner assumes the risk of quantity variations. Frequently the contract will provide for additional protection to the contractor if actual quantities vary significantly from those in the bid schedule.
2. Series of fixed-price contracts: Some of the advantages of fixed-price contracts can, at times, be gained by subdividing the work and awarding a series of fixed-price contracts (or subcontracts), with each contract awarded when the design for that package is complete. This arrangement has two principal advantages over a single fixed-price contract:
 - Part of the project can be built while design continues on other portions, normally reducing total construction time.
 - Shorter contract durations are generally possible, allowing more precise estimating and bidding

² See Appendix A for a comparison of the relative risks to the owner and contractor of fixed-price and cost-reimbursable contracts.

There are, however, some disadvantages to the owner:

- The owner must, as in any fixed price contract, define the scope of work carefully for each contract and become significantly involved in coordination and administration to insure no omission or duplication of effort. Compared with a single fixed-price contract, this usually requires a larger owner's staff or the hiring of a construction-management firm.
 - One or more contractors can cause burdensome delays to others, resulting in numerous claims on the owner as well as overall loss of time.
 - It is difficult for the owner to fix responsibility for problems because frequently more than one contractor is involved.
 - The owner may become enmeshed in labor problems since labor disputes could involve more than one contractor.
 - The overall cost of the project may increase because of the added overhead of the multiple contracts.
3. Fixed-price with escalation: In this variation, the owner assumes the risk for future changes in prices of certain specified materials, or for overall inflation (through an index which adjusts the entire contract price). This type contract, which is most applicable during unstable economic conditions, greatly reduces the contractor's risk on long-term projects. It provides an alternative to the cost-reimbursable contract on such projects, yet it still gives the contractor an incentive to use his resources efficiently. There must be a carefully defined mechanism for measuring and paying escalation on bid prices only, since actual project costs can vary significantly from the reimbursed amounts.

Cost-Reimbursable Contracts

It is generally true that the owner runs the largest economic risk with a cost-reimbursable contract because the owner pays all of the contractor's allowable costs including tools, temporary facilities, home office expenses, and profit or fee. Where the contractor is charged with engineering and materials-management responsibilities, these can also be fully reimbursed by the owner, depending on the type of contract.

If a reimbursable contract is to operate successfully, all costs whether for labor, construction equipment, tools, supplies, or other categories must meet the test of need and auditability. For an expenditure to be made, the question of need must be satisfied. The authority to determine need depends on the contract conditions. If the contract states clearly that the contractor has a certain scope and is deemed to be an independent contractor, the authority to make such decisions belongs to the contractor. For instance, if the contractor is held responsible for meeting the schedule, then the contractor must have the authority to decide how much labor, tools and supplies, construction equipment and supervision is required.

When an owner grants this authority and the risks that go with it to a contractor, the latter has more freedom to act; but the owner needs a way to require the contractor to adhere to his commitments. This can entail encouraging and/or offering incentives to the contractor to spend the minimum amount of money to construct the project within the allotted time frame.

So owners should monitor the contractor's performance by measuring it against the owner's preset standards³. Setting such standards could become very difficult and very burdensome to monitor if every detail is considered. Performance can be measured primarily by the one standard that is affected by all items: labor productivity.

To obtain good labor productivity, a contractor must as a minimum:

- Provide good supervision.
- Provide good planning and scheduling.
- Make sure that the proper materials, equipment and tools are available at the right time.
- Furnish adequately skilled workers or train workers enough to meet project needs.
- Have the ability to measure site productivity in quantitative terms.

Four basic types of reimbursable contracts exist:

1. ***The cost-plus-percentage fee*** is used by private industry but prohibited for most public contracts. The owner assumes the full risk for cost and schedule. The contractor in theory has little, if any, incentive to meet the cost and schedule budgets and is actually, in a sense, rewarded for overruns. The situation can lead to inefficient operations, with constant audits required by the owner. The primary advantages of this type of contract are that it permits an earlier start of construction and provides the owner with a much greater degree of control over project execution.

³ See Report A-1, "Measuring Productivity in Construction, The Business Roundtable, 1982.

2. ***The cost-plus-fixed fee*** has most of the same disadvantages as the cost-plus-percentage fee contract, except that the contractor is probably making less profit than in the percentage fee contract. Although the contractor is not rewarded for overruns, there is still little incentive for underruns. The fixed fee, once established, does not vary with actual cost. However, it may be renegotiated resulting in the same kind of controversy that changes to a fixed-price contract often create.
3. ***Direct-cost reimbursable plus fixed-fee for indirects*** is another variation of the fully cost-reimbursable contract in which the fee includes all the cost items except direct labor, permanent plant equipment, and construction materials. This contract is a hybrid cost-reimbursable-fixed-price contract in which the risk to the owner is reduced by approximately the amount of the indirects, tools, and supplies necessary for the contractor to perform the work. This generally leaves the owner risking about 85% of the project cost rather than 100%. The contractor has some incentive to operate efficiently since overhead and other indirect costs are his responsibility.
4. ***The convertible contract*** is another hybrid in which the owner and the contractor share risk in proportion to the uncertainties of the specifications. The contract starts as cost-reimbursable and is converted to fixed-price as engineering proceeds and the project's scope becomes fully established. Thus the opportunity for the owner to shift the risk to the contractor becomes available. However, negotiating the fixed-price becomes a matter of bargaining rather than competition, as in a pure fixed-price contract⁴.

⁴ See Appendix B for a comparison of relative risks to the owner and contractor on fixed-price vs cost-reimbursable contracts.

Validation Of Contract Strategy

Once the owner decides to perform part or all of the engineering, procurement, and/or construction by contract, he tentatively selects a type of contract and develops a plan leading to contract execution.

With the selection of the desired type of contract (e.g., fixed-price, reimbursable, or some variation thereof), and the determination of an acceptable time schedule, it is prudent to "validate" the contracting plan; otherwise the approach anticipated, though attractive to the owner, may draw too few contractors to provide competitive bidding. This involves a written description of the proposed facilities in very general terms, setting forth the nature of the proposed facilities and the tentative contract terms and inviting contractors to submit an expression of their interest in the described project.

An opportunity is concurrently present for the owner to solicit a description of the contractor's qualifications for the proposed project. It is important to note that any given owner's plan is valid only for a limited time. Any changes in the economic climate may be cause for modifying a contracting plan.

The Role Of Incentives

Incentives are used by some owners in construction contracting in an effort to reduce the total contract cost, control the project schedule and support such performance goals as productivity, quality, safety, technological progress and innovation. Incentives, where used, should be designed to promote efficient contract management, achieve high performance standards, reward efficient contractors, and achieve some or all of the owner's specific project objectives. In general, some portion of the owner's risk is assigned to the contractor with a reward for accomplishing the objectives efficiently. Incentives, along with commensurate penalties, are only means to an end. They are only effective if the objectives are clearly understood by both parties and have a mutual benefit.

Incentives are primarily applicable to cost-plus contracts where they can be used to encourage the contractor to share the owner's risks on cost, schedule, quality or other desired project objectives. Appendix C provides a review of incentives that can be considered for construction contracts.

The major disadvantages of incentives are the difficulty of arriving at fair and equitable targets, a reduction in the owner's control over the contractor's activities, and the costs of additional

administration. Specific areas of difficulty normally encountered include:

- Negotiating problem to arrive at fair and equitable targets.
- Project engineering must be approximately 60% complete to establish the cost and schedule; otherwise, there are too many unknowns for the contract to be defined.
- If incentive provisions are exercised after the project is under way, the contract's general and special provisions must be reviewed and renegotiated to give the contractor necessary control of the work. Similarly, a change in the owner's contract administration would be necessary.

Devising effective incentives is a very complex undertaking. Owners considering their use may want to focus on one contractor goal, job profit, and one or two owner goals such as controlling cost and schedule, thus making the incentive mechanism easier to manage and to understand for both parties. Owners should either develop in-house expertise or hire consultants versed in the subject to assure fair and equitable provisions in contracts.

Analyzing Cost Liabilities

Failure to manage risk can result in project cost overruns of a catastrophic magnitude. While other CICE reports address individual risks, this study addresses the collective impact of contractual arrangements on risk management. A representative sample of major owners and contractors has estimated that contracting practices alone can result in cost impacts equivalent to five percent of the total project cost.

In today's competitive and inflationary economy, managers must become increasingly risk conscious to survive. They need to be able to recognize risk elements, understand risk accountability, know the capabilities required to manage risk, and be able to share risk appropriately through contractual arrangements.

Since the overall financial responsibility for any project rests with the owner, it is logical that the owner take the lead in risk evaluation. This activity should cover every element of the construction process that can be characterized as a potential cost. Appendix B is a generalized list of potential risks. This is not an all-inclusive list, but should stimulate the identification of specific project risks requiring contractual coverage.

Initially, all risks are the owner's accountability. It is only after a contract is consummated that some of the risks become the contractor's accountability; therefore, it is important that the owner understands how accountability varies with the type of contract. For example, the cost impact of labor productivity is the contractor's risk in a fixed-price contract and the owner's risk under a reimbursable arrangement. Appendix B identifies accountability for various risk elements under fixed-price and reimbursable arrangements.

After identifying the risks associated with a particular project, the owner must decide which risks his organization should assume. If experienced personnel are available, he may wish to go reimbursable to achieve some specific project objective such as schedule. If his workload is high or his organization does not maintain project execution experience, he may select a fixed-price contract to utilize the contractor's expertise. The basic point is to match capability and accountability with project objectives and avoid the crucial mistake of assuming risk accountability without the resources for effective management net.

Owners typically operate at the extremes of the risk spectrum. They either favor fixed-price, with the contractor assuming the largest share of risk accountability or reimbursable, with the owner assuming most of the risk liability. With some innovation and creativity, the astute manager can maximize the forte and capabilities of both parties. This is achieved by developing a mixed fixed-price/ reimbursable strategy with performance incentives.

It is important that both the owner and the contractor understand and accept the concept that effectively managed projects should reward both parties. Contracts that facilitate risk management benefit the owner through lower costs and shorter schedules. Acceptance of accountability and superior risk management by the contractor provides the opportunity for additional profit.

Contract Language: A Crucial Item

Many owners today lack a basic understanding of the use of equitable contractual language to obtain a prudent sharing of risks. Traditionally, the cost of a construction project is considered to consist of the cost of labor, materials, supervision, construction equipment, tools, supplies, and temporary facilities. Very little thought has been given to the "cost" of contractual language and its potential dollar impact on a project.

The risks accepted by the contractor through the contractual language are often very difficult to define in absolute terms. But the implied risks in practically any contract, if not tempered by insurance, could drive a contractor into bankruptcy if they actually occur. Contractors are exposed to lawsuits and/or out-of-pocket expenses for a number of causes normally included in construction contracts such as:

- Force majeure
- Indemnity
- Liens
- Labor laws
- Delays and extensions of time
- Liquidated or consequential damages
- Occupational safety and health
- Permits, licenses, laws, and regulations
- Equal employment opportunity regulations
- Termination for default by contractor
- Suspension of work
- Warranties and guarantees

These are often called boilerplate clauses; but different contractual drafting techniques, coupled with the many vicissitudes of give and take in contract negotiations, yield common provisions that can range from minimal impact to possibly catastrophic consequences for contractors. Thus, an owner can unwittingly increase his project costs by being overly protective and using contract language to require a contractor to assume risks over which he has only minimal control at best.

Appendix D provides an example of how contract language can significantly affect the cost of a project by describing three variants of the indemnity clause, one of which is found in practically all construction contracts

Choosing A Contractor

Picking a contractor is potentially a costly step for both the owner/ engineer and the contractor. There are significant cost exposures in merely following a procedure, to say nothing of the major incremental costs associated with the actual construction if the procedure has resulted in a less than optimal choice. So the choice is a major undertaking and worth doing well.

For practical purposes, the owner and/or engineer alone decides how much effort will be made in the selection process. This effort includes internal procedures, requests to contractors to prepare

bid documents, and selection of contractors who will expend resources to compete for the project. The owner has the responsibility for providing an efficient contractor-selection process for each project.

Planning for contractor selection is the first step in managing this process. This step tends to be more efficient and of a higher quality if it is based on internal procedures and policies that the owner has thought through and periodically updates to reflect trends and changes in the marketplace. A formal procedure helps to avoid construction inefficiencies and cost increases when the owner and contractor are mismatched. The procedure should embody as many of the considerations discussed in this report as appear appropriate for the size of the organization and the type of construction involved. Details of the internal procedure must necessarily be tailored to the project and the company.

The Planning Process

Contractor selection should start with an explicit planning process and end with the award to a specific contractor. The action between these two points should be formal, deliberate, and clear to the parties involved.

The first step in planning is to identify and assign a priority to the project objectives. This may seem elementary, but many contracts go awry because the owner's objectives are not clearly presented. Three of these objectives would certainly involve the project schedule and its importance, the project cost, and operational-reliability issues. Most projects have others. From this point, the owner should decide what type contract would be most appropriate. Concurrently, an assessment should be made of the essential factors and potential adversities that may crop up during the construction of the project. To say it another way, the owner should try to anticipate and understand the environment that will exist during construction. An internal procedure helps by providing a checklist of items to be considered .

At this point, a milestone plan for the contractor selection can be developed. Any number of planning and scheduling processes are appropriate. One essential sometimes overlooked is allowing enough time to do the selecting with care.

At an early stage the owner should sketch a profile of desired qualifications in his contractors and use it to screen candidates.

The owner should then develop a list of contractors whom he has reason to believe will be acceptable and who also will be interested in doing the work. This list of potential contractors generally may include as many as 10-20 contractors.

Prequalification

Now that the owner has a broad milestone plan for the bidding process and for the construction of the project, plus a list of qualifications for an acceptable contractor, and has selected the screening criteria for picking a contractor, the prequalifications phase starts. This reduces the number of contractors on the list to those most qualified for the particular project. The two main questions to be determined are the capacity of the contractor to do the work and his ability to manage the project in a manner satisfactory to the owner, including potential adverse or unforeseen matters that may arise. To collect information about contractors' abilities, the owner (or one of his executives) normally should visit each contractor candidate or get a written statement from the contractor. A combination of the two approaches is often used.

A checklist of criteria for prequalifying contractors includes:

Source of information

- Owner's previous experience with that contractor.
- Current information (within last five years).
- References.
- Current knowledge of contractor's workload.

Items for evaluation

- Contractor's financial strength and credit rating.
- Contractor's previous experience with this type work, size job and type contract.
- Contractor's current workload and future plans.
- Amount of contractor's manpower required for job.
- Contractor's experience in the geographic area and knowledge of local labor environment.
- Contractor's management systems including quality assurance, safety, planning and scheduling methods, and estimating and cost control techniques.

Other items

- Overall project management ability and techniques.
- The fit of the project with the contractor's abilities.
- Responsiveness and interest shown by contractor's management.
- Adaptability of the contractor's practices and procedures to the owner's operation at the construction site.

At this stage, the owner has organized the approach to making the final selection of a contractor. The owner normally will ask a number of contractors to expend considerable effort to prepare bids, knowing that only one contractor will succeed; so the owner has an obligation to be efficient in collecting data for the selection decision.

Bidding

The bid document should be specific and well organized, permitting the contractor to optimize his efforts in preparing his qualifications and bid. Likewise, the owner can then reasonably expect the submitted bid to be in a format that facilitates the final selection.

In the bidding process, clarity and understanding are essential. A relatively formal process is desirable, with documentation describing the process and all of the aspects of the bidding itself. For many reasons, steps should be taken to make sure that all bidding contractors receive the same information. Many owners conduct a bidders meeting before bids are submitted to ensure that all parties understand the owner's objectives and plans and specifications for a project. This exercise takes only minimal time in the project cycle and eliminates many of the misunderstandings that have, in the past, led to inefficiencies that eventually increased project costs.

The Contract Award

The final step is the actual selection of the contractor/contractors. If the process has been managed properly, the selection should require mainly a comparison of the predetermined criteria with the data in the bid. The list below includes most of the more commonly considered items. Frequently, they are assigned priorities and even numerical weightings to facilitate comparison.

Selection criteria:

- Basic costs, including direct and indirect costs, home office charges, and profit.

- Change-order handling.
- The fit of the project with the contractor's abilities.
- Owner's satisfaction with the contractor's proposed staffing of the project.
- The contractor's understanding of the project as demonstrated by preliminary milestone schedules, manpower curves, material needs identification, quality control plan and other data.
- The contractor's plans for handling any labor-relations problems.
- The contractor's probable ability to meet reporting requirements.
- The contractor's attitude and intention about safety on the job.

After the submitted bids are evaluated, a pre-award meeting between the owner and the proposed contractor is desirable. The general contractor and all subcontractors, along with their field supervision, should be present. At this session the objective is to make sure that the total expectations of all parties are fully understood by the others. In particular, the owner should understand the relationship that will exist between himself and the contractors. Any unresolved issues should be identified and a method of resolution, if necessary, agreed on. At this stage, the contractor is selected. It is preferable that the contract be signed at this time. The practice of using a letter of intent tends to continue uncertainties and leads to misunderstandings and inefficiencies due to lack of an authoritative contract.

After the Award

It is not uncommon for owners to meet separately with the unsuccessful contractors after the contract is awarded to explain the reasons why they were not selected. These meetings afford an opportunity to improve the contracting process. They also provide a feedback channel to both parties, designed to help make future contractor selections more efficient.

Contract Administration

How much effort should be spent on contract administration depends on the degree of control exercised. Thus a cost-reimbursable contract imposes a considerable administrative burden on the owner and a fixed-price contract considerably less, although still a substantial amount.

The attributes of proper contract administration by an owner are the same regardless of the type of contract:

- Complete knowledge of the contract.
- Equitable but firm enforcement of contract terms.
- Procedures for administration established as soon as the contract is awarded and followed consistently.
- Contract administrators at all levels knowing their authority and making decisions consistent with such authority.
- Changes, claims and disputes resolved promptly at the lowest level possible consistent with delegated authority.
- Excessive bargaining, crisis management and threats to terminate the contract generally avoided.

VI

CONCLUSIONS

There are opportunities for significant cost savings through improved contracts. The construction contract is the prime vehicle by which the owner must achieve project-management objectives such as schedule control and improved cost effectiveness. It is the structure that permits the achievement of the efficiencies defined through recommendations contained in other CICE Project reports.

The process of reaching a contract for construction is an ordered sequence of steps in which the owner must make a series of choices between priorities for his objectives, degrees of risk to be assumed by the parties, control over construction activities, and the cost of achieving selected goals.

The contract should be based on principles of risk management in which the owner's and contractor's goals are mutually considered and which considers the degree of control over a situation, potential gain or loss, and which party is in the best position to assume a risk.

Delegating risks to a contractor involves assigning control over situations that will govern the incidence of a risk, with a potential for profit and other gains, as well as losses. There are

significant opportunities, even on large reimbursable contracts, for owners to shift the control and risk to the contractor.

Incentives are rewards that a contractor stands to gain in return for assuming certain risks. To be effective, the contractor must gain commensurate control, and the incentives must be definable and capable of being administered.

The fixed-price contract is the ultimate incentive for contractor performance. Obviously the contractor has the greatest degree of risk as well as control. The primary disadvantage is the time required to prepare the project scope and engineering design prior to start of construction.

The cost impact of certain construction risks is extremely high; owners should not attempt to shift inordinate risks to the contractor through one-sided contract language. Workable risksharing is not possible in an environment in which one party seeks to gain advantage over the other or to place the other party in a totally adversarial position.

VII

RECOMMENDATIONS

Owners can aid their efforts to improve cost effectiveness by taking a more discerning approach to the contractual arrangements for their projects. Attention to the entire contracting process, in particular the planning and development phase, can result in better project execution and thus, lower costs.

The following recommendations are for owner consideration:

- Accept the fact that contracting is complex.
- Recognize astute contract preparation and execution can yield improved project cost effectiveness.
- Take action to develop appropriate expertise.
- Develop a formal contracting plan in depth as a means of arriving at a logical approach to risk management based on the desired project objectives.
- Develop the terms of the contract to embody the interests of both owners and contractors, recognizing the goals of each and the ability of each to control and reduce specified risks and costs.
- Consider innovative approaches to contracting combining the advantages of fixed-price, cost-reimbursable, and, when applicable, incentive contracts.

APPENDIX A

COMPARISON OF FIXED-PRICE AND COSTREIMBURSABLE CONTRACTS

A. FIXED-PRICE: AGREEMENT TO PERFORM WORK AT
FIXED-PRICE REGARDLESS OF COST TO
CONTRACTOR

Basic Conditions

Fair reasonable price can be established at inception.

Detailed scope, design, and specifications are available before work starts. Adequate professional inspection and supervision will be provided by owner.

Applicability

Major public works.

Commercial and residential construction.

Heavy engineering construction.

Smaller industrial and power projects.

Variations

Lump Sum: Single fixed-price entire contract.

Unit Price: Unit costs and estimated quantities with payment on basis of units of work actually done.

Fixed-Price with Escalation: Price adjustments on cost of certain materials, labor or other factors beyond contractor's control.

Multiple Contracts: Series of Fixed-price contracts on same project. Guaranteed Maximum: Price ceiling; bonus/penalty for cost underruns/overruns.

Fixed-Price with Bonus/Penalty for Completion Schedule: Specified amount per day of early or late completion.

Selection and Award

Prequalification of bidders preferable. Usually competitively bid and awarded to lowest bidder.

Risk

Lump Sum: 100% by contractor.

Unit Price: Prices - 100% by contractor; owner assumes risk on quantity variation. Owner frequently permits contract modification for significant variation in quantities.

Fixed Price with Escalation: Contractor assumes 100% of base costs and nonescalatable prices. Owner assumes most of escalation.

Advantages

Minimum risk of unforeseen conditions.

Well established administrative, legal and contractual precedents.

Overall cost determined before contract is awarded (except for variations in quantities and price as applicable).

Minimum owner involvement in construction process. Owner benefits from price competition.

Innovative contractor can improve profits through productivity.

Significant contractor incentive to reduce costs and meet schedule.

Disadvantages

Design-construct time is longest of all methods.

Owner/engineer and contractor are usually in adversary role.

Contractor bears economic risk of many factors not under his control .

Changes and unforeseen difficulties frequently result in disputes and extra costs to owner and contractor.

Contractor has minimum contribution to design or constructability process. Contractor financial difficulties can cause serious problems. Contractor has no financial motivation to improve quality above minimum required to meet specifications.

**B. COST-REIMBURSABLE: AGREEMENT TO PERFORM
WORK AND BE REIMBURSED
ON THE BASIS OF ACTUAL
COST PLUS A FEE FOR
CONTRACTOR**

Basic Conditions

Scope/cost of work not sufficiently defined to permit use of fixed-price contract.

Qualified contractors unwilling to accept risk of fixed price.

Owner wishes to minimize overall design-construction time period. Sophistication required in contractor selection.

Owner must have ability to closely monitor costs.

Applicability

Industrial construction.

Heavy construction (high risk).

Research, exploratory, or "one of a kind" work.

Variations

Percent Fee: Contractor reimbursed for all costs plus a percentage of cost.

Fixed Fee: Fee covers profit and general administrative costs. All other allowable costs are reimbursable.

Incentive Fee: Some or all fee is dependent upon achieving certain cost or schedule goals.

Performance Fee: Fee varies according to certain agreed criteria on which contractor is rated for performance.

Conversion: Any type of reimbursable contract converted to fixed fee or guaranteed maximum.

Selection and Award

There are various methods used to evaluate the contractor's ability to meet the owner's project objectives. The contract is usually negotiated with the contractor who is judged to be the best qualified and submits a competitive fee and cost proposal.

Risk

Cost Plus Fixed or Percentage Fee: 100% by owner

Cost Plus Incentive Fee: Contractor assumes risk to profit only according to sharing formula.

Cost Plus Performance Award Fee: Contractor assumes risk to profit only according to performance criteria.

Conversions: Contractor assumes percentage of risk for exceeding maximum cost according to formula for sharing overruns of negotiated fixed-price contract.

Advantages

- Construction can start before plans are complete.
- There is flexibility to make changes at actual audited cost.
- It can be used where contractors are unwilling to accept high risks.
- It is adaptable for phased construction.
- It reduces adversary role between the owner and the contractor.

Disadvantages

- It is generally less economical than fixed-price.
- Increased owner involvement in construction process is necessary.
- The final cost is not guaranteed.
- It involves more detailed negotiation and selection process.

APPENDIX B

COST IMPACT OF CONTROLLABLE RISKS

CONTROLLABLE RISKS	<u>COST</u> <u>ACCOUNTABILITY</u>		<u>COST IMPACT</u> <u>TO OWNER</u>	
	<u>FIXED</u> <u>PRICE</u>	<u>REIM-</u> <u>BURSABLE</u>	<u>FIXED</u> <u>PRICE</u>	<u>REIM-</u> <u>BURSABLE</u>
1. Labor productivity			L	H
a. Management of work force	C	O		
b. Timing and quality of engineering data and equipment	O/E	O/E		
c. Quality assurance	O	O		
d. Quality control	O	O		
2. Scope			H	L
a. Initial scope definition	O/E	O/E		
b. Changes in scope	O/E	O/E		
3. Indirect costs			L	H
a. Staff	C	O		
b. Consumables	C	O		
c. Support crafts	C	O		
d. Materials management	C	O		
4. Quality construction			M	M
a. Complexity of design	O/E	O/E		
b. Completeness of engineering drawings	O/E	O/E		
c. Construction procedures and methods	C	O/E		
d. Construction schedule	O/E	O/E		
e. Experience of craftsmen	C	O		
f. Training of craftsmen	C	O		
g. Supervisory personnel	C	O		
h. Construction equipment and tools	C	O		
i. Quality control procedures	C	O		

Legend: C—Contractor L— Low
 O—Owner H—High
 E—Engineer M—Medium
 S—Shared

	COST		COST IMPACT	
	<u>ACCOUNTABILITY</u>		<u>TO OWNER</u>	
	<u>FIXED</u>	<u>REIM-</u>	<u>FIXED</u>	<u>REIM-</u>
	<u>PRICE</u>	<u>BURSABLE</u>	<u>PRICE</u>	<u>BURSABLE</u>
5. Safety			M	M
a. Training	C	O		
b. Contractor's minimum standards	C	O		
c. Owner's mandatory standards	O	O		
d. Regulatory standards (OSHA, etc.)	C	C		
e. Industrial hygiene	S	S		
6. Schedule			H	H
a. Manufacturers' promised deliveries	C	O		
b. Owner-supplied material	C	O		
c. Contractor-supplied	C	O		
d. Manpower resource	C	O		
e. Manpower productivity	C	O		
f. Scheduling techniques	C	O		
g. Schedule duration	O	O		
h. Extended overtime or shift work	O	O		
7. Labor relations			L	L
a. Jurisdictional disputes	C	O		
b. Illegal strikes and walkoffs	C	O		
c. Contract expiration strikes	C	O		
d. Jurisdictional disputes between contractors	C	O		

Legend: C—Contractor L— Low
 O—Owner H—High
 E—Engineer M—Medium
 S—Shared

	COST ACCOUNTABILITY		COST IMPACT TO OWNER	
	<u>FIXED PRICE</u>	<u>REIM- BURSABLE</u>	<u>FIXED PRICE</u>	<u>REIM- BURSABLE</u>
8. Project management			L	L
a. Adequate design drawings	O/E	O/E		
b. Timely procurement and delivery of materials and equipment	O/E	O/E		
c. Limitation of number of changes and revisions to drawings and specifications	O/E	O/E		
d. Quality of fabrication of materials and equipment	O/E	O/E		

Legend: C—Contractor L— Low
 O—Owner H—High
 E—Engineer M—Medium
 S—Shared

APPENDIX C

INCENTIVES IN CONSTRUCTION CONTRACTS

The following text describes the use of incentives with various types of contracts.

1. *Cost-Reimbursable Contracts with Incentive Provisions*

Contractual incentive provisions can be combined with different types of cost-plus contracts so as to yield desired effects by assignment of risk to the owner or the contractor. Such incentives can involve cost and schedule or contractor performance.

Examples of incentives with cost reimbursable plus percent fee:

- Bonus or penalty to contractor by sharing target project construction-cost underrun or overrun. As in the guaranteed-maximum contract, the owner and contractor negotiate a target cost, profit, and sharing formula; however, there is no ceiling price and the contractor is generally entitled to a minimum fee. The bonus is a percentage of the amount by which actual costs under-run the target cost. Similarly, the penalty is a percentage of any overrun.

Bonus or penalty for completing the project ahead of or behind schedule. The bonus is a dollar amount per day.

Penalty consisting of loss of fee on work done past schedule.

Combination of project-cost and schedule incentives.

Examples of incentives with cost reimbursable plus a fixed fee:

- Bonus/penalty for underrun/overrun of targeted direct labor man-hours. Penalty or bonus is established as an amount per man-hour agreed to at time of contract award. The target man-hours to which the penalty or bonus will apply are then mutually agreed to between owner and contractor sometime later when the "definitive estimate" is established. It will be modified only by changes in the project's scope occurring after the definitive estimate.
- Bonus/penalty for contract completion schedule. The completion date is set at contract award, verified at the definitive estimate time, and revised by scope changes after the definitive estimate. The bonus or penalty is set at a dollar amount per day at contract-award time.
- Bonus/penalty for overrun or underrun of the average direct-labor man-hour cost. The targeted averagemanhour cost and the amount of penalty or bonus are set at contract award.

The reason for setting incentive provisions at contract award is to avoid confusion as to the degree of contract control. The advantages to the owner are the same as for incentives with costs reimbursable plus percent fee; the disadvantages in administration also are similar. The owner has considerably less control over the project than on a cost-reimbursable contract without incentives. His role is more nearly like that on a fixed-price contract.

If targets are set on a cost basis, there is considerable difficulty adjusting targets for escalation. If targets are based on costs, schedule or man-hours, considerable effort is required to arrive at equitable adjustments due to scope changes.

Contractor Performance Incentives

In this type of cost-plus-incentive contracting, the contractor earns a bonus or a penalty that adds to or subtracts from his earned fee, based on his performance in the field. The items of performance normally considered are very difficult to measure in an objective way, so a performance norm and method of evaluation must be established in the contract against which the subjective performance factors are compared. A performance norm varies from contractor to contractor and sometimes requires considerable time to establish between an owner and a contractor. Four quarters of operation are usually used to establish a performance norm. The use of performance incentive contracting is more appropriate where owners and contractors have worked together before, thus establishing a more equitable basis for setting performance goals.

Performance is measured against items that have the most significant impact on the construction cost and schedule. Some of them are:

- Craft-labor productivity; A measure of how well the contractor manages his craft labor through planning, scheduling, furnishing of skilled workers, training, crew mixes, and other criteria.
- Indirect costs: A measure of the results against an established budget.
- Schedule: A measure of how well the contractor meets the milestone dates set for the project.
- Safety: A measurement of safety on the project is based not only on injury statistics but on the contractor's training inspections, knowledge of, and attitude toward safety.
- Quality of construction work: To encourage the contractor to meet quality goals which may be higher than normally found in the construction industry.
- Responsiveness: Contractor reaction to changes in the site conditions, objectives of the project, and scope of work .

The contractor's fee is adjusted for an outstanding or poor performance when compared to the norm in accordance with percentages set in the contract. The adjustment is a bonus or penalty. It should not eliminate the contractor's profit.

The advantages and disadvantages of this type of contract are:

- The owner has more control but also has higher administrative costs than in cost and schedule incentive contracts because of his considerable involvement in performance evaluation and setting of award fees.
- Changes can be made in the contract without changing numerical targets.
- Communication and cooperation between the owner and contractor are essential. If communication and cooperation are not effective, disputes can easily result from this type contract.

2. Fixed-Price Contract Incentives

Incentives in fixed price contracts are limited since the contractor already has an inherent incentive to perform well.

- Bonus and penalty incentives for completion on schedule. Such provisions normally provide for a dollar amount per day for early or late completion and may reinforce the owner's need to complete the project on time. Delay penalties, however, can be very difficult to assess because of conflicting claims about who was at fault. Liquidated damage clauses found in many standard fixed-price contracts serve to compensate owners for delays but do not provide incentives to contractors for timely performance.

APPENDIX D

CONTRACT LANGUAGE - EXAMPLE

The following text provides examples of three different indemnity clauses that could be included in a construction contract⁵. Comparison of the three examples demonstrates the impact that contract language can have on project costs. These contrasting clauses demonstrate that the prudent sharing of risks on a construction project through fair contractual language is most important from both a cost and an operational viewpoint.

Example A:

"Except where the sole negligence of COMPANY is involved or alleged, CONTRACTOR shall indemnify and hold harmless COMPANY, its officers, agents and employees, from and against any and all loss, damage, and liability and from any and all claims for damages on account of or by reason of bodily injury, including death, which may be sustained by any person whomsoever, including but not limited to the employees of CONTRACTOR, COMPANY, and of any subcontractor or CONTRACTOR, and from and against any ***and all damages to property, including property of COMPANY and third parties, direct and/or consequential,*** caused by or arising out of, in whole or in part, or claimed to have been caused by or to have arisen out of, in whole or in part, an act or omission of CONTRACTOR or its agents, employees, vendors, or subcontractors, of their employees or agents in connection with the performance of the Contract Documents, ***whether or not insured against;*** and CONTRACTOR shall, at its own cost and expense, defend any claim, suit, action or proceeding, whether groundless or not, which may be commenced against COMPANY by reason thereof or in connection therewith, and CONTRACTOR shall pay any and all judgments which may be recovered in such action, claim, proceeding or suit, and defray any and all expenses, including costs and attorney's fees which may be incurred by reason of such actions, claims, proceedings, or suits".

Comment: This is a very burdensome provision for the contractor. It covers practically every conceivable occurrence and type of damage, except when a claim for loss or damages is due to the sole negligence of the owner. As a practical matter, sole negligence on a construction project

⁵ These are random examples taken from existing contracts and are not necessarily the recommended form for accomplishing any of the three alternatives. Enforceability may vary from state to state.

is very difficult to ascertain because the work is so intertwined. Since there is no dollar limitation to the contractor's exposure, sufficient liability coverage to cover worst scenario risks will be unobtainable. The best the contractor can do is to obtain as complete and broad excess liability insurance coverage as can be purchased. This insurance is costly and *increases the construction cost on a project.*

Example B:

"CONTRACTOR shall protect, defend, hold harmless, and indemnify COMPANY from and against any loss, damage, claim, action, liability, or demand whatsoever (including, with limitation, costs, expenses, and attorney's fees, whether for appeals or otherwise, in connection therewith), arising out of any personal injury (including, without limitation, injury to any employee of COMPANY, CONTRACTOR or any subcontractor), including death resulting therefrom or out of any damage to or loss or destruction of property, real and or personal (including property of COMPANY, CONTRACTOR, and any subcontractor, and including tools and equipment whether owned, rented, or used by CONTRACTOR, any subcontractor, or any workman) in any manner based upon, occasioned by, or attributable or related to the performance, whether by the CONTRACTOR or any subcontractor, of the Work or any part thereof, and CONTRACTOR shall at its own expense defend any and all actions based thereon, except where said personal injury or property damage is caused by the negligence of COMPANY or COMPANY's employees. Any loss, damage, cost expense, or attorney's fees incurred by COMPANY in connection with the foregoing may, in addition to other remedies, be deducted from CONTRACTOR's compensation then due or thereafter to become due. ***COMPANY shall effect for the benefit of CONTRACTOR a waiver of subrogation on the existing facilities, including consequential damages such as, but not by way of limitation, loss of profit and loss of product or plant downtime but excluding any deductibles which shall exist as at the date of this CONTRACT; provided, however, that said waiver of subrogation shall be expanded to include all said deductible amounts on the acceptance of the Work by COMPANY.***"

Comment: This clause provides the contractor considerable relief. He still has unlimited exposure for injury to all persons and third party property but only to the extent caused by the contractor's negligence. The "sole" negligence issue does not arise. Furthermore, the contractor's liability for damages to the owner's property - a major concern for contractors working in petrochemical complexes, at times worth billions - is limited to the owner's insurance deductible, and the owner's insurance carriers have no right of recourse against the contractor. The contractor's limited exposure regarding the owner's facilities ends on completion of the work.

Example C:

"CONTRACTOR hereby agrees to indemnify and hold COMPANY and/ or any parent, subsidiary, or affiliate, or COMPANY and/or officers, agents, or employees of any of them, harmless from and against any loss or liability arising directly or indirectly out of any claim or cause of action for loss or damage to property including, but not limited to CONTRACTOR's property and COMPANY's property and for injuries to or death of persons including but not limited to CONTRACTOR's employees, caused by or resulting from the performance of the Work by CONTRACTOR, its employees, agents, and subcontractors and shall, at the option of COMPANY, defend COMPANY at CONTRACTOR's sole expense in any litigation involving the same, regardless of whether such work is performed by CONTRACTOR, its employees, or by its subcontractors, their employees, or all or either of them. ***In all instances, CONTRACTOR's indemnity to COMPANY shall be limited to the proceeds of CONTRACTOR's umbrella liability insurance coverage.***"

Comment: As for indemnifying the owner, the contractor in this provision has minimal out-of-pocket risk. Exposure is limited to whatever can be collected from the contractor's insurance company.

APPENDIX E

REFERENCES

Crosby, A. R., "How Exxon Selects a Contractor" - A talk, June 1977.

Emmons, M. W., "Project Management Starts Before Contract Award", *Proceedings, Project Management Institute*, 1978, pp 11 L.1-L.10.

Johnson, M. G., "Engineering/Construction Liability form One Contractor's Viewpoint", *Engineering Construction Contracting Proceedings*, 1977, American Institute of Chemical Engineers, pp 58-64.

Ribakoff, S., "Construction Contract Agreements", *Construction Risks and Liability Sharing*, American Society of Civil Engineers Conference Proceedings, 1979, pp 83-101.

Wise, L. E., and Burns, D. L., "Contractor Prequalifying Technique", *Transactions American Association of Cost Engineers*, 1978, pp 186-189.