

DESIGN-BUILD IN THE PUBLIC SECTOR:
A CASE STUDY OF THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF CAPITAL PLANNING AND OPERATIONS (DCPO)
DESIGN-BUILD PROJECT FOR THREE CORRECTIONAL FACILITIES

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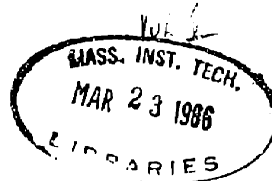
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INTRODUCTION

The motivation for selecting this thesis topic is both theoretical and practical. From a theoretical perspective, the subject of procurement methodology for constructed facilities, ie. the process by which facilities are planned, designed and constructed is an area in which there is a surprising lack of formal investigation and analysis. Very little of the work associated with organizational theory deals with the distinctive problems associated with the building process-- such as the fragmentation of key participants and the dynamic, project-specific nature of activities. This thesis attempts to suggest a preliminary, theoretical framework for studying some of these problems.

The practical motivation for undertaking this topic comes from the case at itself, namely, the Massachusetts Division of Capital Planning and Operation (DCPO) design-build* project for three correctional facilities. This is the agency's first attempt to use an innovative, alternate procurement method for a major project. It is also one of the few applications of design-build in the public sector on a large, institutional project. As a case study, the project offers a valuable opportunity to observe, in detail, the

* Design-build is a procurement method whereby the owner contracts with a single entity for both the design and construction of a facility. In contrast to other procurement methods, the designer works directly for or with the contractor rather than being separately hired by the owner.

problems, decision-making and outcomes associated with this application of design-build.

Previous theoretical and practical work in areas related to this thesis is described at length in Part II. What little theoretical literature on procurement methodology was mostly written in the late 1960's and early 1970's. This writing was largely stimulated by developments in systems building and early applications of construction management (CM) which were taking place at the time. Most of this work focused on how the building industry and building process could be restructured to allow for more industrialized and rationalized production. Much of the emphasis was on how organizations in the industry could be structured to allow technical change. With notable exceptions (GSA/PBS, 1970; IF 1976, Heery, 1975), less attention was given to procurement methodology from the owner's perspective. In particular, there was, and still is, no general theory which systematically relates the resources, needs and constraints of a given owner, project and market to different procurement methods.

This thesis is divided into three parts. Part I consists of general background information on procurement methods. Basic themes and concepts are discussed. The so-called "traditional" procurement method is described and critiqued.

Part II develops a procurement method decision model and discusses critical issues surrounding design-build. This

part of the thesis begins with a comparative examination of different generic procurement methods. Various short cases studies are presented in order to identify empirical patterns of procurement method applications according to owner, project and market conditions. These patterns are generalized into a decision model in which critical owner, project and market variables or "contingency factors" are related generic procurement methods and specific attributes. Various concepts of efficiency and optimization of procurement methods are discussed. Design-build is then explored in greater detail in terms of the procurement model. Critical issues are identified for design build in general and, in particular, public sector applications.

Part III covers the DCPO design-build case itself. A number of hypotheses are presented. These are derived from the procurement method model and examination of design-build put forth in Part II. The case is then studied in terms of the procurement method model and used to test the hypotheses.

Background information is presented on DCPO and the project. The decision making process which led DCPO to use design-build is analysed. The principle actors and organizations surrounding the project are described. These include the project user, the government procurement organization (DCPO), various overseeing entities and the design-build teams themselves. Each major phase of the design-build process is considered in detail: the request for proposal

(RFP) preparation; proposal development and selection; detailed design and construction. The hypotheses are then reconsidered in light of the observations of the case.

Conclusions and and critical questions are raised which refine the model and will, hopefully, help evaluate the design-build project. It is important to note that the project is still in progress. The case study presented is only an interim one. The conclusions put forth are preliminary, pending further observation of the project and its outcomes. A number of broader, overall conclusions are suggested. These concern the nature of innovation in public sector procurement practices and the need to develop a general theory of procurement methodology.

The author acknowledges that this thesis is somewhat longer than normal. Descriptions of the case tend to be quite detailed. This was purposely done, not to bore the casual reader, but to aid those who may analyse and assess the design build project in the future. Certain decisions, actions and conditions associated with the case, which may not seem important now, may prove significant when final project outcomes are known. Readers who are not interested in the fine points of the case are directed to Parts I and II as well as chapter 16.0 in which the conclusions are presented.

PART I

BACKGROUND ON BUILDING PROCUREMENT

CHAPTER 1.0

THE NATURE OF THE PROCESS AND GENERAL THEMES

The process of creating permanent constructed facilities differs from the provision of other goods and services in certain important ways. The scale and commitment of resources, human, material and financial, tends to be large relative to the total resources of a given owner or user. Constructed facilities represent concentrated "lumpy" investments which are amortized over long periods of time. The process of planning, designing and building such facilities usually occurs over a number of years, sometimes even decades.

Constructed facilities tend to be unique, one-of-a-kind entities, both in terms of form, use and location, despite efforts to rationalize and standardize along the lines of manufactured goods. Unlike manufacturing or service industries where delivery of a given product tends to be controlled by a single, integrated organization, the building process is characterized by a highly diverse and fragmented group of actors who all contribute to the creation of a constructed facility.

* The term "constructed facility", as used here, includes all types of buildings (ie. vertical construction) and infrastructure such as roads, ports and utilities (ie. horizontal construction). "Procurement Method", also sometimes termed the "building process" or "delivery method, or approach" refers to the overall process of planning, designing and constructing a facility.

This gives rise to a number of unique organizational and managerial problems which make up the theme of this thesis.

The rest of this chapter will briefly outline these themes. The next two chapters of Part I will discuss the so-called "traditional" procurement method and the basic elements which make up all procurement methods. This, in turn, will form the reference for Part II, which will explore alternate procurement methods in general and the design-build method in particular.

1.2 Control of Time, Cost and Quality

The goal of any procurement method is to control the three critical variables of time, cost and quality throughout the process of creating a constructed facility. These variables are highly interrelated and can often be seen as a series of trade-offs. Failure of a procurement method is manifested in failure to control one or more of these variables.

1.2 External Risk and Uncertainty

The building process is fraught with a number of external risks and uncertainties which are beyond the ability of any actor involved to know or control. These include environmental, economic, social and political conditions which affect a project. Because of their scale, complexity and time horizon, building projects tend to be particularly vulnerable to these kinds of risks. Effort can be made to

identify, forecast, assess and plan for such risks, but ultimately they cannot be avoided. Thus, the problem becomes how to allocate these risks to minimize their effect on the project as a whole and individual actors, so that the net premium cost of risk is minimized.

1.3 Uncertainty and Interdependence

A second type of uncertainty and risk arises from the high degree of interdependence among the various separate actors and sub-actors involved in the building process. This is discussed in great detail in a study of the U.K. building industry by the Tavistock Institute (Tavistock, 1966).

Typically, the facility owner, designer and contractor* all share mutual uncertainty about each others' performance. Yet, at the same time, all depend on each other to be able to carry out their own tasks and responsibilities. This causes fundamental problems of definition of authority and responsibility which must be addressed by any procurement method.

1.4 Information and Communication

Much uncertainty and risk can be mitigated by communication and sharing of information between actors. In some cases, one actor might have better information about an external risk which ,if communicated to the other actors, would reduce their

* These terms will be further defined and elaborated below.

uncertainty. For example, a contractor may have information on the cost or availability of a certain building component which, if known to the designer or owner, might reduce the owner's cost or time risk. This sort of communication may seem obvious, but all too often does not take place.

Similarly, uncertainty can be reduced if actors are open with each other about their own capabilities, constraints and needs. This may occur over time as actors gain experience from working with each other. But because of the fragmented nature of the industry and the fact that different actors rarely belong to the same organization and frequently do not work with each other beyond a single project. It is a significant challenge to create systems and channels of communication which permit this sort of sharing of proprietary information.

1.5 Differentiation and Integration

The problems of risk, uncertainty and interdependence basically consist of reconciling two divergent organizational tendencies among different actors within a building project, namely those of differentiation and integration. On one hand, each actor contributes a unique set of functional skills which differentiates him/her from the others. On the other hand, because of mutual interdependence there is a need to integrate the activities of the different actors (Lawrence/Loerch, 1969). The purpose of any procurement

method, then, must be to effectively identify the boundaries of function, authority and responsibility, ie.

differentiation, and to provide necessary channels of communication among the actors, in order to achieve an effective integration of the actors throughout the building process.

CHAPTER 2.0

HISTORIC DEVELOPMENT OF THE TRADITIONAL PROCUREMENT METHOD

This section will attempt to trace the evolution of procurement method from the original medieval "Master Builder" system to what is now considered the "traditional" or "conventional" method. Then, the failings or shortcomings of this traditional method in the face of changing demands of the building process will be discussed. These failings have given rise to alternative procurement methods which will be the subject of Part II of this thesis.

2.1 Evolution of the Building Process

By the thirteenth century in Europe the building process, particularly the building of cathedrals and other major public buildings, was dominated by a strong system of trade guilds. These guilds were responsible for mobilizing the human, material and technical resources needed to create such buildings. Leadership and supervision of the entire project was provided by the so-called "Master Builder", a highly skilled individual, knowledgeable in all trades and ususally coming from the ranks of the Freemasons guild. The Master Builder was employed directly by the owner or building committee of the project. There was no distinction between architect, engineer and builder under this system; all these functions were carried out by the Master Builder.

With the rise of capitalism, the guild system gradually eroded during the late Renaissance as independent commercial enterprises became involved in construction. Higgin and Jessop (1965) suggest that in England, the London fire of 1666 was the turning point, after which , the guild system was no longer capable of filling the needs or controlling the process of building. At the same time, the role of the architect as separate from the builder began to emerge.

By the late eighteenth century the separation of architect from direct construction was almost complete. As the building process became more commercialized and technically complex it became impossible for the owner of a building, as a layman, to protect his own interests. The role of the architect became defined in terms of professional responsibility to protect the interests of his clients against base or unscrupulous construction contractors. A code of professional ethics evolved which effectively barred the architect from directly engaging in construction. Sir John Soane, sometimes referred to as the father of professionalism in England, stated in 1788:

The business of the architect is to make the designs and estimates, to direct the works and to measure and value the different parts; he is the intermediate agent between the employer, whose honor and interest he is to study, and the mechanic, whose rights he is to defend. His situation implies great trust; he is responsible for the mistakes, negligences, and ignorances of those he employs; and above all, he is to take care that the workman's bills do not exceed his own estimates. If these are the duties of the architect, with what propriety can his situation and that of the builder, or contractor be united? (Plans, Elevations...,p.7 cited in Kostof, 1977)

In 1834 the Royal Institute of British Architects was founded and began to formally regulate the activities of the profession along the lines described by Soane. Similar professional societies were also formed in France, Switzerland and the United States around the middle of the nineteenth century.

The role of architect became more specialized . The function of designing site works, structural and mechanical portions of facilities, was taken over by the engineer. In the United Kingdom and some of Europe, the function of material estimates or "bills of quantities" became the responsibility of the quantity surveyor. The professional conduct of these specialists was governed by a similar code of ethics to that of architects.

2.2 Definition of the Traditional Method

This redefined role of the designer (architect/engineer) as a professional practitioner, distinct from that of builder, gave rise to a process of designing and constructing buildings, and a set of relationships between owner, designer and contractor which is termed "the traditional method". Basic premises and key features of this process include the following:

a.) Design and construction are technically too complex and difficult for the owner of a facility to understand or

control.

b.) The contractor's main interest is profit. Moreover, the contractor cannot necessarily be expected to have the technical know-how to properly design a facility. He cannot be expected to ensure that the owner gets the a technically sound facility which represents a fair value for a given payment.

c.) The role of the architect is to protect the interests of the owner by providing a technically sound design and assuring that it is properly executed, for a fair sum of money. The architect is paid by and works exclusively for the owner and receives no benefit from the construction of the project itself.

d.) The architect is to be selected solely on the basis of professional merit. Since only the architect can determine what design services the owner needs, the owner-architect agreement, including scope of services and fees, is essentially dictated by the architect according to established professional guidelines. Under no circumstances should different architects compete on the basis of lowest fee.

e.) Once the owner-architect agreement is made, the owner provides the architect with a program stating his/her functional requirements for the facility and a budget. The architect then develops schematic and detailed plans and specifications, subject to the review and approval of the

owner. The final documents which become the basis of the construction contract and are assumed to be " The final decision on every matter related to design, specification and cost and a full design of every part and component of the building..." (RIBA Handbook cited in Tavistock 1966). The architect will make an effort to estimate construction costs during design in order to keep within the stated budget. However, he/she does not not assume responsibility for construction cost on the theory that construction cost is a function of market conditions of which the achitect has no control (and implicitly no knowledge). Most professional agreements have strongly worded disclaimers to this effect.

f.) Selection of a contractor is made on a commercial, as opposed to a professional, basis. The recommended practice is to invite a number of contractors to submit bids or tenders for a project on the basis of plans and specifications made by the architect. Award of a contract is based on lowest bid, providing that the contractor is judged responsible (ie. technically, financially and organizationally qualified) and responsive (ie. complies with the terms of the solicitation) by the architect.

(Note that in certain cases, the competitive bidding process may be waived in lieu of some form of negotiated contract.)

g.) During constuction the architect is the arbiter of the construction contract between the owner and contractor. He/she "supervises" the contractor to assure that work

conforms to plans and specs. Note that "supervise" is distinguished from "superintend" which is what the contractor does. The former involves passive observation with the power to stop or reject work, while the latter involves actually directing and controlling the resources required to accomplish the work. The architect approves payments, negotiates changes in the contract or any claims by the contractor, on behalf of the owner. All communication between owner and contractor must flow through the architect. Any direct communication between owner and contractor, particularly any decision pertaining to the contract made directly by the owner without consulting the architect, generally voids the owner-architect agreement.

h.) Just as cost and quality of a project are stated in the construction contract, a time limit is usually specified also. "Liquidated damages" are paid by the contractor to the owner if the completion date is not met. Such a penalty payment is usually contingent on there being no mitigating delays caused by the owner, architect or "forces outside the contractor's control". In practice, such mitigating forces usually exist and liquidated damages for late delivery are rarely collected.

2.3 Problems with the Traditional Method

The traditional method of constructed facility procurement described above represents the mainstream of general

practice, in both the private and public sectors in the UK and North America for the last century and is still prevalent today. In many situations where all actors understand their roles and responsibilities and where technology, scale, delivery time requirements, financing, etc. are not unusual, the traditional method has proven quite adequate. However, with the growing scale, complexity, new technology, time, and budget risks associated with many modern projects, this method of procurement has failed to provide effective control over the critical time, cost and quality.

This failure can be traced to a general inadequacy to effectively integrate the diverse actors involved in the building process while at the same time clearly differentiating their respective roles and responsibilities. The failure is also due to certain unrealistic assumptions in the premises on which the traditional method is based.

The main failure of integration in the traditional method lies in the relationship between the designer and the contractor. Because of the extremely linear nature of the process, particularly the fact that the design is finalized at the time of bid, there is little or no opportunity for feedback from the contractor to the architect during design. Since the architect, in practice, lacks the knowledge of detailed costs, construction methods, time requirements,

material performance and availability, etc., which the contractor has (and on which he/she bases the bid), it is difficult for the architect to optimize the design or even to effectively assure its feasibility in terms of time cost and quality.

Another problem is that because of the differentiation of responsibility in the traditional process, the architect has little or no incentive to optimize the design of a project. His/her first responsibility is to produce a technically sound project, while responsibility for cost (and delivery time for that matter) is all but totally disclaimed. As a result, there is a strong tendency for architects to over-design. Very often, a contractor may know a more cost-effective or faster way of achieving a comparable level of performance or end product, but is unable to do so because he/she is bound by the contract drawings and specs which were prepared without the benefit of this knowledge.

The traditional method has also proven inadequate in promoting the development of innovative building materials and methods for the reasons mentioned above. The method makes it difficult for owners and architects to communicate their needs to manufacturers, who normally deal only with contractors. Conversely, it is difficult for manufacturers to communicate their capabilities and product characteristics to owners and architects. The tendency for the traditional method to promote design conservatism among architects has also discouraged the development of innovative building

techniques.

The traditional method also breaks down on very large, complex or risky projects where there are no contractors capable of committing themselves to total responsibility for delivery, or where the number of qualified contractors is so limited as to eliminate competition. In such a situation the project must be broken down into smaller "packages" of work, yet must be coordinated and integrated to produce a complete and usable facility. A similar problem arises when, in the interest of saving time a project is phased, whereby early portions of work are contracted before later portions are fully designed. The traditional method does not provide a mechanism for this coordinating function.

Because of the linear nature of the traditional method, it tends to be a lengthy process in itself, particularly when used in the public sector where design review and bidding procedures tend to be quite formal and complex. There is also a certain amount of duplication of effort because fact that much of the information describing a project, ie. plans and specs must be reprocessed into shop drawings, material order lists, work orders, sub-contracts, etc.. This reprocessing inevitably results in some mis-communication in the form of errors and omissions. Time and cost could be saved if contract documents were structured more according to contractors' functional needs.

This points to another flawed assumption in the traditional

method, namely that it is possible to create a set of documents which fully describe "every part and component of the building" with no gaps, ambiguities or conflicts and these documents, as a basis of a contract, will produce the same end product regardless of the contractor. As projects become more complex and atypical, this assumption becomes less realistic. There will always be grey areas subject to differing interpretation, which less responsible contractors will exploit. Such grey areas are likely to cause disputes between architect, owner and contractor. The weakness of the traditional method, in this case, lies in its dependence on a "perfect" set of set of contract documents coupled with low bid as a basis for contract award.

This returns to the basic assumptions behind the traditional process that owner must be protected from contractor's base, commercial motives by the gentleman-professional who is above such motives. In fact there is evidence to suggest (Greenfield 1977) that contractors can and often do act in a professional and responsible way themselves in order to maintain a good reputation and get more work in the future. At the same time, there is ample evidence (Ward Commission, 1979) that architects are not above all sorts of unprofessional conduct ranging from simple incompetence to kick-backs from contractors and suppliers. The point here is not to imply that architects are all unprofessional and that contractors are all honest and decent, but that the kind of

double standard of moral, ethical behavior of architects and contractors implicit in the traditional method may be artificial.

In summary, it can be seen that the traditional method of constructed facilities procurement contains critical weaknesses which make it unsuited to the demands of certain modern projects.

CHAPTER 3.0

BASIC ELEMENTS OF PROCUREMENT METHODS

Before describing various alternative procurement methods, it is useful to define certain terms and basic elements associated with all procurement methods. A certain amount of confusion exists around terminology and taxonomy associated with procurement methods. As far as I know, no consensus or standards exist in this area. Different authors often use different terms to describe the same things and vice versa. A consistent terminology will be put forth here. This will serve as a basis for discussing procurement methods throughout the rest of this thesis.

3.1 Actors and Organizations

The terms "actors" and "sub-actors" have been used to describe various key participants in the building or procurement process. An actor refers to an individual or group which performs a unique, basic function or role within the process. A "sub-actor", as the term implies, is an individual or group forming a sub-set of an actor which performs a unique, specific sub-function or role. For example, a specialty contractor is considered a sub-actor of contractor.

An organization refers to a group of actors and/or sub-actors which forms a unique legal, commercial or functional entity with a definable common goal, such as a government, a

firm or a corporation. Note that different actors may belong to the same organization (eg. a corporation which both owns a facility and employs an in-house architect who designs it) and different sub-actors may not belong to the same organization (eg. a contractor who employs a separate specialty contracting company.) The point here is not to confuse actors and sub-actors, which are defined by their generic roles and functions for a given project or procurement method with organizations whose identity and function is often independent of the building process.

Returning to actors and sub-actors, I will offer the following specific terms, definitions and general characterizations:

"OWNER": The entity which holds title (or legal/financial equivalent, eg. leasehold) of a facility and initiates the building process by identifying a need for the facility.

Owner sub-actors include:

--"User" : The entity which generates the need for, and ultimately occupies or uses the facility.

--"Administrative Agency": The entity which acts as point of contact and direct representative and administrator for the owner during the building process.

--"Operation and Maintenance (O&M) Staff": The group which carries out the ongoing operation and maintenance of a facility after user occupancy. Typically this includes operation and monitoring of mechanical/electrical sub-systems, cleaning, grounds-keeping, janitorial service,

painting and minor repairs and renovation.

Owners tend to be a diverse group with many different motivations, goals and objectives. Developers are obviously motivated primarily by profit and satisfying general market demands. This usually entails considerable financial risk. Opportunity costs are often a driving force for developers which makes timely project delivery a priority. Private businesses which build for their own needs view building as subordinate to a larger set of business objectives. Cost control is often an overriding factor for these owners. Institutional and government owners are generally motivated by functional and political considerations more than financial ones. Quality is often a prime objective. Political accountability is also an important factor in many cases.

In many cases, owner sub-actors have divergent goals and objectives. This can become a serious organizational problem in itself since the administrative agency is usually dominant during planning, design and construction phases, while users and O&M staff often do not get involved until after construction is complete. A common dysfunction of many procurement methods and owner organizations is lack of communication and feedback between these sub-actors.

"DESIGNER": The entity which, based on the owner's requirements, provides the technical definition of the

project. This involves performing the necessary data gathering, analysis, design and documentation to provide a basis for construction. Sub-actors include:

"Architect": Specializes in general space planning, form-giving and physical treatment of exposed portions of a facility. Often provides overall design leadership on building (as opposed to civil or industrial) projects.

"Engineer": Specializes in design of civil works (earthwork, roads, ports, utilities, waterworks, etc.) as well as mechanical (plumbing, HVAC, conveying systems, etc.) and electrical (generation, transmission, distribution, communications, controls, etc.) systems. Usually these functions are further broken down into engineering specialties.

"Planner": Specializes in space, functional, environmental and economic planning and programming of facilities associated with pre-design phases of a project.

"Design Specialists": A host of other entities specializing in other areas of design such as "Interior Designers",

"Restaurant Planners", etc..

An important motivational characteristic of most designers is a strong personal identification with the object of their design efforts. They tend to get significant intrinsic ego gratification from their work. This motivation often dominates more obvious, extrinsic motivations like business success and is not always consistent with owners' needs.

"Intuitive", "expansive", "idealistic", "sensitive",

"integrating" are words that have been used to characterize architects. "Analytical", "precise", "optimizing" ,

"arrogant" are adjectives that have been applied to engineers (Freidman, 1986).

Because of certian legal liabilities which designers often assume, there is often a tendency to "play it safe" by making things a little stronger, bigger, and better than they might need to be. The fear of catastrophic failure must always remain in the back of any designer's mind.

Designers tend to share a strong common culture which is reinforced by standardized professional education, established professional oranizations and a formal system of legal registration. They often feel a sense of loyalty toward each other and their profession which transcends their loyalty toward a particular client or the public in general. Of all the actors in the building process, they are probably the most homogeneous.

"CONTRACTOR": Any entity which directly provides goods and services directly associated with the construction of a facility, including the following sub-actors:

--"General Contractor": An entity which undertakes contracts to deliver all goods and services required to realize a design for a facility.

--"Specialty Contractor": An entity which undertakes contracts to provide or install a specific portion or subsystem of a facility with the bulk of the work being performed on site.

--"Supplier": An entity which buys and resells or leases

materials or equipment used in the construction of a facility.

--"Manufacturer": An entity which makes materials, equipment and sub-systems used in the construction of a facility, most of which is made off site and installed by others.

Contractors are at the heart of the building process, for they are the ones who carry out the physical realization of a constructed facility. They are intimately familiar with all the diverse resources which go into a facility. They have detailed technical knowledge of manufacturing and construction methods. And in particular, they have detailed knowledge of time and cost associated with the activities and components which make up a project.

Outside the socialist block and some third world countries, most contractors are private firms which must make a profit to survive. General and specialty contractors in particular are especially vulnerable to business risks owing to the large volume of business they handle in relation to their net worth. One unprofitable job can ruin an otherwise profitable company. The business also tends to be highly competitive and sensitive to general economic trends. For these reasons contractors are extremely conscious of, and driven by the need to manage and control risk.

"OTHER ACTORS": There are a number of other actors who participate in the building process, but do not, per se, fit into any one of the three major groups described above.

These include:

"Construction Manager (PM/CM): This is a new actor which has emerged in the last twenty years to assume considerable importance in many projects. The true nature and definition of this actor is still being debated and will be discussed at greater length in later chapters. The role of the construction manager can best be defined as integrating the building process. In particular, the CM brings construction knowledge and expertise to the design phase of a project and coordinates design and construction, especially when the two phases are overlapped (ie. "fast-tracked"). Basically, CM's are an outgrowth of either designers or general contractors and their motivations and "cultural orientation" tend to correspond to one of these two groups.

"Financier/Investor": The entity which provides capital for a facility, including long-term and working capital for the owner and/or contractor. Current trends indicate that financing is playing an increasingly important role in the building process. The subject of finance in relation to design and construction is beyond the scope of this thesis, but is mentioned here because of the increasing prominence of finance as a factor in facility procurement.

"Quantity Surveyor": In UK and some European countries the function of formally estimating the quantities of materials and other work of a facility is done by an independent entity. The "Bill of Quantities" then becomes an important

supplement to the drawings and specifications and becomes the basis of tenders and payment. In a sense, the quantity surveyor becomes a kind of arbiter between the designer and contractor concerning the quantitative interpretation of the design. In the US, this function is usually split between the designer and the contractor.

"Quality Assurance/Quality Control (QA/QC) Agency":

Recently, many projects have used an independent agency to provide inspection, testing and other services related to QA/QC. Such agencies may be directly employed by the owner, contractor or designer, but may also serve as a sub-contractor to a general contractor or CM.

3.2 Relationships and Communication

The above section outlines the individual actors and sub-actors involved in the building process. In this section, the "connective tissue" which binds these actors together will be considered. Actors and organizations to which they belong can be seen to have two generic types of relationships: contractual and normative. These relationships are characterized by the exchange of goods and services as well as information, ie. communication, which can be further classified as informational, advisory, delegated authority and direct authority (Irwig 1976, Paterson 1966). These terms are defined as follows:

"Contractual Relationships": Formal or informal agreements between separate organizations for the provision of goods

and/or services, usually in exchange for monetary payment.
eg. an owner-architect agreement for design services,
contractor-supplier purchase order, etc..

"Normative Relationships": Formal or informal relationships which do not involve the exchange of goods and services, but only definition of function and/or responsibility among different actors either within a single organization or between separate organizations (eg. relationship between a field superintendent and project engineer within a construction company or a manufacturer's technical representative and an architect.)

"Informability": Communication of neutral information between two actors, eg. a price quote on material from a supplier to a general contractor.

"Advisability": Communication of specialized or expert information which carries with it special importance by virtue of its expert quality, eg. an architect advising an owner on the choice of certain materials for a new project.

"Delegated Authority": The power to issue directives by one actor to another on behalf, and with the consent of a third, eg. an architect directing a contractor to correct a defect on behalf of the owner.

"Direct Authority": The power to issue directives by one actor to another by virtue of a contractual or normative relationship between them, eg. a contractor who directs a

specialty contractor to correct a defect.

3.3 The Dimension of Time

The third aspect which must be considered in defining a procurement method is time. The creation of a constructed facility does not involve a static set of actors and relationships, but a dynamic process where these elements change. As such, any single relational diagram of actors in a given procurement method will fail to capture the quality of change through time.

A procurement method must be seen as a series of inter-related phases corresponding to the basic activities needed to create a facility. Each phase is characterized by a different set of actors and relationships depending on the procurement method. The order phases over time be sequential or overlapping. For this discussion, the following generic phases are defined as follows:

"Brief or Programming": This involves translating a general set of goals for a facility into an explicit set of measurable objectives which serve as a basis for physical design. Typically this involves gathering data on owner requirements, resources, environmental conditions etc., analyzing and synthesizing them.

"Design": This translates the brief or program into a physical description of a facility which can serve as a

basis of construction. Typically it involves a "spiraling" process of definition, documentation, coordination and evaluation, refinement, further definition, etc. until a sufficient level of detail and definition is reached to allow actual construction (Tavistock 1966). This level of detail varies depending on the nature of the project and the procurement process.

"Contractor selection/negotiation": This process involves selecting one or more contractors and defining the terms of the construction contract(s) through any one of a number of procedures. Assuming the contractor does not belong to the same organization as the owner, this includes some form of soliciting tenders or proposals from one or more contractors, selecting contractor(s) according to some criteria, negotiating and finalizing a contract. It should be noted that a similar process is involved in selecting a designer, but that this is generally a relatively minor phase in comparison with the others and is often not formally treated. Most of the same procedures involved with contractor selection/negotiation can be applied to designer selection/negotiation.

"Construction": The process of mobilizing "men, materials and machines" to physically construct a facility. This also involves a host of related management and resource allocation functions including detailed planning, scheduling, sub-contracting, material procurement, superintending, monitoring and controlling time, cost and

quality.

"Post Construction": This phase is often not formally considered-- both in procurement theory and in practice, but is critical to the successful realization of the procurement cycle. Activities include start-up, testing and fine tuning of all sub-systems, occupancy by the user, establishing ongoing operation and maintenance procedures, correcting defects covered under warranty, and monitoring performance. The last activity, in particular, is vital to closing the feedback loop between occupancy, planning and design of new projects.

PART II

ALTERNATE PROCUREMENT METHODS AND DESIGN-BUILD

CHAPTER 4.0
GENERIC TYPES OF PROCUREMENT METHODS

This chapter will concentrate on describing several generic types of alternate procurement methods with respect to the traditional method.

4.1 Defining and Classifying Generic Procurement Methods

Various generic classifications for procurement methods appear in the literature on the topic. Bobrow (in IF/OP 1, 1976), Glover (1976), Turin (1969) and Haviland (1976) all propose various generic terms and classifications which can be summarized as follows:

Bobrow -----	Glover -----	Turin -----	Haviland -----
Traditional	Traditional	One-off	Design- Award- Build
Management	Modified Traditional CM/PM	Process Approach	Construction Management
Design/ Build	Design/ Build	Model Approach	Design/ Build
Building Subsystems	Building Systems	Component Approach	
Special Process			

For the purpose of this thesis, four generic methods will be discussed: Traditional, Management, Systems and

Design-Build. The first, which was already discussed in Chapter 2.0, serves as a baseline reference; the other three are what may be broadly considered as alternative procurement methods. These alternative methods all represent attempts to address various problems with the traditional method cited in Chapter 2.0 .

These alternative methods are not mutually exclusive, and tend to overlap each other. They all represent different patterns of integration and differentiation of actors and their relationships through the building process. In particular, they all significantly restructure the relationship between designers and contractors in order to more closely integrate the two. In the rest of this section, comparative descriptions of each of these methods will be presented and significant differences and similarities between them will be summarized.

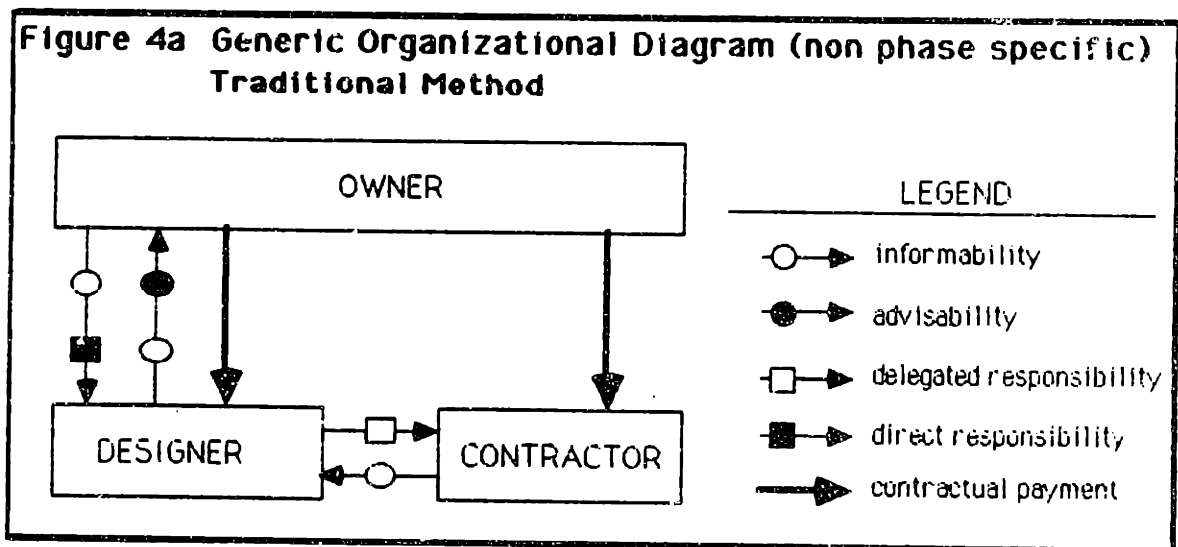
4.2 The Traditional Method

4.2.1 Description/Key Features: Owner hires designer on a negotiated fee basis to develop design and construction documents based on program or brief supplied by owner. Once construction documents are complete and approved by owner a contractor is selected, usually through competitive bidding and owner enters into a separate, usually fixed price contract with single general contractor. During construction designer acts as owner's representative to assure contract

compliance and advises owner on payments, changes, etc..

Key feature is total separation between design and construction phases. General contractor takes entire risk for time, cost and quality and coordination of trades, subcontractors, suppliers, etc.. This results in a basically adversarial relationship between owner and designer vs. contractor

4.2.2 Variations: Negotiated construction contract in lieu of competitive bidding may be used. Various degrees of shared savings and cost-plus contract pricing arrangements may be used to spread risk between owner and contractor.



4.2.3 Typical Phasing: Highly sequential. Typically no overlapping of phases. In some cases, long lead materials and equipment may be pre-purchased and furnished to contractor by owner.

Figure 4b Typical Phasing: Traditional Method



4.2.4 Advantages:

- * Competitive bidding usually yields lowest cost and maximized accountability for given scope and quality of work.
- * Unique, non-standard requirements, high level of quality are easily accommodated.
- * Cost fixed prior to start of construction.
- * Quality and scope of work well defined by construction documents minimizes risk of disputes over interpretation.
- * Designer's role as protector of owner's interests clear.

4.2.5 Disadvantages:

- * Long total project delivery time, especially for public sector projects where strict bidding/award procedures apply.
- * Project cost difficult to control prior to contract award owing to lack of good cost data/feedback during design.
- * Limited value engineering during design due to lack of construction cost and constructability feedback during design may result in unnecessarily expensive design.
- * Competitive bidding invites unrealistically low bids (due

to estimating errors or "low balling") which can create contract compliance problems. Changes usually costly and subject to dispute. Bidding may not always be feasible if competition limited due to size, location or special requirements of project.

4.2.6 Typical Applications:

- * Most public sector projects.
- * Projects where delivery time is less important than cost and/or quality.
- * Projects with unique requirements, high level of quality and/or design expression, eg. monumental projects with special architectural features.

4.3 Management Methods (Construction Management)

4.3.1 Description/Key Features: Often called construction management (CM) or project management (PM), this encompasses a broad range of procurement methods which are characterized by a fourth major actor, distinct from the designer or contractor, who is responsible for managing or coordinating design and construction activities. Two generic modes have evolved, one an outgrowth of traditional designer services the other an outgrowth of traditional contractor services. Both involve applying formal scheduling, cost control and value engineering techniques to to the design phase of a

project. The designer is usually hired directly by the owner, although he may be hired directly by (or the same as) the CM. Some owners such as developers, large corporations and governments may have in-house CM capabilities.

4.3.2 Variations: In the designer-CM mode embodied in the standard AIA CM contract form (AIA Document B801, 1973), the CM uses his expertise and "best effort" to advise the owner, but does not assume ultimate responsibility for construction methods, time or cost. Typically, contracts with either a general or multiple specialty contractors are held directly by the owner. These contracts may be bid or negotiated and subject to various pricing and risk allocation arrangements.

In the contractor-CM mode, embodied in the AGC standard CM agreement (AGC Document 8, 1977), the CM guarantees the project price at some point during design, typically at about 70% design development. Project costs are audited and any savings at the end of the job are shared between the owner and the CM. During construction, the CM acts essentially as a general contractor and usually holds specialty contracts directly.

4.3.3 Typical Phasing: CM is usually associated with phased or "fast-track", scheduling whereby construction and procurement of long-lead items starts before the design is complete. The CM manages or coordinates design and various specialty contractors, usually employing critical path scheduling techniques.

**Figure 4c Generic Organizational Diagram (non phase specific)
Management Methods (Construction Management)**

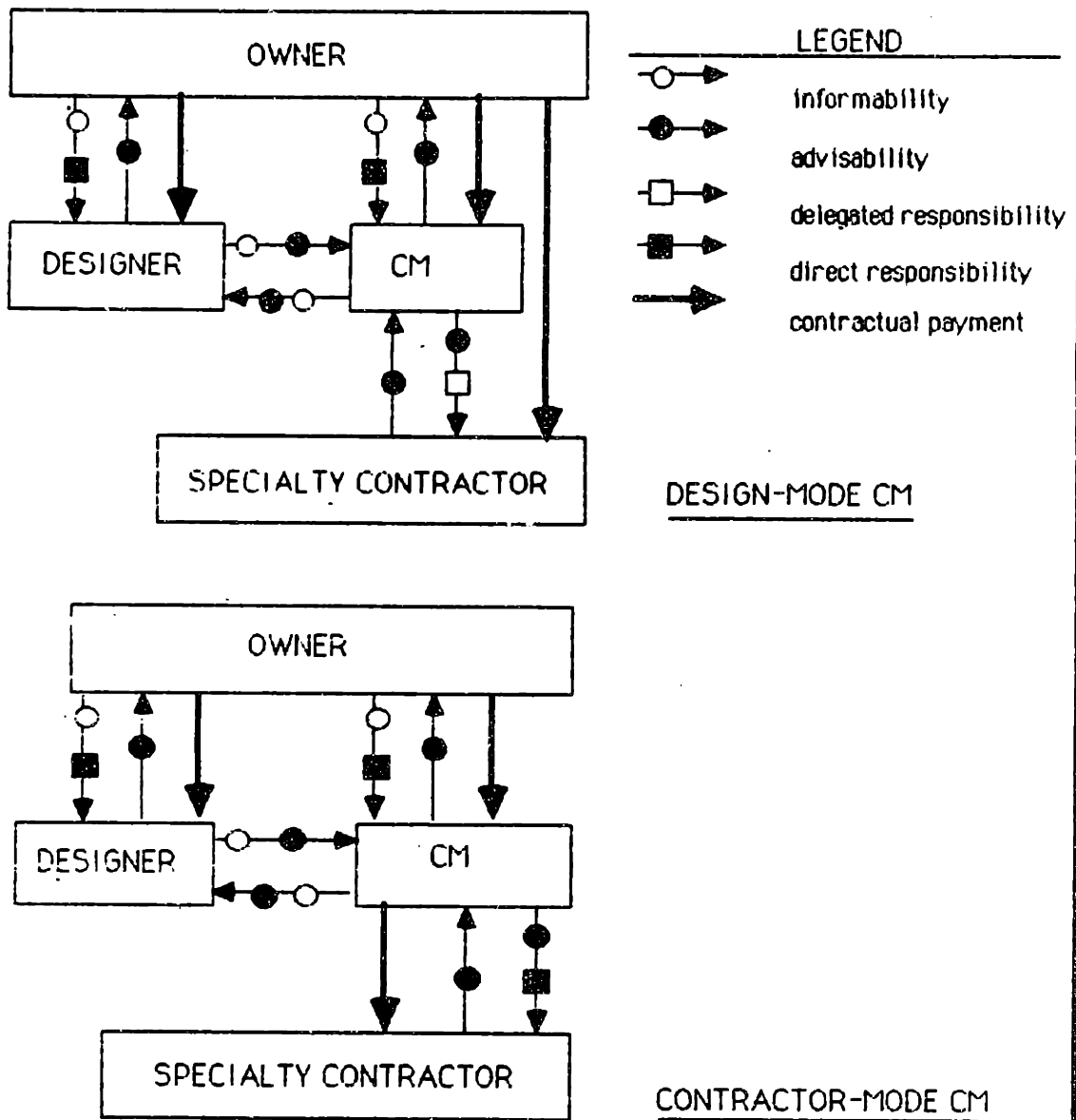
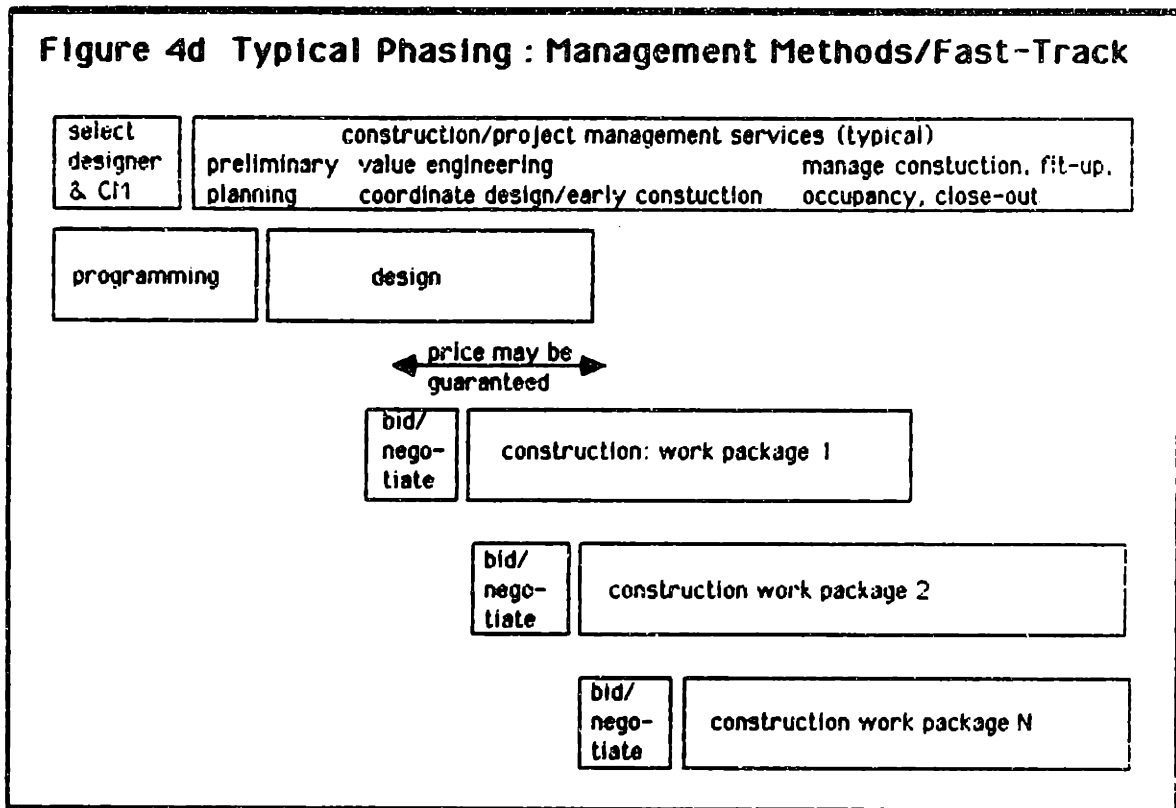


Figure 4d Typical Phasing : Management Methods/Fast-Track



4.3.4 Advantages:

- * Overall project delivery time can be shortened significantly
- * Cost control is increased by good estimating feedback throughout design.
- * Total cost/value may be increased through value engineering and constructability feedback throughout design.
- * Changes during construction are easier and less costly due to less adversarial owner/CM relationship.

4.3.5 Disadvantages:

* In design-CM mode, owner bears entire cost risk throughout project or at least until fixed price contracts awarded for entire project with one or more prime contractors. CM lacks direct cost incentive to perform since fee based on "best effort" only. Similarly, in the case where an owner combines in-house project administration with an outside CM, roles of authority and responsibility can become ambiguous and lead to disputes.

* In contractor/CM mode, owner and CM have a potentially adversarial relationship once price is fixed. If fast track used, an inherent conflict between the CM's contractual responsibility (direct authority) and advisability with respect to the owner (Irwig, 1977). Because price is fixed through negotiation, owner loses benefit of competitive bidding (this may be partially offset by shared savings).

* Risk of early construction constraining later design decisions and increasing cost of design changes if fast track used.

* If fast track used, coordination of work becomes more difficult. Specialty contractors may claim extra compensation if their work is delayed or impeded by lack of coordination or delays of other specialty contractors. If owner holds specialty contracts directly (ie. multiple prime contracts) as in designer-CM mode, he/she bears this risk.

4.3.6 Typical Applications:

- * Projects requiring accelerated delivery
- * Large and/or complex projects requiring sophisticated management techniques and multiple, interdependent designers and contractors. Especially when owner lacks in-house management capability.
- * Projects where scope and requirements are likely to change during construction.

4.4 Systems Methods

4.4.1 Description/Key Features: A set of standardized, pre-engineered components are designed and produced to achieve a given level of performance required for a generic type of building, eg. schools, housing, warehouses, etc.. Components are then selected, configured and modified, as required for a specific project application. The systems method is usually associated with off-site prefabrication and industrialized production of components, although any rationalized, pre-engineered/pre-designed approach to building can be seen as system.

Typically, a system is developed in response to a certain level of market aggregation for a generic building type which promises sufficient demand to justify the initial development and capital costs. The building process is organized around, and dominated by, the system manufacturer(s). Usually, some sort of direct relationship

exists between the owner and system manufacturer. The designer and contractor may be directly contracted by the owner or by the system manufacturer.

4.4.2 Variations: Systems may be characterized by their degree of completeness, flexibility and adaptability to non-system components .

Closed systems are based on a highly specific set of components, interfaces, dimensions, etc. which require a high degree of coordination. Closed systems are often proprietary and produced exclusively by one manufacturer (or licensees).

Open systems are more flexible and easily used in conjunction with non-standard, non-system components. These systems are usually based on accepted industry standards which allow mutually compatible components and subsystems to be produced by various manufacturers.

A very wide range of technologies, materials and degrees of off-site production may be used including small, linear components to various panel systems to complete, volumetric modular units.

4.4.3 Typical Phasing: Design, engineering, setting up of production facilities for a system and sometimes component production is done prior to starting specific individual projects. Design may often proceed from schematics directly

**Fig.4e Generic Organizational Diagram (non phase specific):
Systems Method**

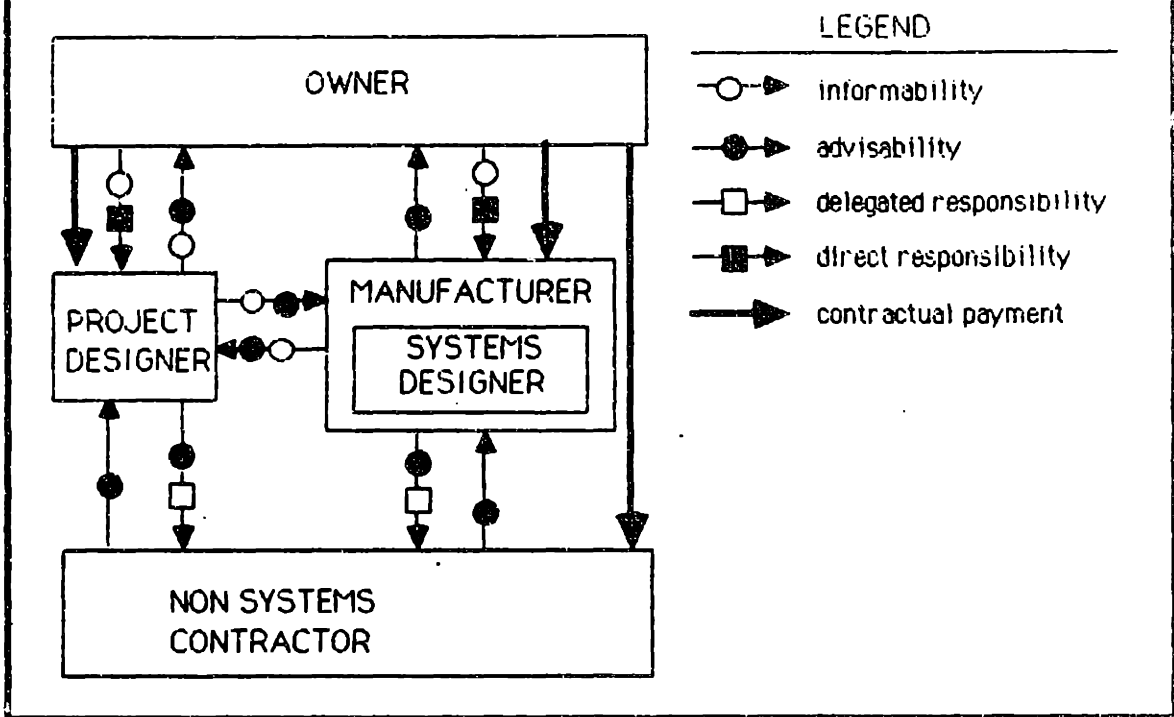
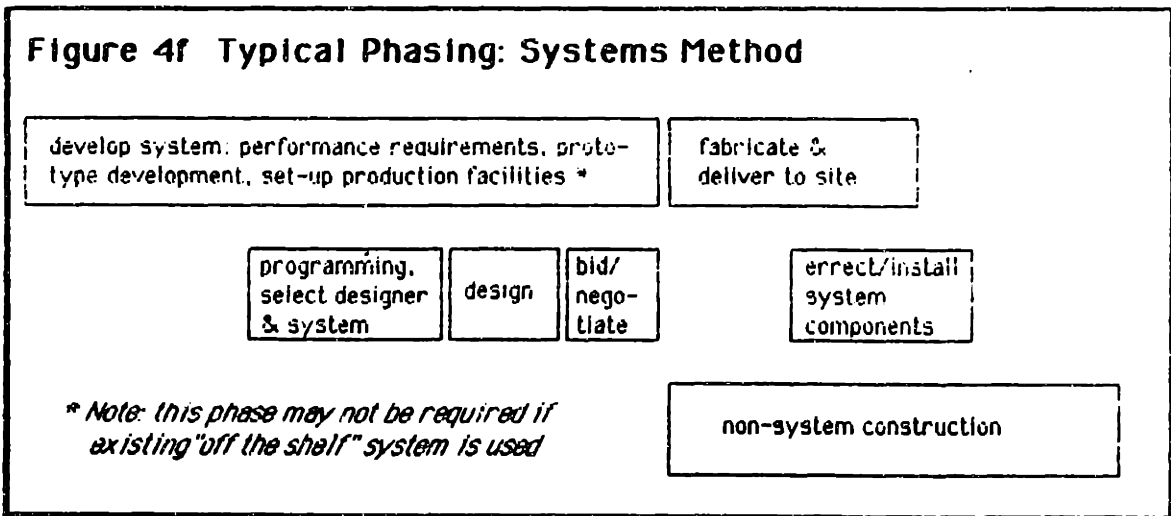


Figure 4f Typical Phasing: Systems Method



to shop drawings with minimal design development or working drawings. Off site fabrication may proceed simultaneously with site development and foundation work. Off-site

production not affected by weather.

4.4.4 Advantages:

- * Time savings as described above.
- * Industrialized production techniques can result in lower costs and better, more uniform quality.
- * Costs may be more accurately predicted and controlled, especially during early design.
- * Direct design costs for individual projects lower, design effort may be concentrated into system improvement rather than "reinventing the wheel".
- * May minimize work performed by traditional building trade unions (if union work considered disadvantageous).

4.4.5 Disadvantages:

- * Design is constrained by limits and requirements of system. This becomes more of a problem as the project design requirements become atypical and/or if system is closed.
- * Transportation and handling costs may be high. Material must be double handled and shipped to factory, then site..
- * Coordination between system and ex-system components can create problems, especially for designers unfamiliar with

system.

* High development and captial costs may not be recovered if market demand is low.

* Various institutional barriers historically have existed, especially in the US, including building codes, trade unions, negative public image, etc..

4.4.6 Typical Applications:

* Relatively simple, generic buildings with large market which can be aggregated geographically and institutionally.

* Economies with low capital and/or high labor costs where cost savings can be achieved through industrialized production.

* Remote locations where fast construction and semi-permanent facilities are required.

4.5 Design-Build Methods

4.5.1 Description/Key Features: Owner contracts with single company or joint venture for both design and construction services. Typically, design-build proposals are solicited based on a scope of work, program and performance specification and sometimes a rough, conceptual plan. Proposals showing schematic design and specifications then become the basis of the contract.

Contracts may be negotiated or competitively solicited and awarded on the basis of a combination of cost, quality and time, depending on owner's priorities.

Owner may hire an outside designer/consultant to develop program and performance requirements and as representative during design and construction to monitor performance of design-builder.

4.5.2 Variations: Land and financing may also be included along with design and construction as a single contract package. (This is usually called a "turnkey" package, although sometimes this term is also applied to design and construction only).

Public sector design-build projects are sometimes procured using a "two-step" method-- In step one, only technical proposals are submitted without price. Proposals are then judged either acceptable or non-acceptable. In step two, offerors with acceptable technical proposals are asked to submit a price proposal. A contract is then awarded to the low bidder.

4.5.3 Typical Phasing: The programming or predesign phase is usually more formally defined than other methods and often includes what would normally be considered early design phase. Bid/negotiation then occurs between programming and design phases. Design and construction are usually overlapped or fast-tracked.

Figure 4g Generic Organizational Diagram (non phase specific Design-Build Method)

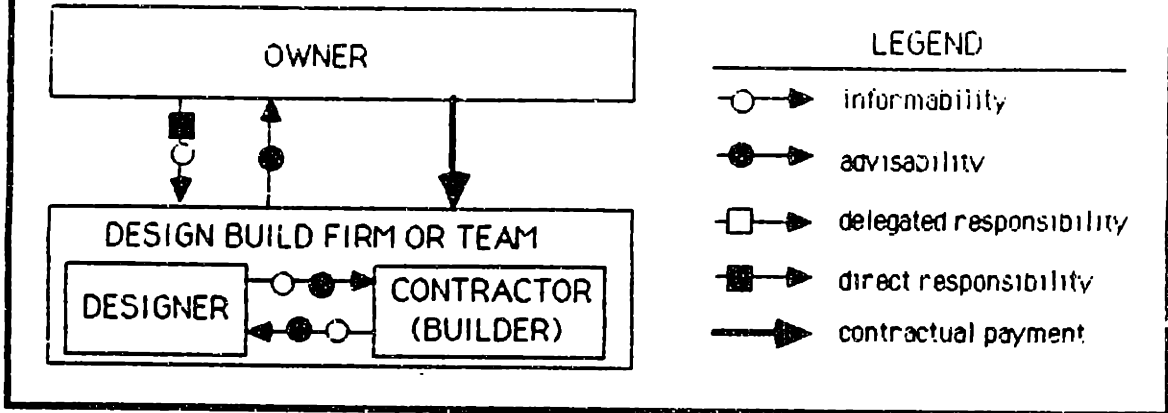
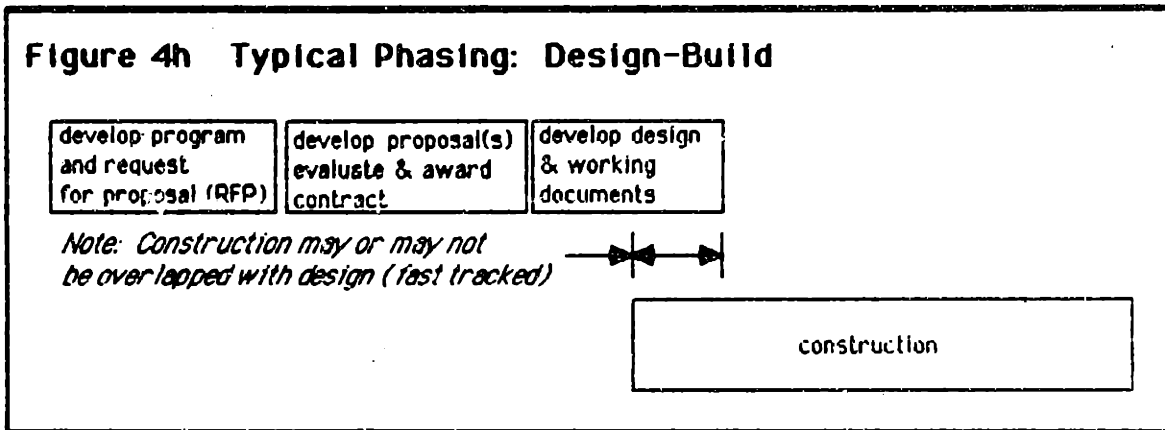


Figure 4h Typical Phasing: Design-Build



4.5.4 Advantages:

- * Maximum integration of design and construction allows optimal value engineering and high level of coordination.
- * Single responsibility for design and construction minimizes owner's risk for design errors and omissions and other cost over-runs, also simplifies project administration for owner.
- * Delivery time often shortened due to fast-tracking and because of good constructability input and feedback during design.
- * Owner management resources may be reduced in some cases due to "one-stop shopping" approach.

4.5.5 Disadvantages:

- * Minimum control by owner over project.
- * Changes difficult and costly to make once proposal accepted.
- * Low level of project definition as basis for contract creates potential disputes during design development over interpretation of program scope and performance requirements. This increases risk premium incurred by owner and/or contractor.
- * In public sector, lack of objective basis for evaluating quality of proposal and potentially awarding to non-low

bidder may create accountability problems.

* Potential conflict of interest for designer who is ethically bound to protect owner's interest and assure that construction quality is maintained, but also seeks to maximize profit for design-builder.

* High cost of proposal development and related administrative costs if multiple, competitive proposals solicited.

4.5.6 Typical Applications:

* Highly complex industrial, mass transit and other projects which are based on specialized, often proprietary equipment and processes which require special technical knowledge to coordinate with design and construction of overall project. Such projects include manufacturing, processing and power plants, mass-transit systems, certain bridges, etc..

* Relatively simple, generic projects where codes, requirements and standards are well established (thereby reducing the need for explicit, detailed project definition in contract). Such projects include mass housing, speculative commercial and office structures, warehouses, etc..

4.6 Distinctions and Similarities Between Methods

4.6.1 Traditional vs Management

* **Distinctions:** Management involves formal integration of design and construction by systematically applying construction knowledge and planning during design phase, ie. value engineering, constructability reviews, etc. and uses modern project control techniques such as CPM scheduling to enhance owner's control of overall schedule, cost and quality. This allows construction to overlap design phase, ie. fast-track makes it possible to control very large, complex projects involving multiple prime contractors. Generally CM is characterized by a less adversarial owner-contractor relationship due to team approach and more even risk sharing.

* **Similarities:** Design-CM mode can be seen as simply an expansion, but not a fundamental change of the designer's role under the traditional method. Designer still is primarily an advisor to owner and represents owner in dealing with contractor(s). Contractor-CM mode is basically a form of negotiated general contract with an expanded pre-construction role for contractor.

4.6.2 Traditional vs Systems

* **Distinctions:** Systems method implies a more direct working and contractual relationship between the owner and the manufacturer. During the system development phase, owner may specify system performance requirements and commitment for a certain volume of work to be built using the system.

Systems method is often associated with industrialized, off-site production of major building components.

* Similarities: Industrialized, prefabricated building systems, especially open-type systems, may be used under a traditional design-bid-build approach. In this sense, most modern construction in industrialized countries is systems-based. Development of the CSI Master Specification format in the US and efforts of manufacturers to standardize and coordinate their products represents a continuing trend toward comprehensive open systems.

4.6.3 Traditional vs Design/Build

* Distinctions: Owner designer relationship is fundamentally altered. Designer no longer acts as owner's agent. Likewise, designer-contractor relationship changed as designer becomes a partner or sub-contractor of contractor. Project definition and contract more based on program and open performance requirements, rather than detailed, prescriptive plans and specs.

* Similarities: Owner may employ a separate designer to develop a program, requirements and even conceptual plans for request for proposal (RFP). As RFP becomes more detailed and prescriptive, design-build approaches traditional method. Design phase under design-build becomes more like preparation of elaborate shop drawings than original design work.

4.6.4 Management vs Systems

* **Distinctions:** Management methods do not necessarily involve industrialized or prefabricated production techniques. CM has no vested interest in a particular building system and may select whatever available technology is most appropriate and cost-effective for a given project. Building system manufacturers, particularly those who produce closed systems, have a vested interest in using their product even if it results in a sub-optimal solution for the owner.

* **Similarities:** Management methods may be seen as the "software" which complements the "hardware" of building systems. During the development phase of a building system a third-party manager may play an important role in aggregating and defining market (owners') demand, and coordinating technical development by manufacturers (eg. SCSD program, described in detail later). Once a system is established a CM may help facilitate its application on specific projects by coordinating design by independent designer to properly use system and to manage field assembly and procurement and installation of non-system components or coordinate the application of multiple sub-systems.

On a philosophical level, CM and other management methods may be seen as a sub-set of a "systems" approach to

building, of which kit-of-parts "building systems" are another sub-set.

4.6.5 Management vs Design/Build

* **Distinctions:** Generally, owner and CM share common interest and have non-adversarial client-agent relationship, at least until a GMP is fixed. Design-builder has relationship with owner more akin to the owner-contractor relationship under the traditional method. This means that CM allows owner more flexibility and control over building process. Design-build implies a "package-deal" over which the owner has less control once the design-build proposal is accepted and contract signed. To the extent that price is fixed at an earlier point in design, the owner carries less cost risk under design-build. For design-builder, this additional risk is somewhat offset by the lower level of uncertainty in the designer-contractor relationship.

The role of the designer fundamentally differs under the two methods. Under design-build the designer and builder have maximum incentive to cooperate and integrate their activities, however the owner must rely on his/her own expertise and the integrity of the design-builder to ensure that quality is not compromised. Under management methods, the designer is usually hired directly by the owner and has more incentive to defend the owner's interest, especially during the construction phase of the project.

* **Similarities:** Design-build necessarily embodies management techniques required to coordinate design and construction activities. Typically, the project manager of a design-build team will carry out the same functions as a CM in terms of design review, scheduling, managing multiple specialty contractors, etc.. Both design-build and management methods usually incorporate fast-track design and construction phasing.

Some owners simultaneously hire a designer and a builder under separate agreements during early design phases of a job and call this design-build, however for the purpose of this discussion, such an arrangement would come closer to the contractor-CM method.

4.6.6 Systems vs Design-Build

* **Distinctions:** The same distinctions described in systems vs. management apply. In addition, design-build always implies a complete, usable project, whereas building systems, in the hardware sense of the term, may or may not provide for a complete facility and often only provide for a limited portion of sub-system(s) which must be supplemented by non-system construction.

* **Similarities:** Design-build is often associated with systems for the same reasons that management methods are. Systems development involves some sort of design-build

effort organized around a proto-type system or model building. Both design-build and systems are associated with performance specifications. Design-build is commonly used as a mechanism to procure building systems when multiple proprietary systems which meet the same performance standards are available or where it is desirable to allow systems to compete with non-systems construction. Because of the potential difficulty of coordinating design and construction around a proprietary system, particularly coordinating system and ex-system components, site adaptations, etc., many systems manufacturers have found that the best way to market their product is on a design-build basis. Butler Buildings' light commercial building system described in the next chapter is an example of such an approach.

Philosophically, design-build embodies a "systems" approach to building in the same way that management techniques do.

This concludes the outline description of generic procurement methods. The following chapters will build on and elaborate these descriptions to create a generalized model of procurement methodology.

CHAPTER 5.0

APPLICATION OF ALTERNATE PROCUREMENT METHODS:

PATTERNS OF DECISION MAKING

5.1 Case Studies of Alternate Procurement Method Applications

This chapter will investigate a number of specific cases where alternate procurement methods, described in the previous chapter, were used, and will try to identify patterns of decision making which led to the selection of and shape specific attributes of a procurement method.

5.2 The School Construction System Development (SCSD) Project

The SCSD project and subsequent related developments can be seen as a seminal example in North America of a systems approach to buildings, not only in terms of development of a physical building system, but also in terms of innovations in procurement management and organization. The following description is largely based on the account of the project given by Boice (1971).

The idea for SCSD was first proposed by Ezra Ehrenkrantz as a means for building better quality public schools more economically and quickly. The concept, which was based on experience with building systems in the UK during the 1950's, was to sufficiently aggregate the market for school construction so as to interest building component manufacturers in developing new sub-systems specifically to

meet the performance requirements of the schools.

Under the auspices of various non-profit organizations, El Enkrantz and a small group of other architects approached a number of manufacturers with the idea of developing new building sub-systems specifically for schools in California. The manufacturers indicated an interest if they could be guaranteed a minimum volume of sales which worked out to a total of approximately 1,400,000 square feet of total new construction. A number of California school districts were then approached with the idea of collectively committing themselves to using the new systems, if they were developed, for the required minimum amount of new construction.

The school systems agreed and proceeded to work with the SCSD group to develop the generic requirements for structural, HVAC, lighting/ceiling and partition sub-systems which could then be configured to meet the specific requirements of various individual school projects. Rather than stating requirements in prescriptive terms of materials and methods of construction, they were defined in terms of performance criteria such as structural loading, environmental standards, etc. and for interfacing requirements between sub-systems. This allowed maximum latitude for value-engineering.

Manufacturers were then invited to submit proposals for specific sub-systems. After a period of proposal evaluation and modification, manufacturers of proposals

which were judged as meeting the performance requirements were asked to submit price proposals. Winning proposals were selected on the basis of lowest first and operating costs. This unconventional method of specification and selection by a public agency was upheld by courts in a legal challenge by a losing manufacturer.

Mock-ups of the winning sub-systems were built, tested and assembled into a small prototype building. Despite the fact that designs for individual schools were not yet finalized, the districts let pre-purchase unit price contracts for the sub-systems to allow manufacturers sufficient lead time to get into production.

The design of individual schools was done by different architects retained by the separate school districts. These architects had been involved in developing the original performance criteria and were given guidance by the SCSD group in how to design within the system's constraints.

Coordination of the system procurement with design and construction of the individual schools emerged as a significant problem. In some cases manufacturing schedules could not meet construction schedule requirements. The school districts did not have the capability of managing and coordinating the multiple prime contracts for supply of sub-systems with general construction contracts. The scheduling problem was overcome by the SCSD group in conjunction with DMJM, one of the architects who developed and applied a

detailed CPM schedule for the overall project. On individual school projects, the sub-systems contracts originally made with the school districts were transferred to the general contractor as the general construction contracts were let.

The SCSD project attracted considerable attention among other school districts and the building industry throughout North America. Similar school building systems were developed in Toronto, Montreal, Boston, Florida and Alabama. An interesting spin-off of SCSD was the Space Grid System marketed by Butler Buildings (IFOP1/Worden, 1976). Butler had initially lost its bid for the SCSD structural system but decided to market the system independently.

After two years of trying unsuccessfully to get independent architects to design with the system they changed their strategy and began to market the system on a design-build basis, employing their own architects, supplying all sub systems and managing construction. They found that dealing directly with owners and offering a complete package they could provide better cost control, faster delivery and ensure best use of the system and optimize their own production efficiency. At the same time they found that their market shifted from 90% public sector projects to 90% private owners, most of whom selected Butler on a negotiated contract basis.

5.3 GSA/PBS Experience with Construction Management and Fast Track

In the late 1960's the Public Building Service of the General Services Administration (the agency which handles most non-military federal building procurement) began to investigate alternate procurement methods, primarily as a means of expediting the unusually long delivery time associated with most federal building projects (typically seven years or more) and also to improve cost and quality control.

A study entitled "Construction Contracting Systems: Report on Systems Used by PBS and Other Agencies" (GSA/PBS1970) recommended that PBS adopt construction management in conjunction with fast-track scheduling on large, complex institutional projects. The report also suggested design-build might also be advantageous on smaller, more straightforward projects, but felt it was inappropriate for larger, more complex ones because of the lack of owner control and flexibility in design-build.

The first major use of CM by GSA was on the Aerospace Museum in Washington. The basic building needed to be completed in 1975 to allow mounting of exhibitions in time for the US Bicentennial. This allowed about three years for design and construction of a monumental scale building which required numerous sophisticated features related to special exhibits.

Under GSA's approach, an in-house project manager (PM) worked with an outside designer and a CM. The CM was

selected competitively on a basis of qualifications, management plan and price (Dibner 1983). The CM provided a scope of standard services including design review, cost estimating, value engineering as well as packaging, bidding and administering various specialty contracts which GSA held directly. Work packages for foundations, structure and long-lead items were awarded while design work was still in progress.

The museum was completed about 10% below budget and on time, despite the tight schedule. The success has been attributed to the fact that the owner, GSA, had a knowledgeable staff which actively participated. The PM had ultimate decision-making authority and, if necessary, resolved any disputes between the CM and the designer (Hyman in IF/OP2 1976). It should also be noted that both the CM, Gilbane and the prime designer, HOK, were large firms with extensive CM experience and excellent reputations. Although Gilbane acted in a professional advisory CM mode, with no ultimate cost or time responsibility, historically its approach to CM stems from its origins as a general contractor (Gilbane, 1986).

The success of the National Aerospace Museum project prompted GSA to use CM on a number of other projects in the \$10-20 million range. However these projects were not as successful and exceeded budgets and delivery dates. Some of the problems stemmed from a certain ambiguity of responsibility and authority between the PM and CM. GSA felt

it could not delegate the amount of authority and responsibility for managing the projects to the CM which would be typical in the private sector. At the same time, because the CM contracts contained no incentive for shared savings or on-time delivery and because the scope of work was difficult to quantify, GSA found it difficult to enforce contract performance with the CM. (Dibner, in Law and Contemporary Problems, 1983).

Another problem GSA had with CM/fast track was the risk associated with holding and being ultimately responsible for the coordination of multiple prime specialty contractors on a single project. This was highlighted in a law suit brought against the US Government by the Fruehauf Corp., a specialty contractor for a Post Office Building. Fruehauf was delayed fifteen months from installing a mail handling system because of the late completion of other work on the building performed under separate contract with the government. The court found in Fruehauf's favor, overturning a previous decision by a Post Office claims appeal board, thus creating a legal precedent for similar claims on any government job involving separate, multiple prime contracts. Because of these and other problems associated with CM and fast track, GSA has since shifted back to traditional lump-sum general contract procurement methods (GSA, 1986).

5.4 Power Plant Design and Construction

Until the late 1960's most power plants, both fossil fueled

and nuclear, were built on a design-build basis. Power plant constructors could offer a known product of complex, often proprietary, but proven technology for a fixed price and delivery time. Owners, ie. utilities, saw themselves in the business of power generation and distribution and wanted to minimize staff and management resources which they committed to procuring new plants. However in the late 1960's a number of changes occurred in the construction environment which made fixed price design-build contracts unviable and forced utilities to change their procurement practices.

A study by Theodore Barry & Associates (1979) investigated trends in procurement of new power plants. They examined various alternate methods which they classified on the basis of owner involvement, ranging from design-build to separate designer with a general contractor to in-house construction management using multiple prime specialty contractors. They found that most utilities were moving away from design-build toward the prime specialty contract approach. The major constraint to this tendency was development of in-house staff and management capabilities.

The driving force behind this trend had to do with project risk management and allocation. Throughout the 1970's a number of factors including rising inflation, uncertainty about environmental and regulatory problems, changing technology and increasing scale of projects made it impossible for design-builders to accept the risk associated

with a fixed price contract. Many fixed price contracts had to be renegotiated and new ones were made on some form of cost-plus basis. (Most of the projects were extremely large, in the \$ 100-1,000 million range).

With the increased risk the utilities had to bear, they felt the need to more actively control the projects. Initially, this meant more involvement in monitoring design-build contracts, sometimes with the aid of an outside construction management consultant. The separate designer with a general contractor represented a further degree of involvement and control, but in most cases, it was not feasible to obtain a fixed price. The size of the projects and, for nuclear plants, NRC contractor quality assurance certification requirements, effectively barred many contractors and reduced competition. The solution to this problem was to divide the projects into smaller work packages based on specialty, location, phasing, etc.. This allowed greater competition and better prices. Because the scope of these packages was limited and could be well defined, fixed price contracts were feasible.

Contrary to the experience in building design and construction, this trend toward construction management was associated with less fast-track scheduling. Fast track scheduling had been the norm under design-build. Under the CM approach, complete design documentation, both of the overall project and of individual work packages, was required. Again, the impetus was to reduce and manage risk.

The organization of in-house construction management groups also changed. Not only did staff tend to increase and project managers report to higher level executives, but responsibilities and lines of authority tended to evolve from a functionally oriented to a project oriented matrix type organization.

5.5 Heery and Heery Case Studies

During the 1960's and '70's the architectural firm of Heery and Heery of New York and Atlanta developed an approach toward design and construction management based on certain common principles and procedures and, at the same time, the unique requirements and constraints of each owner and project. This approach is described in the book Time, Cost and Architecture (Heery, 1975). It is a useful reference for this discussion because it is one of more coherent attempts in the literature to develop an empirical theory for building procurement methods.

Heery describes a number of projects in terms of requirements and constraints, ie. contingency factors and corresponding responses in terms of procurement methods applied. A summary of these cases is given in appendix A.

Heery sees CM, in its broadest sense, as a group of services carried out through pre-design, design and construction to control time and cost. He asserts that although CM is often

associated with fast-track and multiple prime contracts, it is not necessarily so and that in many cases a CM will best serve the owner's interests by using a general contractor.

He suggests that the single responsibility general contractor should be seen as the default or base case which should only be deviated from for a specific reason. Such reasons for multiple contracts may include:

- * Accelerated project where one or more activities (eg. foundations, long-lead items) are critical and time can be saved by awarding early contracts for them. He notes, however, that in many cases such activities are not critical and that no significant time saving can be realized by awarding them early.

- * In the case of certain pre-engineered building systems or sub-systems.

- * If required by government statute (eg. New York City requires separate mechanical and electrical contracts on public projects) Heery suggests that this only serves special interests of specialty contractors and should be avoided.

- * Very large projects where competition is limited if the project is built under a single contract.

- * Long projects where the owner is better able to accept escalation risks by bidding later portions of work at the time when they will be built rather than ask a general

contractor to carry such risks at the time of initial bid.

* On certain projects where phasing of work must be coordinated with owner occupancy.

Heery recommends that once design for a project is complete, a general contract should be awarded and that if separate contracts for early work have been previously awarded they should be transferred to a general contractor, with the terms of the transfer clearly stated in both early and general contracts. By transferring contracts, responsibility and authority for controlling is shifted from the owner to the GC, who Heery feels is better able to accept the associated risks.

Although he does not explicitly say it, Heery implies that in this way the total risk premium for the project will be minimized. But, nevertheless, there will always be a risk premium associated with separate contracts and fast-track scheduling. Presumably the decision to use fast-track and multiple contracts should be based on weighing such risk premiums against potential benefits of early completion.

Heery recommends that wherever pre-engineered systems are available which meet the project requirements they should be used. He suggests that although construction costs are usually comparable with non-systems construction, engineering costs and fabrication, delivery and assembly time are usually reduced significantly. On projects where an

appropriate system does not already exist, consideration should be given to developing one if the project is large and/or repetitive enough to justify development costs.

The decision to competitively bid or negotiate should be a function of the owner's ability to effectively negotiate. He classifies owners into two groups. Group I consists of owners who are in a weak negotiating position mainly because they cannot offer the prospect of repeat work if the would-be contractor performs well. Such owners typically include most smaller, private owners who do not regularly build in a given geographic area and most government agencies. Heery notes that even when a government agency is not legally prevented from negotiating sole source contracts, it should still avoid it since decision making authority is usually so diluted and transient that it negates any prospect of repeat work for good performance.

Group II owners are those who can hold out the promise of repeat work. These would include large developers, certain corporations and institutions with ongoing building programs, etc.. Heery points out however that even Group II owners often will find it advantageous to competitively bid rather than negotiate contracts. He also points out that the most important tool for controlling cost is design and clear definition of contract scope, and that time is rarely saved by negotiating instead of bidding.

5.6 Chapter Conclusion

This concludes the short case studies of alternate procurement method applications. In the next chapter, these empirical observations will be used to inform the generalized classification of procurement methods described in the preceding chapter and derive the generalized model of procurement methodology previously mentioned.

CHAPTER 6.0

A PROCUREMENT METHOD DECISION MAKING MODEL

6.1 Towards a Theory of Procurement Methods

Although much has been written on procurement methods and their applications, most of the literature is based on limited empirical and even anecdotal experience. What is lacking, however is a rational general theory which explains the relationship between independent and dependent variables that go into a procurement method for a given project.

Given the problems which have been experienced with both traditional and various alternate methods in many cases, such a theory might prove very useful as a means of informing the owners and other actors in implementing the optimal or most efficient procurement method for a project.

It is not hard to see why such a theory has not been developed. The subject is complex and the issues tend to be vague, elusive and indeterminate. The lack of consistent terminology and definitions further adds to the confusion. The problem of selecting and implementing a procurement method, like many organizational planning problems, tends to be overly constrained, with ill-defined objectives, often surrounded by a lot of extraneous "noise".

This chapter will take a tentative step towards such a theory by attempting to propose a decision making model for planning procurement methods. The approach is loosely based

on one used by Minzberg (1979) for analyzing general organizational structures in terms of what he calls contingency factors.

Critical independent resource and constraint variables which will be called contingency factors will be identified.

Intermediate and dependent variables which will be called procurement method attributes will be discussed in relation to these contingency factors and to themselves. Figure 6a summarizes these variables.

Figure 6 a. Procurement Method Decision Model Variables

(CONTINGENCY FACTORS)	(PROCUREMENT METHOD VARIABLES)	
INDEPENDENT VARIABLES	INTERMEDIATE VARIABLES	DEPENDENT VARIABLES
<p>PROJECT REQUIREMENTS</p> <ul style="list-style-type: none"> *delivery time *size/ complexity/ environmental risk *cost <p>OWNER ATTRIBUTES</p> <ul style="list-style-type: none"> *management capability *bid/ negotiating constraints <p>MARKET CONSTRAINTS</p> <ul style="list-style-type: none"> *bidding climate *risk aversion *benefits of project disaggregation * available systems *aggregation potential 	<p>SCHEDULING</p> <ul style="list-style-type: none"> *sequential *fast-track *pre-engineering <p>WORK PACKAGING</p> <ul style="list-style-type: none"> *single responsibility *early work pkgs w/ transfer *multiple work packages <p>SYSTEMS APPLICATION</p> <ul style="list-style-type: none"> *develop new system *apply existing system 	<p>MANAGEMENT METHOD</p> <ul style="list-style-type: none"> *traditional *CM <ul style="list-style-type: none"> -design mode -contractor mode *design/build *systems <p>CONTRACTOR SELECTION</p> <ul style="list-style-type: none"> *bid *negotiate <p>PRICING</p> <ul style="list-style-type: none"> *fixed *shared savings/ incentive *cost plus

Criteria and objectives for decision making will be presented. Finally, a decision making model based on these contingency factors, procurement attributes and objectives will be outlined.

In subsequent chapters of this thesis, this model will be applied to examine design-build in the public sector in general and as a hypothetical basis for a specific case study.

6.2 Contingency Factors

6.2.1 Project Requirements and Constraints: These are essentially the three critical project variables of time, quality and cost discussed previously. In a later section of this chapter, they will be shown as the basis for an "objective function" to be optimized subject to other contingency factor constraints.

* **Delivery Time:** Essentially this is the time from the decision to implement a given project until it is complete for use and occupancy. This may be seen in terms of the opportunity cost of not having the project, which may be determined by any number of financial, social, political, military or other requirements. Delivery time usually includes a portion of the programming and design phases as well as construction.

The critical issue here is usually whether or not delivery

requirements can be met under the traditional, sequential design/bid/construction scheduling or whether design and construction must be overlapped or otherwise accelerated.

* **Size, Complexity, and Environmental Uncertainty:** This covers a broad range of mostly technical variables which together affect the risk associated with a project, project management requirements and the degree to which a project's technical requirements are standard versus special and unique.

--Size tends to govern project management requirement, with a need for more formal management, control and integrating mechanisms.

--Unusually high quality or performance requirements essentially add complexity. Like size, management, control and integrating mechanisms become increasingly important as complexity increases. While complexity usually increases with the size of a project, a relatively small project may be unusually complex and vice-versa. Increasing complexity also tends to push the project away from standard technology toward special solutions. This, in turn, affects the project definition and documentation requirements. Definition by scope and reference to existing generic performance standards becomes less practical. More detailed, prescriptive plans and specifications are required to achieve the same degree of time and cost certainty.

--Environmental uncertainty includes factors such as unknown site, weather, logistical, economic and political conditions affecting a project. This directly affects risk associated with a project.

* **Cost Constraints:** Typically cost becomes the common denominator for the above contingency factors. Size, quality, complexity, risk and management requirements can all be associated with cost. As such, the realm of acceptable solutions for any building project are bounded by cost. As quality increases or delivery time decreases, cost must necessarily increase for a given scope of work (see figure 6b). As a project budget becomes tighter, so does the realm of possible combinations of time, cost and quality, and hence the potential procurement methods which may be used. This will be further discussed in section 6.4 below.

6.2.2 Owner Resources and Constraints: These are the set of constraints which are associated with the project owner or sponsor as opposed to the project itself or the market conditions surrounding the project.

* **Management Capability:** This may be seen both in terms of the owner's expertise and "savvy" relative to a given project and to absolute management resources. For example, a certain owner may have a relatively small, but very knowledgeable project management staff which is capable of "managing other managers", although due to size, unable to directly manage a

project itself. This would suggest better ability to utilize design-build or CM, particularly the more adversarial contractor-CM mode.

An owner which has both a large and expert management staff may be able to directly manage complex projects and multiple work packages on an in-house basis. Whereas an owner with neither expertise or staff, or staff only, would probably be driven to more traditional or non-adversarial designer-CM procurement methods.

* **Bidding/Negotiating Constraints:** This is basically the Type I versus Type II owner distinction discussed above in Chapter 5.5. Depending on public or corporate policy and statutes, as well as the ability to offer repeat work, an owner will be more or less able to negotiate effectively with a sole source and thus be required to bid firm price contracts.

* **Risk Aversion:** This is basically the ability to bear different types of risk, notably cost risks. At one extreme is the owner who requires a firm price as early as possible, even before design is complete. A more common requirement is for a firm price prior to committing to construction. This is often a critical contingency factor relative to the decision to use fast-track phasing. At the other extreme is the owner which, because of size, economic/political support or other reasons, can accept almost all risk and therefore does not necessarily require any cost guarantees. Note that in very few cases is cost risk born entirely by one actor.

Even fixed price contracts usually require the owner to accept certain cost risks such as environmental risk.

6.2.3 Market Opportunities and Constraints: These refer to the conditions governing the supply and demand of construction resources potentially available for a given project.

Generally, they most affect procurement attributes revolving around bidding/negotiating, pricing, work packaging and use of building systems.

*** Availability of Capable Contractors/Bidding Climate:**

Because of strong demand or a general lack of contractors capable of building a certain project, an owner may be faced with weak or even no competition. This would tend to force an owner toward negotiating versus bidding. Conversely, the more qualified contractors and greater the competition, the more viable competitive bidding becomes.

*** Contractor Risk Aversion:** Similar to owner risk aversion, a contractor may be more or less able and willing to accept different types of risk. This is reflected in the patterns of mark-up or risk premiums which contractors apply in the case of a fixed price contract. Typically, as competition increases, this premium is reduced (Levitt, 1978).

Increasing risk aversion and premiums tend to favor pricing arrangements which shift risk on to the owner as well as negotiating versus bidding.

*** Potential for Improving Competition by Disaggregating**

Project: The degree to which competition can be improved and risk premiums reduced by breaking a project up into separate work packages. Very large projects often have this potential, but small, complex projects where competition is limited due to special skills or resources required, may not.

*** Availability of Building Systems Which Can Meet**

Requirements: If such systems are available, it often pays to use them. This usually then drives a chain of procurement method decisions revolving the characteristics of the available system(s).

*** Potential for Aggregating Demand:** In some cases competition is low due to insufficient size of the project, or, as in the example of SCSD, there is the potential for system development if demand can be aggregated. This will usually affect a chain of decisions regarding work packaging, schedule and management.

6.3 Procurement Method Attributes

These variables represent the range of choices which, collectively, define a procurement method. They not only include the major, generic procurement methods described in chapter 4.0, but also attributes which define the variations among the generic methods.

6.3.1 Scheduling: This is usually dependent on project

delivery time requirements and project size and complexity. It often determines work packaging, management method and pricing.

* **Sequential:** This is the traditional design/bid/build sequence described in previous chapters. It is usually associated with no early delivery requirement or an owner requiring a fixed price prior to committing to construction. It is sometimes possible to reduce delivery time under sequential scheduling by accelerating design and construction.

* **Fast-Track:** Overlapping design and construction phases is usually associated with early delivery requirements. It almost always requires some type of centralized management, usually CM or design-build. Where the owner must have a fixed price prior to construction, CM, with a guaranteed maximum price set at some point in design development, or design-build with a fixed price may be used. The later may also be used where competitive bidding is an additional requirement and where the project can be defined in terms of generic standards.

* **Pre-Engineering:** This is always associated with some sort of systems application. If an existing, "off-the-shelf" system is available. Design time, and often construction time may be significantly reduced, even without fast-tracking. If a new system is to be developed, design time is often longer than under traditional sequential scheduling.

Pre-engineering is also associated with some form of formal management, especially during design to coordinate system design with project-specific design. This may be provided through some kind of CM, particularly design-CM mode, or design-build.

6.3.2 Work Packaging: This attribute, which refers primarily to construction work, is generally determined by a combination of owner management capability and risk adversity, market conditions and scheduling decisions.

* **Single Responsibility:** This is usually based on owner's lack of management ability or aversion to accept the risk associated with multiple contract packages. It is almost always a prerequisite to a fixed or guaranteed price for an entire project. As such, this packaging dictates a traditional general contractor, design-build, or contractor-CM with the CM holding specialty contracts.

* **Early Work Packages with Transfer to Single Responsibility:** This is a kind of compromise which can sometimes satisfy the requirements determined by using fast-track while minimizing owner's risk and management requirements. This packaging method usually requires some sort of design-CM arrangement to ensure coordination of contract transfers.

* **Multiple Work Packages:** In this case, the owner directly holds multiple separate work package contracts throughout the duration of the project. The decision to use such packaging may be dictated by the use of fast-track

scheduling and/or an attempt to enhance competition and manage risk by disaggregating the project. Generally, the owner must have the in-house capability to manage such contracts or manage an outside CM and must be able to accept the risk associated with this management. While it may be theoretically possible to secure firm prices for all multiple packages prior to starting construction, thus guaranteeing the total project cost, in practice, the owner cost risk is increased as compared with a single responsibility fixed price contract. However, owner's risk would be lower as compared with a cost-plus single responsibility contract.

6.3.3 Systems Applications: These attributes result from the decision to use a building system based on availability of existing system(s) and/or develop a new system in response to a generic, standardized requirement and potential for market aggregation. This decision then affects work packaging, scheduling, management method and contractor selection.

*** Apply Existing System:** This decision is primarily based on whether a system that can meet project requirements is available. (This is a largely a function of how those requirements are defined and if they can be stated in generic standard terms). If a complete system is applicable, some sort of design-build method is usually indicated. If limited sub-systems are involved which cannot provide a

complete facility, a CM may be required to coordinate system with non-systems portions of work during design and construction.

* **Develop New System:** If this decision is made then usually some sort of overall project management method is required to coordinate technical and market-related activities . Multiple work packages and pre-engineering scheduling are typically involved.

6.3.4 Generic Procurement Methods: These are a function of almost all the other variables discussed up until now. Detailed description of these methods was already covered in Chapter 4.0. The following is a brief summary of these methods in terms of the independent and intermediate variables discribed above.

* **Traditional Method:** Typically this is the "default" method selected in the absence of unusual project requirements or market constraints by owners without significant management capability, particularly if they are risk adverse and/or required to competitively bid work.

* **Construction Management:** At the very minimum, some degree of cost estimating and constructibility feedback construction management services are useful on almost any project where cost and time are a significant constraint, even if a conventional schedule and single responsibility contract is used. However, if fast-track scheduling, multiple

work packages or systems are used, some form of CM, either in-house or by an outside CM is generally called for.

However to use CM in this way, the owner either has to be prepared to accept most risk associated with multiple contracts directly, as with in-house or design-CM, or he must be able to effectively negotiate with the CM to avoid an inflated risk premium as in contractor-CM with a guaranteed price. In either case the owner should have sufficient management capability in-house to "manage the managers". If these conditions cannot be met, the owner is limited to design-CM with a single responsibility general contractor, (which is essentially the traditional method with enhanced value engineering), or, in some cases, he may use design-build.

* Design-Build: The main contingency factor governing the decision to use design-build is the extent to which the project can be defined in terms of scope and generic standards, as opposed to prescriptive detail, without compromising quality or other requirements. Because the designer works directly for/with the contractor, not the owner, the owner must have the management capability and/or the negotiating power to ensure that the project meets technical requirements at a fair price. If these conditions are met, then design build may offer not only a means of obtaining an early, competitive, fixed price, single responsibility contract, but also optimal fast-track

scheduling and value-engineering, owing to the high level of design and construction integration.

* **Systems Methods:** As previously mentioned, systems methods may be applied in conjunction with any of the other three methods described above depending on the particular characteristics of a given system. In this sense, systems represent more of a technical rather than a management variable. The contingency factor associated with systems is primarily availability and market conditions in terms of the potential for aggregating demand.

6.3.5 Contractor Selection: This is primarily driven by owner bid/negotiating constraints, and, to a lesser extent by contractor availability/bidding climate and potential for improving competition through work packaging.

* **Competitive Bidding:** This includes open and prequalified or limited bidding as well as selection on the basis of cost only or a combination of cost, reputation, management plan, quality, etc.. An absolute requirement for bidding is competitive interest by more than one qualified contractor. If this does not hold, bidding is not a viable selection method. In addition to being dictated by owner negotiating constraints, bidding is also almost always associated with some sort of a fixed, unit or guaranteed maximum price. As such, a prerequisite for bidding is a well defined scope of work and requirements and a manageable amount of contractor

risk.

* **Negotiating:** As previously mentioned, negotiating is often not acceptable or desirable for a number of owners due to policy regulations or weak negotiating position. Limited competition, excessive risk or lack of project definition may make negotiation unavoidable. In such cases a CM may be able to improve the situation by stimulating contractor interest, possibly disaggregating the project into biddable work packages and, if necessary, negotiating on behalf of the owner, using his own savvy and potential to offer repeat work as a CM to enhance the owner's negotiating position.

6.3.6 Pricing: Pricing is essentially a function of the relative ability of the owner and the contractor to bear risk associated with a given project. It also serves as an incentive for optimizing project management efficiency, depending on the management method used.

Pricing arrangements can be seen as a continuous spectrum ranging from the contractor bearing all risk as in a pure fixed price contract, to the owner bearing all risk as in a pure cost plus percentage profit contract. Between these extremes is a range of shared risks and rewards including escalation clauses, unit price, shared savings, cost plus incentive and fixed fees.

In most cases the owner is, or behaves as though he is, less able to bear risk than the contractor. In such cases the

tendency is to use something closer to a fixed or guaranteed maximum price contract. However, when lack of project definition, size, complexity or environmental uncertainty, coupled with the contractor's own risk aversion make a fixed price contract unviable, or the risk premiums excessive, some sort of cost plus contract is required. This concept of risk and efficiency will be further elaborated in the next section of this chapter.

6.4 Criteria for Assessing Procurement Method Variables:

The Concept of Efficiency and Optimization

This section will attempt to refine the basis for relating independent variables or contingency factors to dependent variables, or procurement method attributes. Until now, the relationships and decision-making patterns surrounding procurement method variables have been discussed primarily in simple, deterministic terms of "if-then" relations. In practice, these relationships are rarely absolute and clearly defined: there are too many "buts" and "maybe's". Very often, what starts out seeming like an fixed constraint is not when it is presented in direct conflict with another constraint. In such a case, the owner either has to abandon the project, or redefine the constraints by making some sort of trade-off.

This section will try to examine such trade-offs. The basic issue is what is the role of a procurement method in terms of optimizing the overall project outcome, and how can the

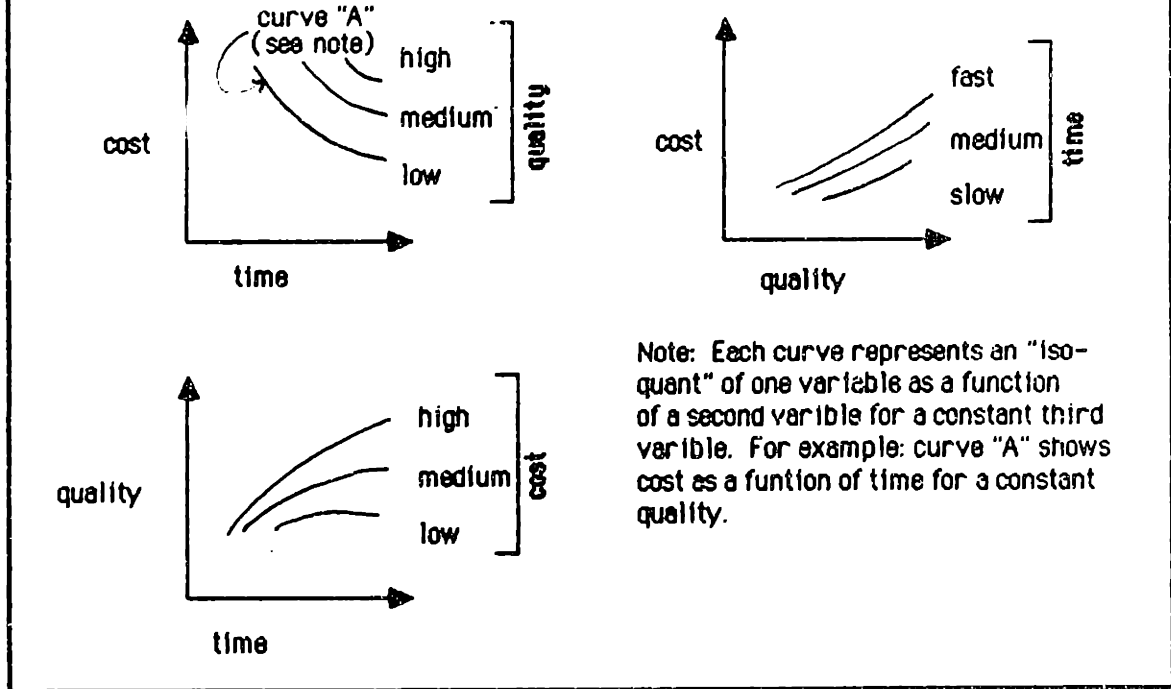
efficiency of a procurement method be defined and optimized? A rigorous and thorough discussion of risk analysis and optimization techniques is beyond the scope of this thesis. The following discussion is intended to present some of the more important points in a general and descriptive way.

6.4.1 Optimizing Time, Cost and Quality

As previously discussed, the ultimate objective of any project and procurement method is to optimise the three variables of time cost and quality. Quality, in this sense, is understood to be how well the facility performs its intended function which may be a function of size, quality of materials, workmanship, technical features, etc.. Figure 6b presents, in a general way, the relationship between these three variables, where the range of values of any one variable can be seen as "isoquants" on the two dimensional graph defined by the other two variables.

This sort of definition of project parameters will define a range of possible solutions and outcomes. To quantitatively analyze and optimize alternatives within this range the three variables need to be valued in a common unit of measure, usually money. For business projects this is a matter of some sort of financial analysis where costs and benefits can be expressed as discounted cash flows. With institutional, governmental and military projects, more subjective judgment comes into play as various non-monetary costs and benefits are usually involved. Decisions relating

Figure 6b. Time/Cost/Quality Relationship for Typical Project



to such projects which may seem sub-optimal from a strict financial sense are often justified, either implicitly or explicitly, in terms of such non-monetary factors.

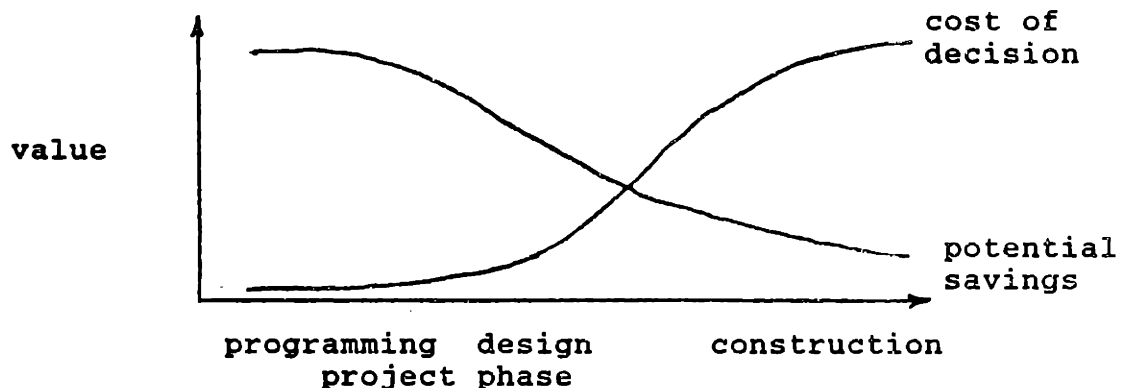
In any case, the final outcome of a project in terms of "net present value" is largely determined by programming and design decisions, usually made long before construction or even detailed design. It is important to note that relative to these decisions, a procurement method, in and of itself, is much less significant in terms of determining the final project outcome.

6.4.2 Optimizing Communication

A major problem in making programming and design decisions

which will produce an optimal project is lack of information on time cost, and quality impact of these decisions. One of the primary objectives of any procurement method, then, must be to ensure that the necessary information be provided to the decision makers at the right time to make the best decision. Figure 6c illustrates this relationship.

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Figure 6c Potential Savings vs Cost of Decisions During
the Project (after Macedo, et.al., 1978)



The problem then becomes a trade off between the cost of information relative to the potential savings or optimization which it allows. This is the basic principle of value engineering. On relatively simple, straight-forward projects this sort of value engineering may be done informally, usually by the designer working directly with the owner. But as projects become larger and more complex, more formal mechanisms and management methods need to be provided.

In many cases the biggest problem is good cost and time information based on knowledge of construction technology and

market conditions. Typically, this is the primary role of a CM prior to construction. Another problem, however, which is often not as well recognized is, fully communicating the owner's needs to the designer and then translating those needs into a design or project definition which will form the basis of construction.

This sort of user-responsiveness and owner control becomes a key factor in shaping the particular set of organizational relationships involved in a procurement method. In some cases a trade-off exists between enhancing owner-designer communications on one hand and designer-contractor communications on the other. Such a trade off would come into play when considering CM versus design-build, for example.

6.4.3 Optimizing Management Resources

A procurement method which optimizes direct project value through enhanced communication and other mechanisms must be judged against the indirect costs, i.e. the management costs of the method. In many cases, management resources are the scarcest of all and the cost of wasting them is high. Before any outside management such as a CM or design-build firm is brought in, an owner must make sure that in-house management resources are being used efficiently and that the roles and responsibilities of the outside managers do not conflict or unnecessarily overlap with the in-house management. This is

a particularly important issue for many public sector owners which already have extensive in-house management staffs.

6.4.4. Minimizing Risk and Optimizing Risk Allocation

Any risk connected with a project or a procurement method has a cost or premium associated with this. This premium is a function of the absolute degree of risk and the risk adversity of the actor who must bear it. The absolute risk may be expressed as a distribution of possible outcomes. Risk adversity may be expressed as a function of utility or subjective value of those outcomes to a given actor.

One very important objective of any procurement method is to minimize the total risk premium. As discussed in Chapter 1.0 there are two broad types of risks associated with any project. The first is external risk, ie. risk inherent in the project itself. The second is risk arising from interdependence and uncertainty of the actions and behavior of the different actors involved.

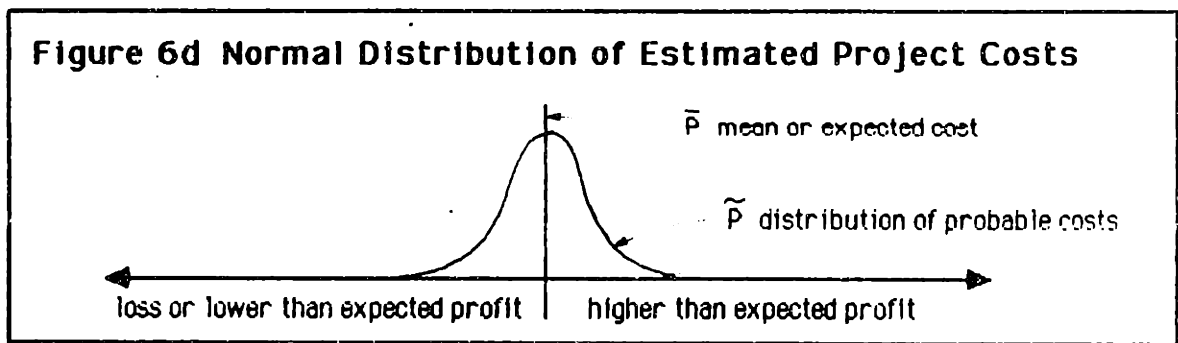
External risk must be identified and, if possible broken down and quantified. Often, the risk can be significantly reduced by increased information about the risk in question. If the risk stems from project definition, further research and documentation of project scope and technical requirements may be provided. Uncertainty about costs may be reduced by researching and analyzing historical data. This

implies that such risks should be born by whatever actor can access this information most easily and for the lowest cost.

Once external risk is minimized through better information, it should be assigned according to the actor with the lowest risk aversion. This is often difficult to quantify since almost all actors will appear risk adverse. One way to test risk aversion is to consider the effect of negative outcomes on different actors. A large cost overrun might bankrupt a small contractor, but only slightly reduce profits of a large, financially secure owner. The contractor would then have to carry a larger premium for accepting such a risk.

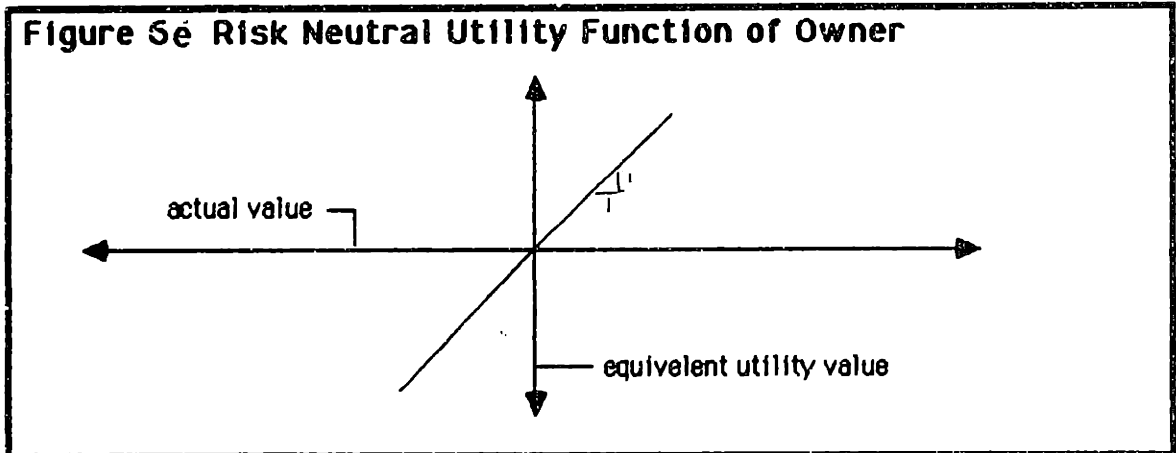
These concepts of risk management may be illustrated by the following examples (after Raiffa, 1965 and others):

Assume a normal probability distribution of final costs for a given project as shown in figure 6d

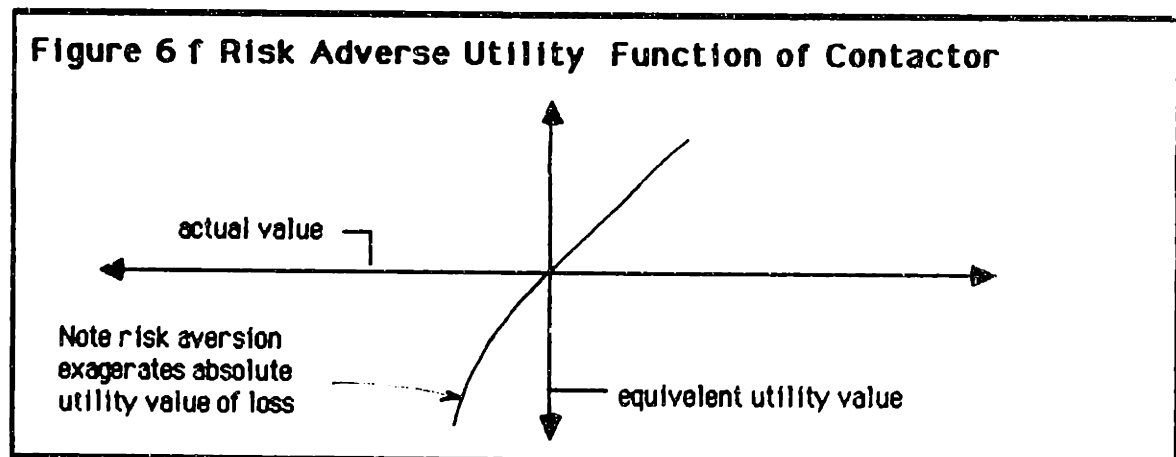


Assume the owner of this project is very large and the project represents only a small fraction of his/her

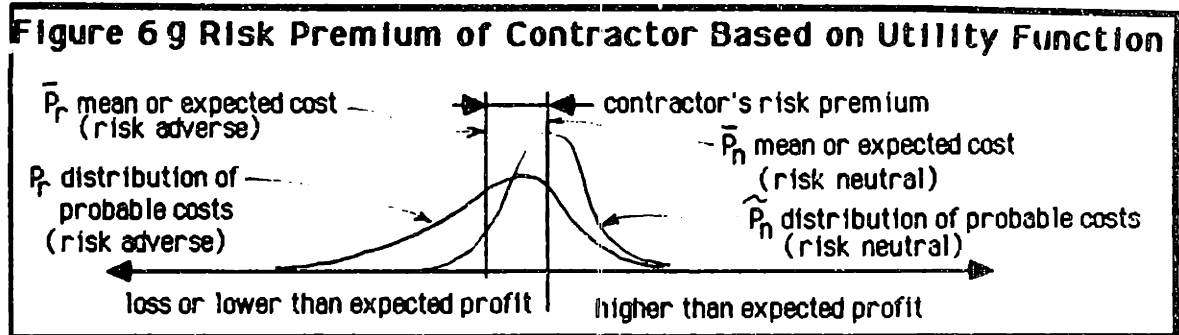
financial activity and is fairly risk neutral with respect to the project, ie. actual value and equivalent utility to the owner have a linear relationship shown in figure 6e.



Assume the contractor, in contrast, is smaller and the project represents most of his/her financial activity. If costs are higher than expected the contractor stands to lose money which may bankrupt him/her. This makes the contractor more risk averse than the owner. His/her utility function is suggested by figure 6f.



If the contractor's equivalent utility values are substituted for the actual monetary values in the project cost probability distribution shown in figure 6d, the distribution becomes skewed in proportion to the contractor's risk aversion. The mean or expected value of the project based on the new cost distribution also shifts. This shift between the two means corresponds to the contractor's risk premium shown in figure 6g.



In this example, all other things being equal, the owner would be able to realize savings if the contract, and especially the pricing, were structured in such a way as to make the owner bear most of the cost risk, since the owner is less risk averse and realises a lower risk premium.

Internal risks deriving from uncertainty between actors can be minimized by structuring incentives for cooperation and good performance by each actor. From the owner's point of view this means a pricing structure which rewards the contractor or CM for time and cost saving. It also means a mechanism for assuring quality. The prospect of repeat work for good performance is also a powerful incentive. To make it real, however, the owner must be in a position to

evaluate past performance and use it as selection criteria in future projects. This is common in the private sector, but many public sector owner's cannot or do not exercise this incentive.

From the contractor's perspective, pricing and other contract provisions can also provide an incentive for the owner and designer to be responsive and reasonable. Shared savings and value engineering clauses which give the owner a stake in cost savings are examples of these.

Perhaps more important than pricing is structuring of decision-making authority and responsibility. Whenever there is a mis-match of responsibility and authority, the actor which must accept responsibility for certain outcomes while another actor has the authority to affect those outcomes, the first actor must necessarily view the situation in terms of risk and apply corresponding risk premiums. The basic principle, then, is to make authority and responsibility coincide. This is particularly critical with CM where authority and responsibility between owner and CM can easily become muddled. Owner review of submittals, or design work in the case of design-build, is another potential source of non-cooperation and unnecessary contractor risk premiums.

6.5 Procurement Method Decision Tools

The procurement method decision model presented above can be

conceptualized and summarized with the aid of several tools which are presented in this section. A general algorithm shown in figure 6h describes the basic decision making sequence. A matrix form based on this algorithm is then presented. Finally, some simplified typical decision trees are given.

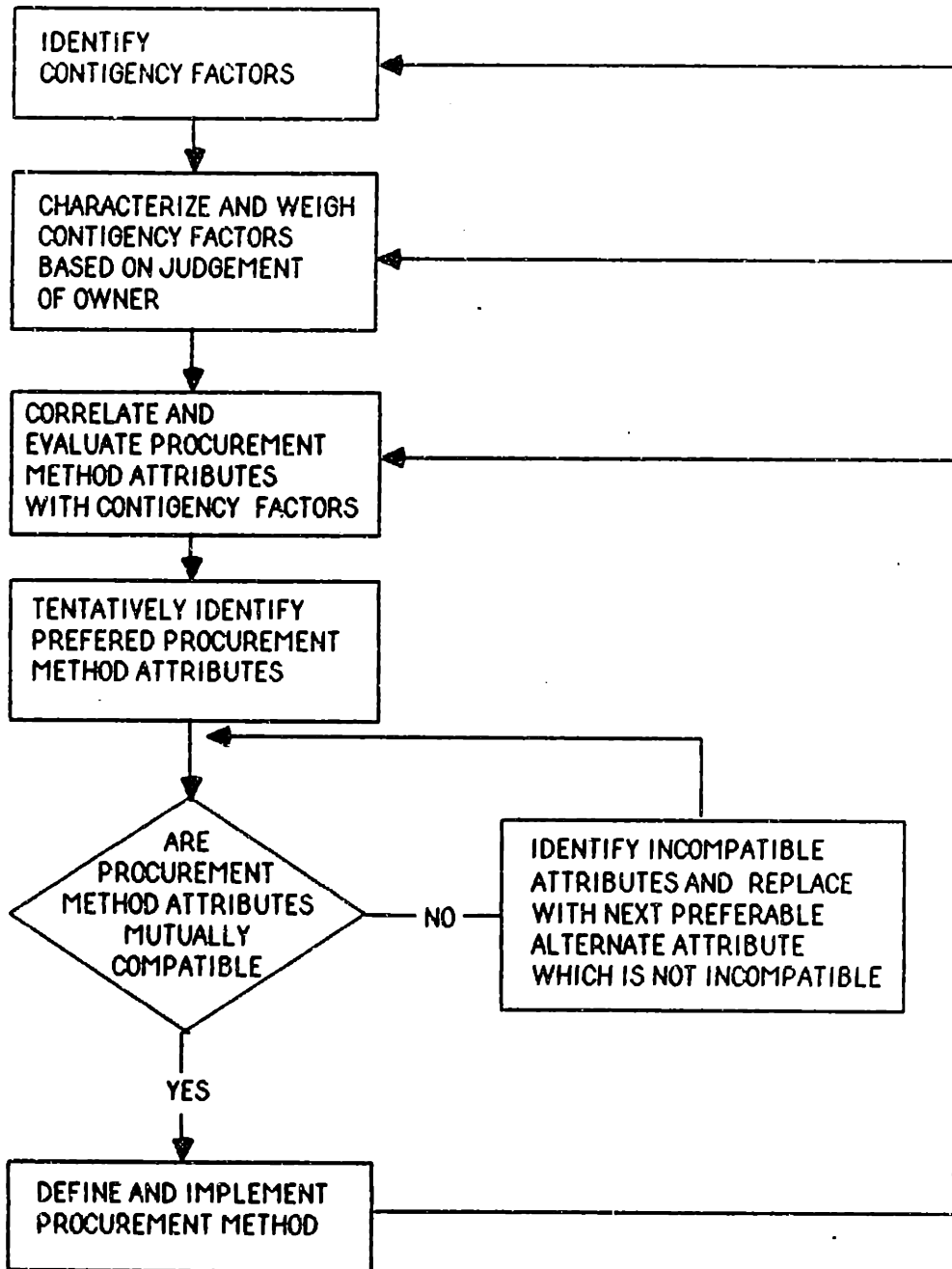
6.5.1 Decision Matrix

The decision matrix in figure 6i, is based on the above algorithm. Positive or negative correlations are indicated in the intersection cells between contingency factors and attributes and between attributes. The matrix may be used to identify preferred procurement method attributes based on these correlations and weight factors assigned to the contingency factors.

6.5.2 Decision Trees

Figures 6j, k, l and m illustrate several typical decision trees based on the model. These trees may be particularly useful in identifying potential combinations of constraints which result in "empty sets" of no acceptable procurement method which requires project abandonment or redefinition of contingency factors.

Figure 6 h A General Procurement Method Decision Algorithm



Instructions

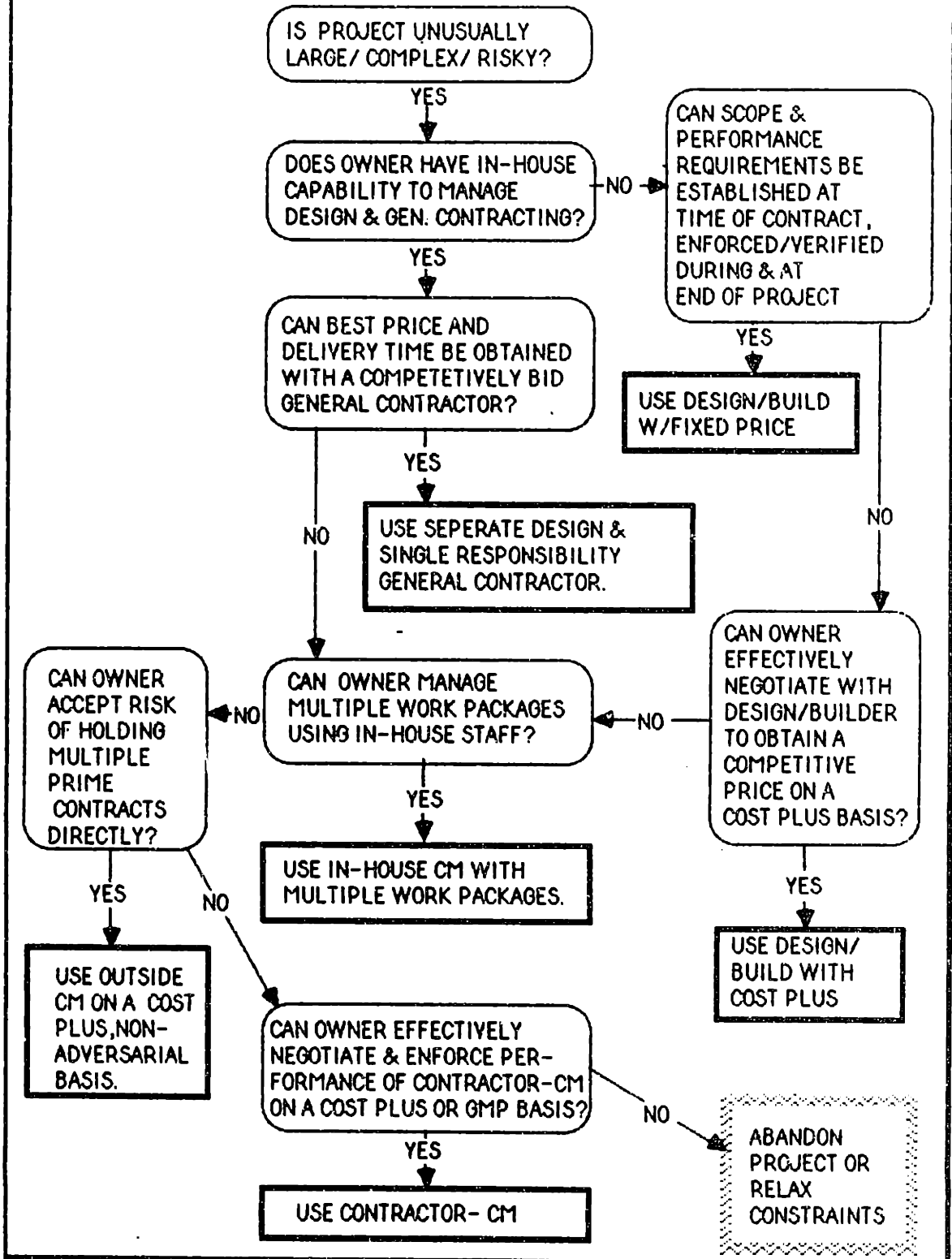
- 1 Select contingency factors which apply to project.
- 2 Weigh contingency factors in terms of relative importance.
- 3 Compare each contingency factor with procurement method attributes as indicated on the left matrix.
- 4 Score each attribute according to correlation with weighted contingency factors. Example: Score design-build given:
- 5 Tentatively select attribute in each category with highest score.
- 6 Compare attributes on right matrix for incompatibility, denoted "X". If incompatibility detected, select alternate attribute(s) to eliminate incompatibilities while optimizing total score of all attributes.

	weight	correlation	score
Early Delivery	5	0	5
Complex Project	2	x	-2
Tight Budget	3	0	3
Sophisticated, limited mgmt	2	0	2
Type II Owner	4	0	4
Total Score	—————▶		12

Procurement Method Attributes		Score	Rank	Compatible	Selection
Normal Sequential Design/ Bid/ Build Schedule	scheduling				
Accelerated Design &/or Construction					X
Fast-Track					X
Pre-Engineering	work packaging				
Single Responsibility Contract					X
Early Work Packages w/ Transfer					X
Multiple Work Packages	systems applications				
Use Existing System					X
Develop New Building System					X
Use Open Systems or Conventional Technology	generic procure-ment method				
Traditional Method					X
Design-CM					X
Construction-CM (CM w/GMP)	contract award				
Design-Build					X
Systems					X
Bid Competitively*	pricing/risk allocation				
Negotiate*					X
Fixed or Unit Price*					X
Shared Savings*					
Cost Plus*					

** For overall project, not necessarily separate work packages*

Figure 6j Decision Tree for Large/Complex/Risky Project



**Figure 6k Decision Tree for Early Delivery/
CM/ Design-Build**

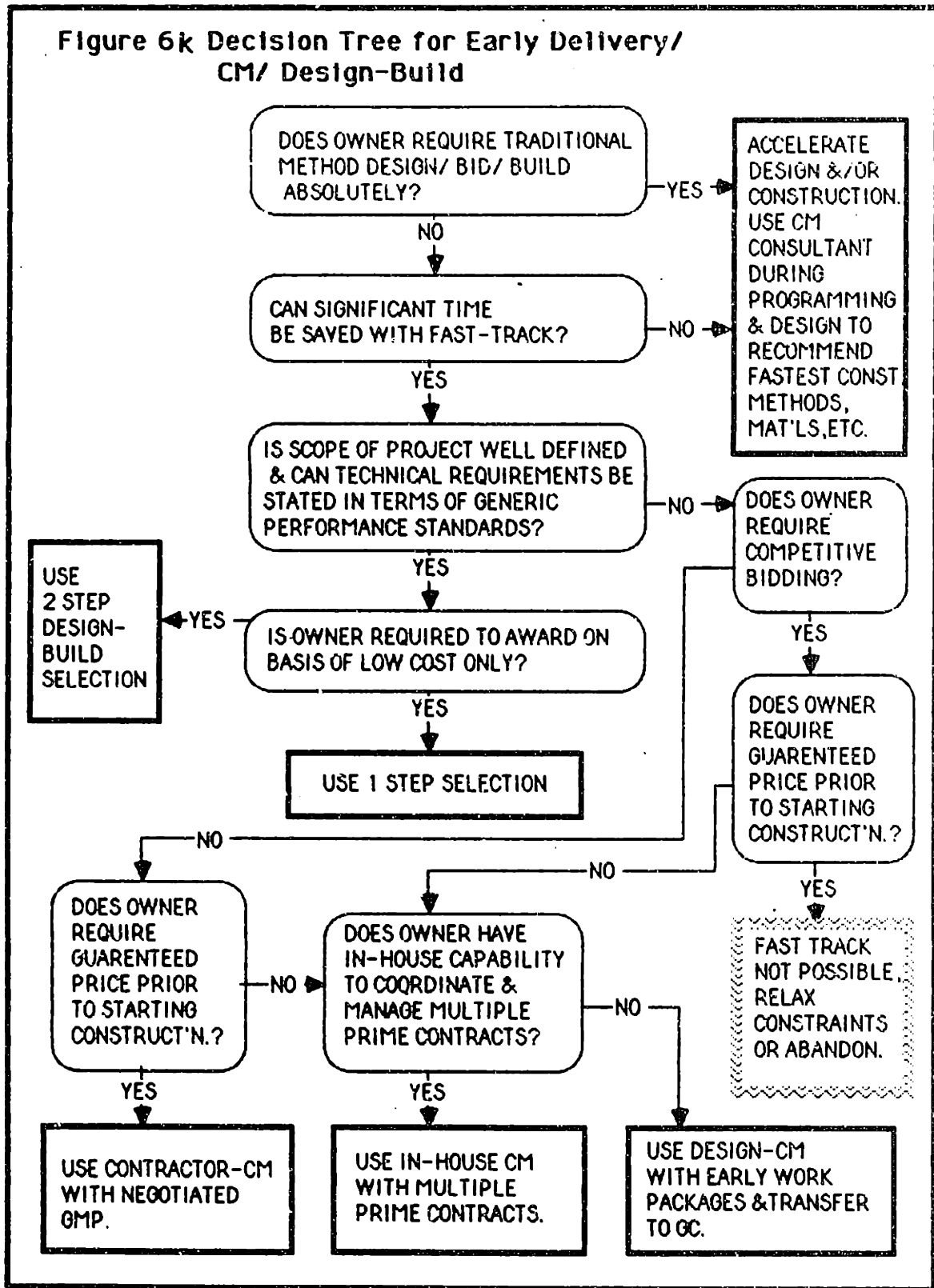


Figure 61. Decision Tree for Using Existing Building Systems

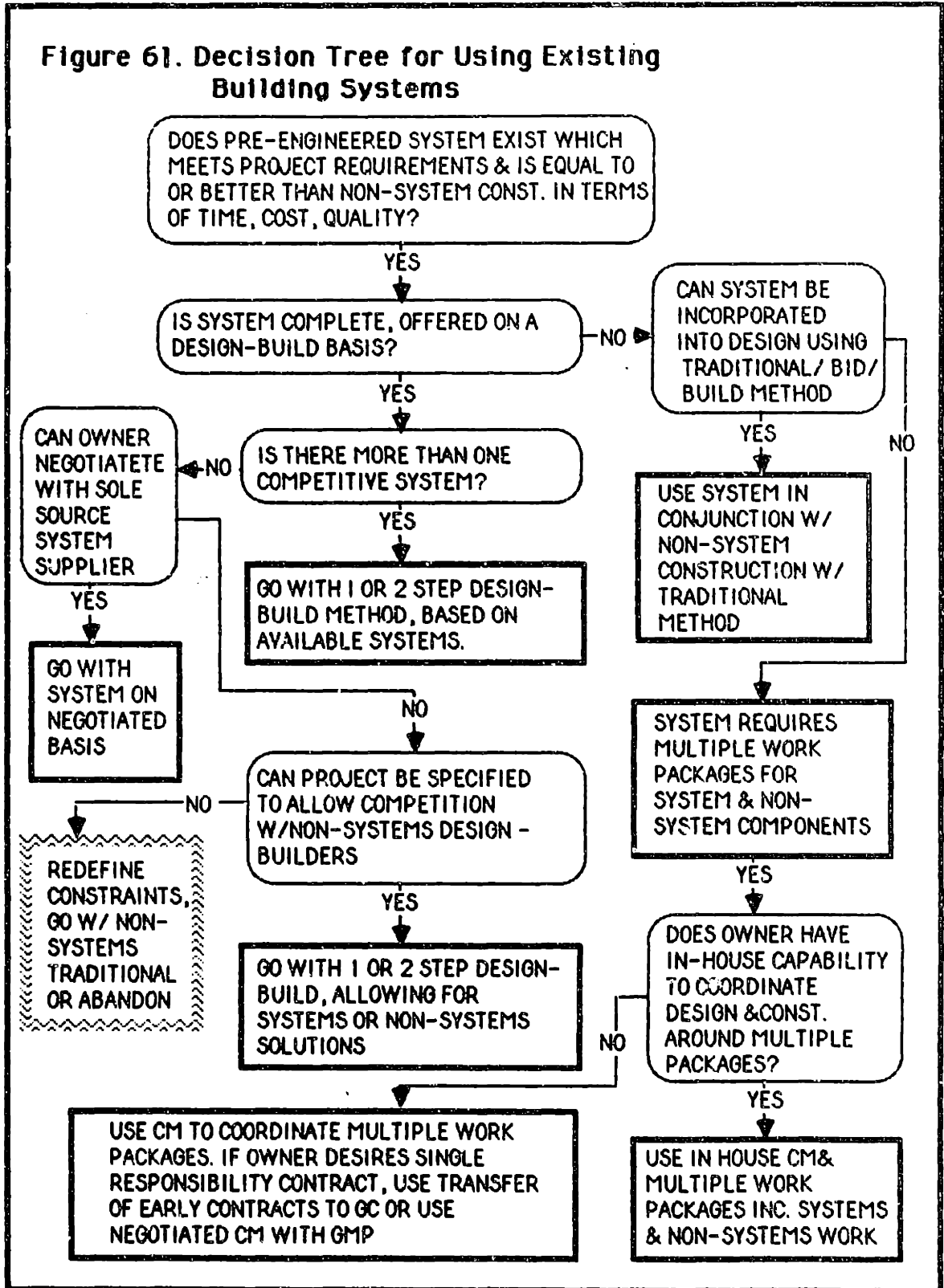
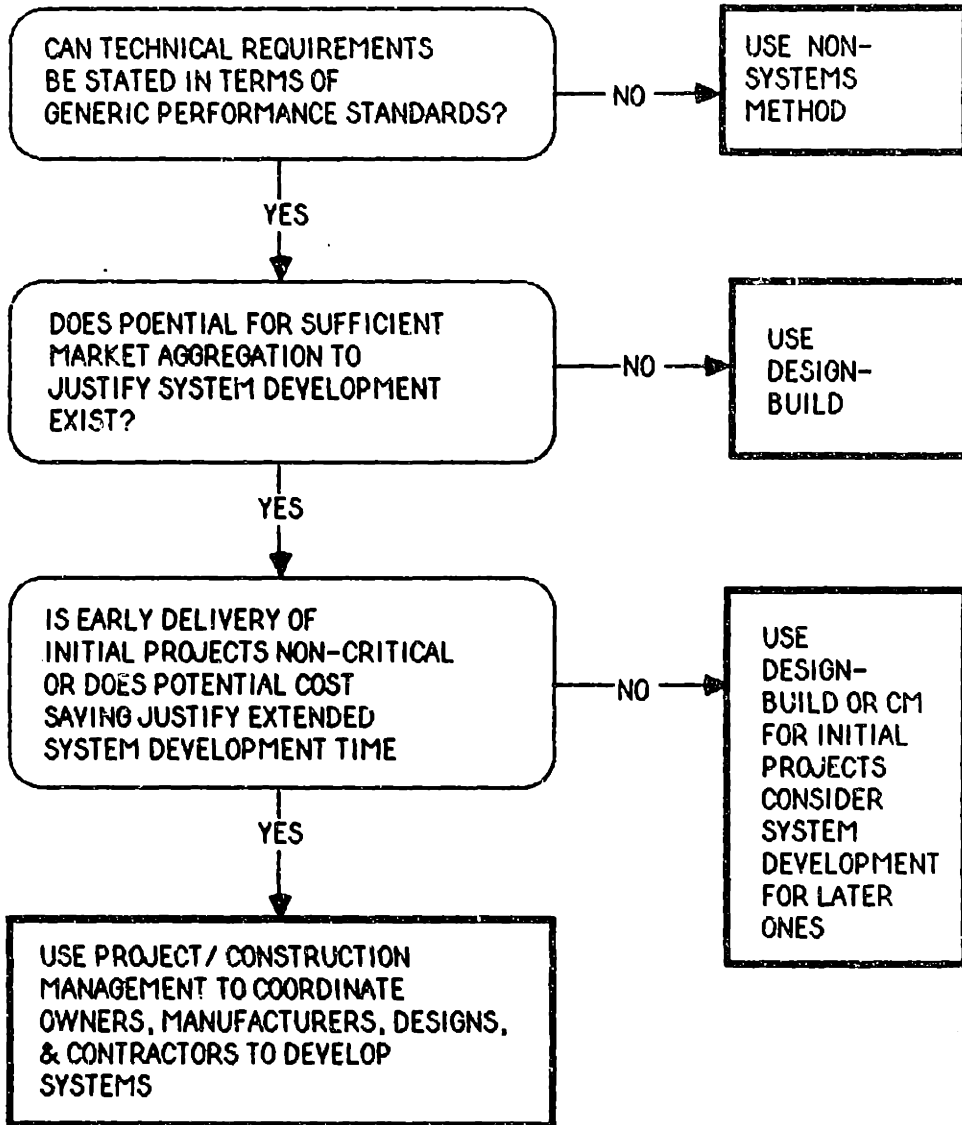


Figure 6m Decision Tree for Developing New System



CHAPTER 7.0

DESIGN-BUILD IN DETAIL

This chapter will describe the design-build method in detail; first, the basic roles and relationships between actors during each phase of the process; second, historical development and applications of design-build; and third, the critical issues surrounding design-build.

7.1 Organizational Analysis by Phase

In order to understand the critical issues surrounding design-build it is useful to examine the organizational relationships between actors during each phase of the process. This section will discuss these relationships in terms of roles and responsibilities of the major actors during the basic phases of a typical, non-specific design-build project.

In addition to the owner, designer and builder, a fourth major actor, the consultant, is usually involved in one or more phases of the project. This consultant may be part of the owner's in-house staff or an independent design professional. The need for such a consultant arises from the change in the designer's role from the owner's professional advisor to a member of the builder's team which is inherently a contractual adversary of the owner. Unless the owner has the technical capability to fully define project requirements and assure that they are met during all phases of design and

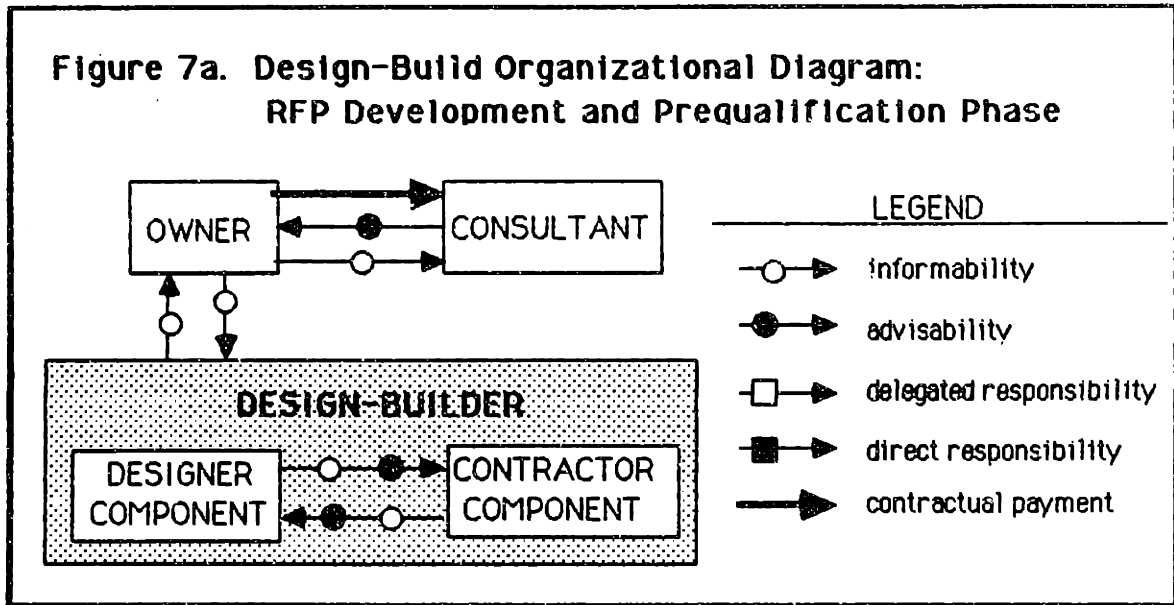
construction, he must bring in a consultant to fill this role.

7.1.1 Pre-Qualification/Request for Proposal Phase

In this phase the owner's requirements are developed into a program and set of design and performance criteria by the consultant. These technical guidelines are usually more detailed and comprehensive than a normal pre-design program and often include conceptual plans and construction specifications. The technical guidelines along with various non-technical general conditions and requirements form the basis of the request for proposal (RFP). Ideally, the RFP should be written in such a way that allows maximum latitude for alternate design solutions within the constraints and requirements of the owner. This is a critical issue in design-build and will be discussed in detail later in this chapter.

While the RFP is being developed the owner usually goes through a process of pre-qualifying design-build teams. Pre-qualification is usually made on the basis of past experience, resources and management plan. Pre-qualification helps ensure that the team(s) asked to submit proposals have the capability to perform the work required, and limits unnecessary redundancy in the proposal development and review phase.

**Figure 7a. Design-Build Organizational Diagram:
RFP Development and Prequalification Phase**



*** Actor Relationship Matrix--RFP and Prequalification**

(see note)	OWNER	CONSULTANT	DESIGNER	BUILDER
OWNER		*provides info. on user needs, etc.		*issues request for qualifications *assesses qualification *conducts interviews *prequalifies team(s)
CONSULTANT	*develops program, technical request for proposal			
DESIGNER	*submit qualifications			*if designer and builder are separate firms, negotiate terms of relationship *develop strategy
BUILDER				*prepare qualification statement

(Note: read matrix horizontally for actions of each actor. Vertical columns indicate actor which actions are directed to, eg. OWNER provides info. on user needs to CONSULTANT)

7.1.2 Proposal Phase

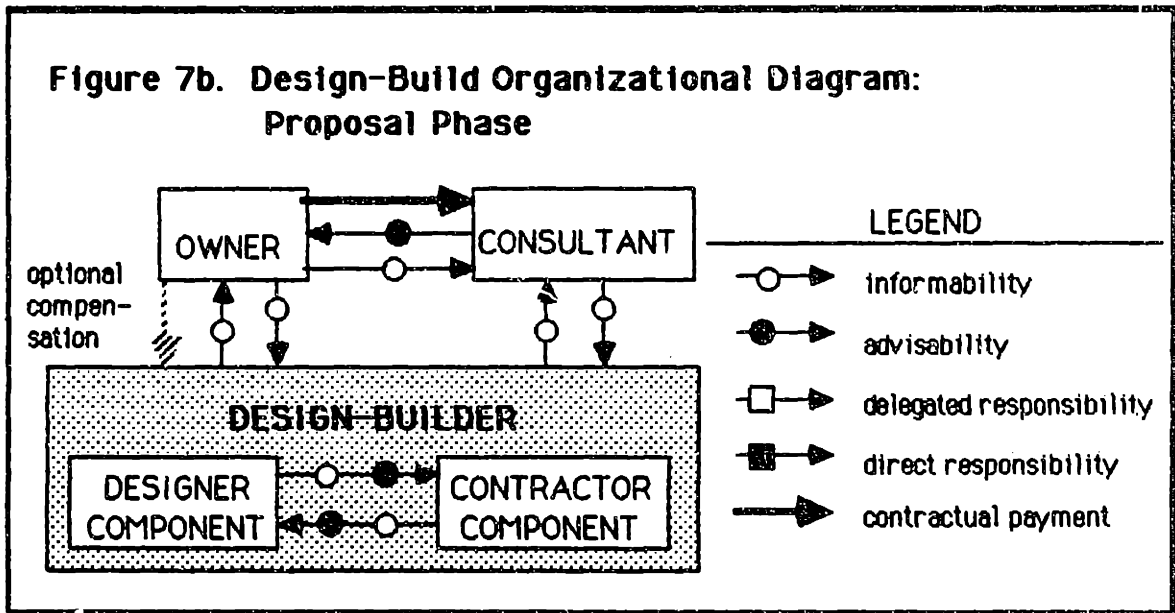
The pre-qualified team(s) develop a proposal based on the RFP. Proposal requirements may vary, but typically they will include plans and specifications at a level of detail corresponding to schematic or early design development documents plus supporting engineering data, soils analysis, etc. and a price. If project financing, provision of a site and/or post-occupancy maintenance of the project is required in the RFP, these will also be documented in the proposal. Often, a management and implementation plan will also be included in the proposal.

In many cases, design-build teams will incur considerable expense in proposal development, typically of the order of one half to one percent of total project cost (Haviland, 1976). In some cases the owner provides some compensation to unsuccessful teams, but often proposers bear the entire cost (and risk) for an unsuccessful proposal. This potentially creates certain practical and ethical problems for designers.

Proposal(s) are then reviewed by the owner, often with the assistance of the consultant. The review must verify that proposal(s) comply with the requirements of the RFP. If multiple proposals are received they must be evaluated and ranked. Various evaluation and selection methods will be discussed in the next chapter.

There may be a certain amount of negotiation with the

**Figure 7b. Design-Build Organizational Diagram:
Proposal Phase**



*** Actor Relationship Matrix--Proposal Phase**

	OWNER	CONSULTANT	DESIGNER	BUILDER
OWNER			*issues RFP, conducts pre-proposal conference *reviews proposal(s) *selects and/or negotiates design/build contract	
CONSULTANT	*provides technical advice on proposal(s) to owner		*technical review and evaluation of proposals *requests technical modifications of proposals	
DESIGNER	*submit design and cost proposal *negotiate design/build contract	*provide technical clarification *provide technical modifications as necessary		*develops and revises design proposal
BUILDER			*value engineering & cost estimate for proposal	

one or more design-builder prior to executing a contract. These negotiations may adjust details of cost, time and/or quality. The final contract is then usually based on a fixed or guaranteed maximum price for the final proposal, although in some cases the final price is not fixed until later in design. Various cost-plus arrangements may also be used.

7.1.3 Design Phase

In some cases, particularly turnkey projects where financing and/or land is provided by the design-builder, a separate contract will be issued for design only, with a follow-on construction and sale contract contingent on development of an acceptable set of detailed working documents (GSA/PBS 1970).

More typically, a single contract is made for design and construction and the two phases are overlapped, ie. fast-tracked. Indeed, a major advantage of design-build is the ability to fast-track under a single responsibility, competitive, guaranteed price contract.

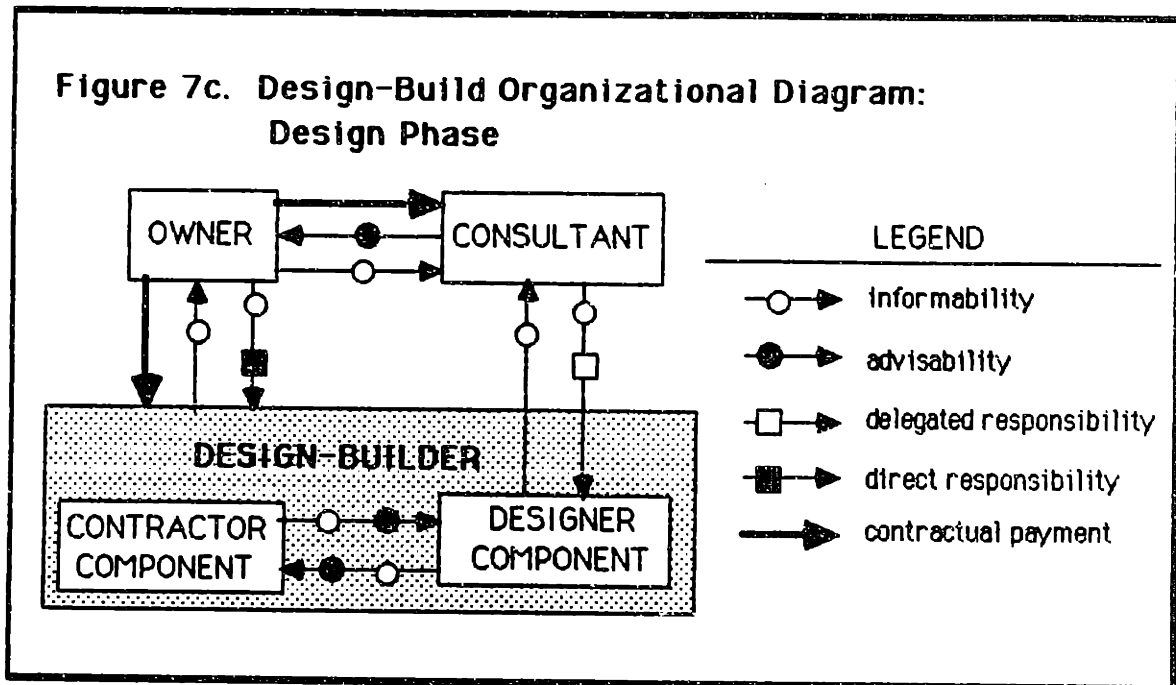
During the design phase, the proposal is elaborated into full design development and then working documents. The key issue here is interpretation of the proposal. To the extent that the quality (and/or scope) of work is not fully defined in the RFP or proposal, there is the potential for disputes during design.

Aside from actual disputes, even scope/quality changes which

are recognized by both owner and design-builder are difficult to administer since they must be negotiated, rather than subject to competitive bidding. This puts the owner at an inherent disadvantage, particularly if he/she is not in a strong negotiating position to begin with. This is not unique to design-build, per-se, since design or scope changes may also occur after bidding under other methods. However, because competition occurs at a much earlier point in the design process and a fixed price contract is often made when the level of design definition is quite low, potential for changes is greater. In order to avoid extensive negotiated contract changes, the owner must be prepared to accept the design-build proposal as a complete package and often must forgo modifications which would otherwise be desirable. This is one of the main areas in which the owner gives up control under the design-build method.

The consultant may provide some quality assurance for the owner by reviewing and approving detail design documents. The design-builder's own integrity and interest in maintaining a good reputation is the primary assurance of quality. Again, this represents a potential loss of control by the owner.

**Figure 7c. Design-Build Organizational Diagram:
Design Phase**



*** Relationship Matrix--Design Phase**

	OWNER	CONSULTANT	DESIGNER	BUILDER
OWNER			*reviews and approves detailed design *negotiates design changes *issues progress payments	
CONSULTANT	*advises owner on technical compliance & changes		*reviews design to ensure compliance with RFP and proposal	
DESIGNER	*submits design development & constr. documents	*provides technical clarification and design revision as necessary		*develops design & working documents
BUILDER	*negotiates design changes *pre-purchasing *mobilize		*value engineering *scheduling *negotiates sub-contract	

7.4.1 Construction and Post Occupancy Phase

During construction the designer and contractor will carry out functions along traditional lines. But owing to the designer's relationship to the owner and contractor he/she is limited in the quality assurance role which a designer would play under other methods. Again, the owner may rely on a consultant to provide independent technical quality assurance.

The "up side" to design-build during construction, in terms of risk, is the fact that the owner is not exposed to liability for delays or cost increases for design errors and omissions. Because of the single responsibility for design and construction, the contractor cannot claim extra compensation for such errors as he/she would under the traditional, and, to an extent, CM methods.

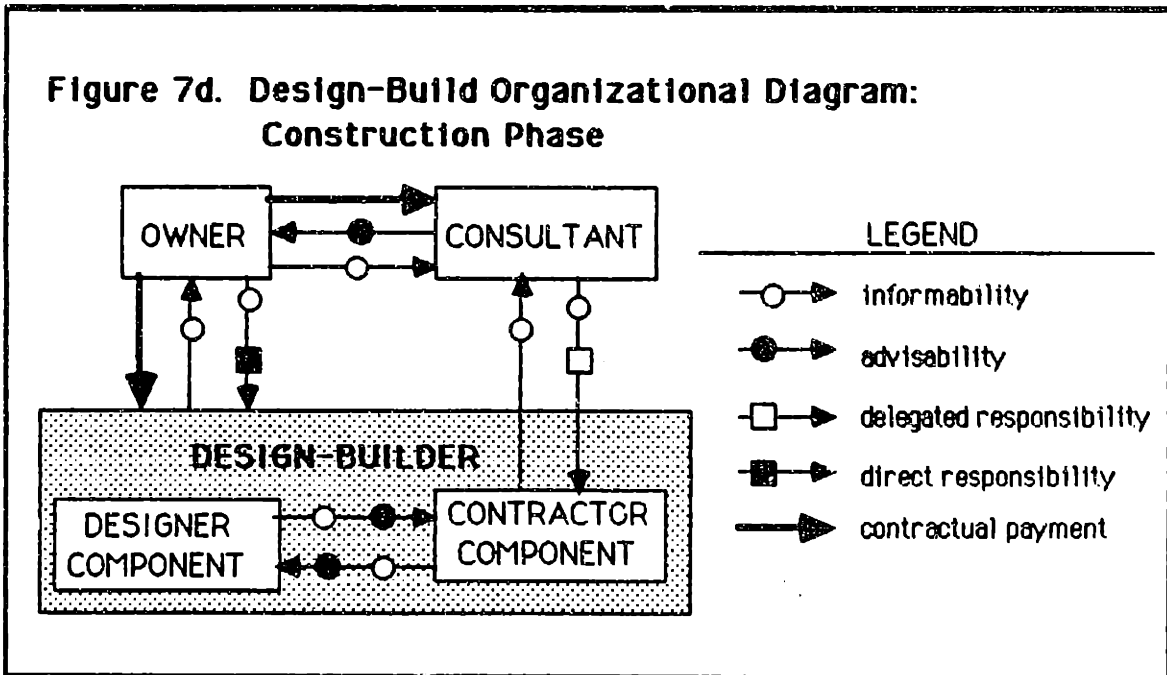
The design-builder must fully bear the risks of design errors and omissions. But because the designer and contractor are highly integrated under design-build, uncertainty stemming from the interdependence of the designer and contractor is reduced. This, in turn, reduces much of the risk of design errors and omissions as well as the related risk of contractor misinterpreting plans, estimating errors etc.. The design-builder has a strong advantage in terms of knowledge and information about the project, knowing the project "inside and out" on both a design and

construction level. This often makes it possible to minimize the time/cost/quality impacts of any design errors if they occur.

On industrial projects such as plants and refineries, the design-build contract usually includes start-up and "run-in" (Greenfield, 1982). Proper performance of all equipment is verified and the design-builder must correct any sub-standard operating performance.

Various post-occupancy contractual arrangements may be provided, depending on the project. At a minimum a one year general warranty is provided. In many cases, however, the design-builder may be asked to provide some sort of maintenance service. In the case of turnkey financing with a leaseback, the design-builder actually retains title to the facility. Such arrangements further extend the single responsibility concept of design-build and also provide a direct incentive for the design-builder to optimize total lifecycle costs.

**Figure 7d. Design-Build Organizational Diagram:
Construction Phase**



*** Actor Relationship Matrix--Construction and Post Occupancy**

	OWNER	CONSULTANT	DESIGNER	BUILDER
OWNER			*monitors progress *approves and issues progress payments *negotiates change orders *coordinates occupancy	
CONSULTANT	*advises owner on technical compliance & changes		*assures quality and compliance with working documents	
DESIGNER	*provides construction submittals if necessary *provides general conditions *performs construction with own forces			*reviews & approves construction submittals
BUILDER	*manages sub-contractors *performs time, quality and cost control *coordinates closeout *provides warranty		*prepares construc- tion submittals	

7.2 Historical Development and Applications of Design-Build

The Austin Company, Cleveland, Ohio is often mentioned as the first modern design-build firm. Austin's first design-build project was a lamp factory built in 1913. Through this and subsequent jobs, the firm developed a vertically integrated approach to design and construction of industrial and manufacturing facilities which became a model adopted by other firms. Design-build or design-construct (the latter term connoting large scale, industrial work) accounted for nearly half the total volume of construction in the US in 1985 and over half the total engineering work (ENR 4/15/86).

The petrochemical, power and other industries have traditionally used design-build for refineries and plants. In many cases, the projects are based on a proprietary process or technology which can only be provided by a single firm. As noted in chapter 6.0, however, in more recent years there seems to be a trend away from design-build on some particularly large projects apparently due to increased risk and the inability to effectively manage it under a single responsibility contract.

Transportation projects, including mass transit systems and bridges, have been successfully done using design-build. In these cases the motivation was largely based on allowing alternate proprietary technologies to compete eg. segmental concrete bridge systems, light rail systems, etc..

Internationally, in Latin America and certain European

countries, design-build has been used extensively. The reason for this appears to be due, in part, to differing institutional environments. Design professions have not been as well established and distinct from construction in these countries. It also appears that institutional mechanisms for administering design-build projects and providing both positive and negative incentives for design-builders to maintain quality and cooperative behavior are better established and recognized in these countries (Greenfield, 1982).

Although in the US design-build has been primarily used in the private sector, over the last fifteen years a number of public agencies have begun to use it. Housing has been the primary application although office buildings and even sewer treatment plants have also been built under design-build. The experience and unique problems of adapting design-build to the public sector is the major focus of this thesis and will be covered in detail in the remaining chapters .

7.3 Critical Issues Surrounding Design-Build

7.3.1 Owner Control

Because of the "package deal" involved in design-build, the owner gives up a substantial amount of control over the design and construction process as compared with other procurement methods. The RFP and proposal which form the basis for contract usually contain fairly limited levels of detail and

definition of the project. The owner may attempt to make changes and monitor quality after the contract is signed, but he/she is in an inherently weak position to do so, even with the help of a knowledgeable staff or consultant. Excessive, adversarial involvement in the project by the owner or consultant is also liable to diminish the primary advantage of design-build, namely the integration of the designer and contractor.

The primary assurance that the owner gets what he/she wants and pays for is effective project definition despite lack of detail prior to contract award and on the integrity and reputation of the design-builder. Industrial and transportation projects, especially those involving proprietary technology, lend themselves to design-build because they can be defined in terms of measurable performance---eg. 100 megawatt, coal fired, 35% thermal efficiency, etc. and because the project and technology involved is directly associated with a single, reputable firm. Housing, small commercial projects, warehouses, etc. can also meet this requirement, mainly because they are technically simple and can be described in terms of well established standards and performance criteria. Almost any type of project can, at least in theory, be procured using design-build, particularly if the owner is in a good position to negotiate changes as the design is being developed. However, in practice, certain projects do not lend themselves well to design-build. Examples of such

projects would include projects where a high degree of artistic design expression and symbolic importance is involved, such as important churches, public institutions and the like.

7.3.2 Defining Project Requirements

There is an inherent conflict in writing an RFP between specificity and detail on one hand, and sufficient latitude for design creativity and value-engineering on the other. An RFP which is overly specific may unnecessarily constrain proposals and limit innovations which could save time and cost or improve quality. An RFP which is too loose may not adequately convey all of the owner's requirements and be subject to misinterpretation.

Theoretically, the way to solve this problem is with performance specifications, ie. specifying building attributes and components not in terms of prescriptive materials and methods of construction, but in terms of desired end performance such as strength, durability, sound and thermal resistance, etc.. However performance specification is not always feasible if the attribute in question cannot be easily tested and measured. Any sort of special, esthetic quality would fall into this category. Long term durability is often difficult to measure, especially for a new, unproven material or system. In addition, performance requirements which are not based on

established standards and tests will need special prototype testing to verify which is expensive and time consuming.

7.3.3 Proposal Development

If only one proposal is solicited, ie. the owner negotiates with a single source, the cost of proposal development or preliminary design is no more than it would be under any other method . No premium is paid for developing a highly detailed proposal as long as the owner negotiates in good faith with a commitment to build. However, if multiple proposals are involved in a competitive selection process there is a complex trade-off associated with the number of proposals, the degree of proposal documentation and detail and the risk associated with price.

Unsuccessful proposals amount to wasted design and preconstruction planning effort. If the owner chooses to reimburse the proposers, he/she bears this cost directly. If the owner does not fully reimburse this cost then the proposer must absorb it as part of general marketing overhead. From the design-builder's point of view, there may still be value in making a proposal even if no compensation is given. This value can be modeled as the risk/decision tree below in figure 7e. (after Raiffa, 19)

Figure 7e Risk Decision Analysis for Making Proposal

$$\begin{aligned} \text{probability} &= \frac{\text{--proposal successful, win contract,}}{\text{(1/\# of proposals) / assume profit=.05 * contract value}} \\ & \quad / \quad \text{(including cost of proposal)} \\ \text{make proposal} & \text{----} \\ & \quad \backslash \\ \text{probability} &= (1 - \text{--proposal unsuccessful, cost of proposal=} \\ & \quad \text{1/\# of proposals) .01 * contract value - proposal honorarium} \end{aligned}$$

Assuming the profit and proposal costs indicated and little or no honorarium, the option of making a proposal would still have net positive value as long as there are less than five proposals, ie. (probability of winning contract * value of profit on contract) > (probability of unsuccessful proposal * cost of proposal). It should be noted that this analysis also assumes a linear, risk neutral utility function for the proposer. Risk aversity, perception of competition and value of honorarium all could alter the net equivalent value of making a proposal.

Some have argued that lack of full compensation for proposals will not affect contract price because the cost of proposals is regarded as a necessary part of marketing overhead and not specifically allocated on an individual job basis by the design-builder (Poody, 1986). Others have argued that this expense will inevitably be passed back to the owner in the form of increased bid mark-ups, if not initially, at least over the long run (IF/OP2,1976). The true situation would seem largely dependent on market conditions, ie. how "hungry" design-builders are and the extent to which the market is closed among a limited set of

owners and design-builders.

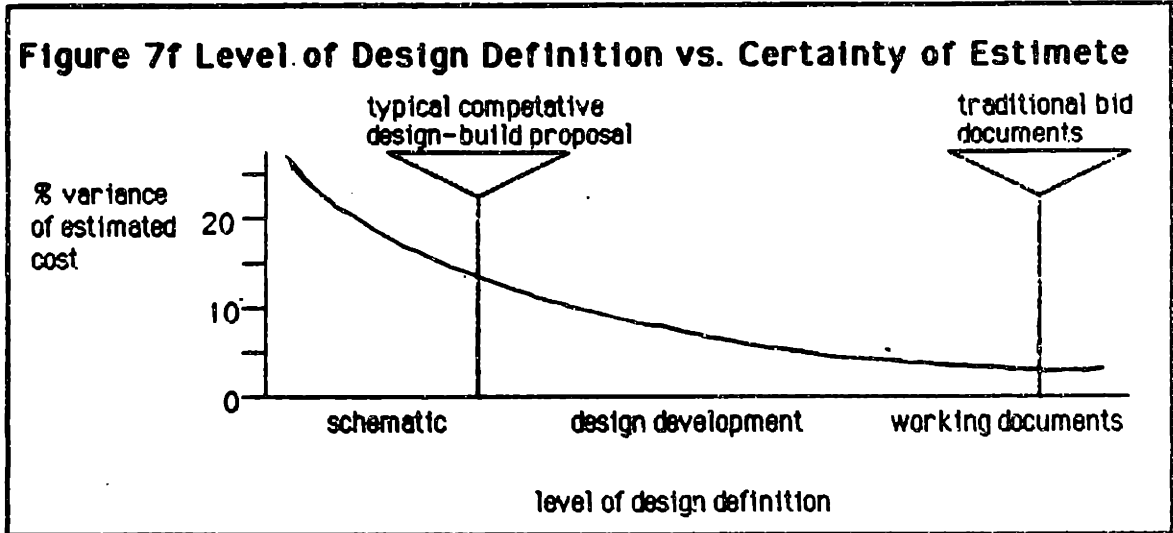
Wasted design effort stemming from unsuccessful proposals can be minimized by reducing the number of proposals requested or by reducing the level of documentation and detail required in the proposals. If the number of proposals is reduced, competition will be lower, resulting in a corresponding increase in price (De Neufville, 1982). However some design-builders may be reluctant to make a proposal if they feel their chances of winning are too slim (Ball, 1986). The cost of proposal review and evaluation is also reduced.

Reducing documentation requirements and detail increases the uncertainty of cost and quality. Assuming a fixed or guaranteed price contract is made on the basis of the proposal, the design-builder will perceive this risk in terms of cost and increase his/her risk premium (sometimes called contingency mark-up) to the bid price. The design builder may choose to develop a proposal in more detail than required in the RFP in order to reduce price risk, but often this is not practical within the proposal time constraints.

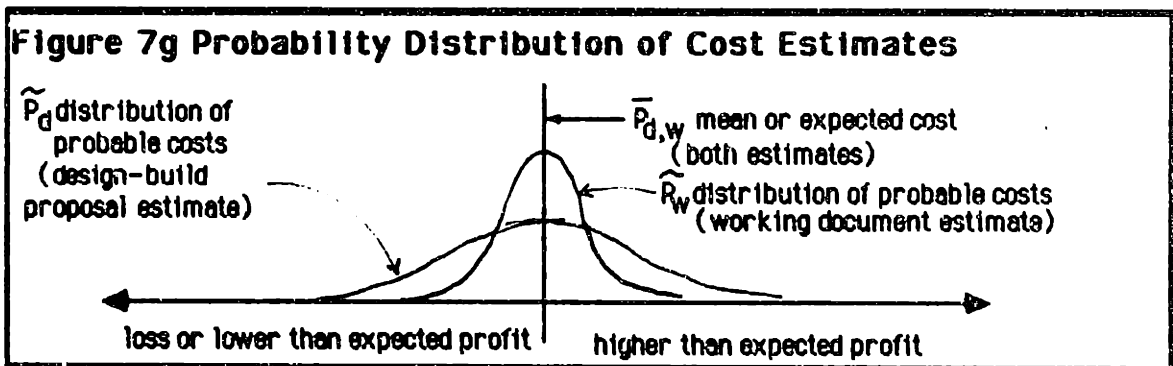
This risk premium may be illustrated by the following example:

Assume that the accuracy of a cost estimate for a given project is a function of the degree of design definition. This may be expressed in terms of variance

or standard deviation of an estimate versus the level of design definition as illustrated in figure 7f (After Halpin, 1983). (Note that this assumes essentially a normal distribution of costs. Some evidence suggests that this is not always true.)



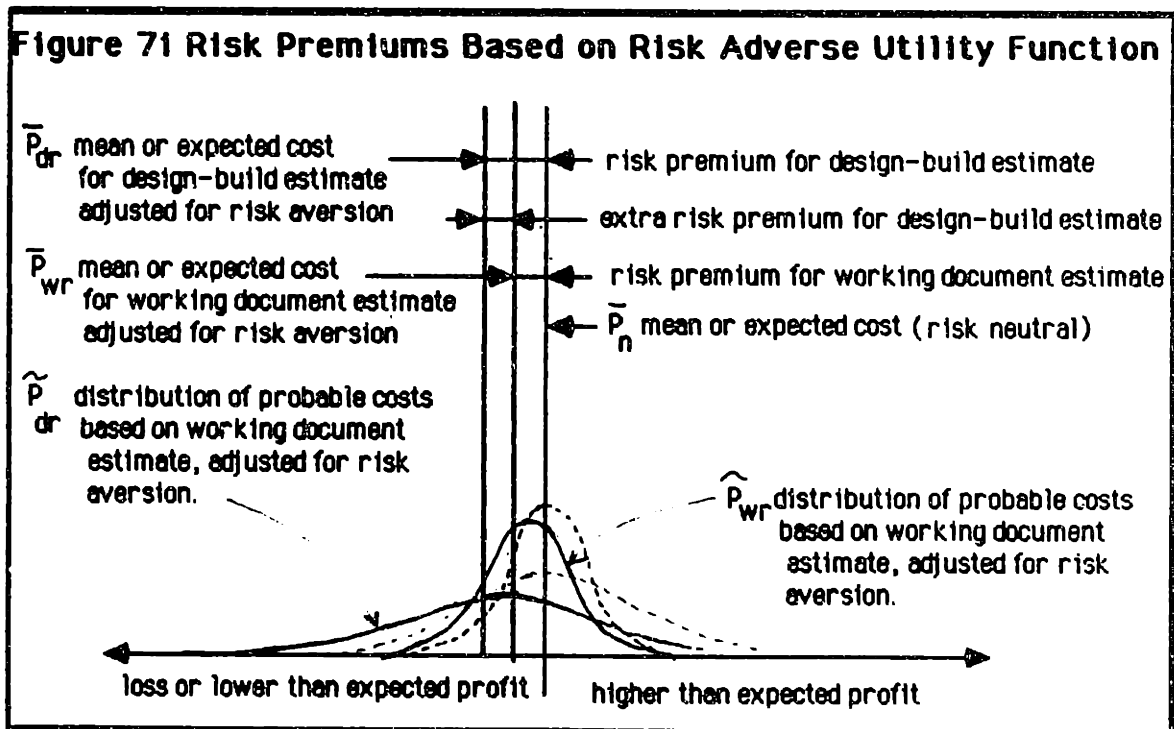
The probability distributions of two cost estimates, one made after preliminary design, corresponding to the level of definition of a typical design-build proposal; the other based on complete working documents corresponding to typical bid documents under the traditional method are indicated in figure 7g. Note that the mean cost of the project is the same, only the variance changes.



If the contractor is perfectly risk neutral, his/her

bid on the project based on either estimate would be the same. However, assume that the contractor is somewhat risk averse and has a utility function as shown in figure 6e.

If the equivalent utility values based on the above utility function are substituted for the actual costs indicated in figure 7g, the revised probability distributions for the two estimates are skewed. Moreover, the earlier estimate with a higher variance is skewed more. The mean, or expected value of the project also shifts for both estimates, but it shifts more for earlier one, thus giving the earlier estimate a higher risk premium.



The owner will perceive the risk of a less defined proposal in terms of potentially sub-standard quality or additional

contract changes. He/she may try to compensate for this by stating project requirements in more prescriptive detail in the RFP. This, however, limits the designer's ability for innovation and value engineering as mentioned above. At a certain point, an RFP can become so detailed and prescriptive that it approaches a traditional set of bid documents and the benefit of design-build is lost.

If proposals can be developed relatively cheaply by using standard "stock" solutions, the trade-offs described above become less critical and it is likely that a satisfactory compromise between openness of the RFP, detail of proposals and number of proposers can be achieved. However, as a project becomes more complex, involving special, non-standard solutions, proposal costs and risks increase and design-build, at least using competitive proposals becomes less feasible.

7.3.4 Proposal Review, Evaluation and Selection

Many of the same problems and trade-offs associated with proposal development also apply to review, evaluation and selection. Under the traditional method where scope, quality and time are fully defined and fixed, selection on the basis of low bid is fairly straightforward. With design-build, quality and time may vary between proposals.

To get the best proposals possible, the owner must be able to articulate not only requirements, but the relative values

and weights he/she will put on them. Otherwise, the design-builder will be forced to second-guess the owner and may make sub-optimal trade-offs in the proposal. Yet, for most owners, this process of evaluating and weighing requirements is done during the design process as alternatives are reviewed and discussed. To do this effectively before an actual design is produced requires considerable imagination and forethought which many owners lack. For public sector owners the problem is further complicated by the need for accountability, an issue which will be covered more fully in later chapters.

The review and evaluation process for design-build proposals can be complex and exhaustive. It is not uncommon for a team of a dozen architects, engineers and other specialists to spend three or four days reviewing a single proposal for a \$10 million housing project. Often the process involves several proposal revision and resubmission iterations (,1986). Again, the time and administrative cost of this process increases with the number of proposals, complexity and degree of non-standardization of the project.

7.3.5 Detail Design and Construction

One of the biggest risks and potential sources of failure in the design-build process is disputes during detail design over interpretation of the RFP and proposal. Since price and time are usually fixed in the contract, the only way a

design-builder can control cost overruns (or compensate for estimating errors) is by increasing efficiency, reducing profit or reducing quality.

Since it is often not possible to increase efficiency, and highly undesirable to decrease profit, the design-builder is likely to look towards opportunities for reducing quality wherever possible. This is not inherent in design-build and is a potential problem with any fixed price contract. But in design-build there may often be more opportunities for reducing quality.

Ideally, the level of quality in all parts of the design should be well established in the proposal, but in practice this is often not possible. This means that there is an inherent potential for the design-builder to substitute more economical materials and construction methods, especially if he/she finds the project running over the original budget. Such substitutions may be tolerated by the owner, especially if quality is not critical and cost is an overriding constraint. But, where quality is critical, the owner is likely to be faced with disputes or change orders and a highly adversarial relationship with the design-builder.

Some owners have attempted to mitigate this problem by splitting design and construction into separate contracts. Initially, a design contract only is made, with the construction contract contingent on satisfactory working

documents and reconfirmation or renegotiation of the original price. Theoretically, the owner can use the threat of not signing the construction contract as a strong bargaining advantage to force the design-builder to stick with his/her original proposal or to give generous price concessions if substitutions are made. It is not clear if this strategy is very effective in practice since it becomes increasingly impractical and costly for the owner to terminate his/her relationship with the design-builder as the project progresses (Hasbrouck, 1977). Such an arrangement also precludes any fast-tracking which is normally a major advantage of design-build.

Quality assurance during construction is also a potential problem area, again because of the altered role of the designer. It is not hard to imagine the dilemma a designer would face when having to reject materials or workmanship in a design-build situation. One solution is for the owner to use in-house or independent construction inspectors. Another solution, favored by the New York State Dormitory Authority, has been to hire the designer directly during the construction phase. This has the advantage of capturing the extensive knowledge of the project which the designer has already acquired while reducing the potential conflict of interest (Hasbrouck, 1977). Such an arrangement, however, might not be practical on a fast-track schedule or if the design-builder was actually a single vertically integrated firm.

Many of these cost/quality trade-offs manifest themselves in terms of lower construction cost, but higher operating/lifecycle cost. One way to create an incentive for the design-builder not to sacrifice quality for first cost savings is to make him/her responsible for operating costs as well. This may be done through optional maintenance contracts, extended warranties and other contractual mechanisms (NAVFAC, 1985). The problems with this include adequately providing for cost escalation, lack of maintenance capability among design-builders and integrating an outside contractor with in-house maintenance organizations (Carlson, 4/86).

7.3.6. Professional Ethical and Institutional Issues:

Historically, some of the most vocal opponents of design-build have been design professionals. Their objections have been based on legitimate ethical concerns and, to an extent, on selfinterest.

The major ethical problem associated with design-build is the altered role of the designer from being the owner's agent and professional advisor to essentially a contractual adversary. The ethical codes of the American Institute of Architects (AIA), American Society of Civil Engineers (ASCE) and other organizations of design professionals are based on the traditional owner-designer relationship described in chapter 2.0, and generally prohibit the designer from acting

in the role of a contractor. Yet confronted with the fact that design-build has been coming into ever wider practice, these organizations have attempted to establish guidelines for design-build.

The AIA recommends that architects participating as sub-contractors in a design-build entity should fully disclose the nature of this relationship to a prospective owner and anyone else who might otherwise assume that a traditional owner-designer relationship was in effect. However architects with ownership interest in a design-build entity are considered to have a potential conflict of interest and, as such, violate ethical standards promulgated by the AIA.

Moreover, architects who participate in competitive design-build proposals are potentially violating ethical standards which prohibit "free sketches" and competing for work on the basis of fee (Haviland, 1976). It should be noted that the only time when architects are permitted to give free sketches is in a formal design competition. However, it is not clear that a design-build competition is really the same as a design competition. If the architect considers it a design competition, ie. that he/she is working directly for the owner, then, implicitly the architect is also taking an ownership position in the design-build venture. This violates the ethical principle described above. However, if the architect instead considers him/herself working as a professional sub-contractor for a contractor or developer who develops a proposal for a design-build competition then

the architect must receive compensation for the design work done for the proposal. Otherwise the architect would violate the ethical principle of no free sketches.

The ASCE came out with similar guidelines in 1974 after several years of study and some heated internal discussion. (Some members likened the guidelines to procedures for obtaining a prostitute.) (Narver, 1975). The Consulting Engineer's Council actively lobbied against turnkey construction in the early 1970's and advocated instead an alternate method they called "Turnkey Plus" which was basically a form of design-CM (Consulting Engineer, 4/73).

Another potential professional conflict of interest arises when owners retain designers as a consultant to help administer a construction contract involving a contractor with whom the designer might be working as a sub-contractor on another design-build project. This situation is especially likely to arise where the designer is known as an expert in a particular specialized building type.

CHAPTER 8.0

DESIGN BUILD IN THE PUBLIC SECTOR

This chapter will serve as a bridge between the first two parts of this thesis which deal with procurement methods in general, and design-build in particular, to the third part of this thesis which will examine an actual case of the application of design-build on a public sector project. A number of issues affecting design-build which are unique to the public sector will be discussed. Various examples of public sector design-build applications will be reviewed with respect to these issues. Finally, there will be a brief summary of the previous chapters. This summary will lead into a set of hypotheses which will be presented in the introduction to Part III following this chapter.

8.1 Unique Requirements and Constraints of Public Sector Procurement

Probably the most important and overriding requirement of public sector procurement is accountability. Any public procurement method must minimize the potential for "waste, fraud and abuse". As such, it must be sufficiently transparent so as to allow systematic verification that waste, fraud and abuse have not been committed (Lee, 1986). This implies that any decision making process involving procurement should minimize subjective, individual judgment and maximize objective, quantifiable facts and procedures

as a basis for action.

There is a strong preference for methods which provide for competition among the widest possible group of offerors. Moreover, the basis for competition must be as objective as possible. Not only must the government be able to prove to its constituents that maximum value has been obtained for a given expenditure, but potential suppliers of goods and services must be given equal opportunity to compete.

The traditional method of design-bid-build, with bidding based on a full set of detailed construction documents and bidding open to all responsible (ie, qualified) contractors and award based strictly on low bid is generally the preferred procurement method in light of the above.

Negotiated contracts, particularly single source negotiations, are typically used only when the traditional method is not feasible or practical, such as for emergency construction or when there is absolutely only one contractor capable of building a project. As discussed in chapter 6.0, most public agencies are in an inherently weak position to negotiate and usually require special, often cumbersome bureaucratic procedures such as special review boards, audits, etc. if any negotiation is involved.

The biggest problem with design-build, in this context, is assuring objectivity and accountability in the selection process. Unlike the traditional method where, in theory,

only cost distinguishes different proposals, design-build inherently involves some degree of subjective judgment on quality. This disadvantage in terms of accountability may be offset in cases where design-build is the only way to allow alternate proprietary systems to compete.

The relative importance and value attached to time, cost and quality in the public sector is often very different from private owners. Institutional and budgetary procedures often distort building economics in the public sector. Unlike a commercial developer or industrial facilities planner who can accurately translate schedule and quality alternatives into accurate dollar values, most public owners are not oriented to making such trade-offs in a rigorous, analytical way.

Quality may be over-valued in the interest of reducing maintenance costs, not because of true life-cycle economy, but because money saved in capital costs cannot be reprogrammed into operating funds. Time may be under-valued since the social and political benefits of occupying a facility often cannot be readily translated into market value and because the true cost of financing construction may be concealed by budgeting and accounting practices. In other instances, an unusually high premium may be placed on time because of nearing elections or other political factors. Various institutional procedures for appropriating funds, as well as soliciting and awarding design and construction contracts, also serve to delay any procurement

process. In terms of design-build, this further complicates the proposal evaluation process and also may serve to discourage time saving efficiencies normally associated with the design-build method.

Distribution of authority and mechanisms for decision making in the public sector are often significantly more diffuse and cumbersome in the public sector as compared with private organizations. Part of this is due to the need for accountability through structuring checks and balances into a process or organization. Part may also be due to a certain dis-incentive which many bureaucratic organizations give to individual initiative. This can be a potential problem to the extent that design-build requires more definitive decision making about project needs and requirements, particularly prior to issuing the RFP, and often requires more subjective, complex and responsive decision making by the owner.

8.2 Design-Build Applications in the Public Sector

8.2.1 HUD Turnkey Housing Projects

The US Department of Housing and Urban Development has been using "turnkey" design-build as a standard method for procuring low and medium income housing projects since 1966. It is generally cited as the first US Federal agency to use turnkey construction. The original impetus for using this

method was to streamline bureaucratic procedures and take advantage of the skills and capabilities of established developers. (HUD, 1971)

Under the HUD turnkey method, local housing authorities (LHA's) are directed to publically solicit developer proposals for housing projects. Technical requirements are stated in terms of established HUD and FHA minimum property standards, which are based on a medium level of quality. Proposals include financing and usually land as well as design and construction. A firm price must also be included with all proposals, which is subject to downward adjustment as the detailed design is refined. In many cases, extensive negotiations are conducted with one or more developers to improve cost-benefits of proposals. Selection is based on cost, quality, time of delivery, architect and other factors.

Upon selection of a developer an initial contract for design only is let. The LHA monitor and review design and HUD participates in an intensive one day session to ensure quality stanards are maintained. Additional negotiations may take place to reduce cost or trade various alternate design features.

Once the design and any price revisions are complete, a second contract for construction and sale is made. Field inspection is provided by the LHA or HUD representatives. Because the developer must carry construction financing

charges until the project is accepted for occupancy there is a strong incentive to expedite work. No liquidated damages are involved and the developer bears the full risk of delays, regardless of cause. If any construction is found to be not in compliance with the detailed design the developer must replace it or a further price adjustment will be made. This provides additional incentive for the contractor to maintain quality and reduces quality risk for the owner.

8.2.2 GSA Turnkey Offices

As a result of the study of various construction contracting systems (GSA/PBS, 1970), which included a detailed examination of the HUD Turnkey method described above, GSA recommended that turnkey be adopted for small simple projects. The study, which also recommended numerous changes in the traditional method, noted:

"...The system appears to have merit for relatively simple projects. In the case of complex projects requiring numerous technical decisions during design and construction, this system could prove difficult to administer because of the inherent conflict between the PBS desire for higher quality and the developer's motivation to reduce quality to stay within the budget. Accordingly, it does not appear desirable to use the turnkey system on complex buildings until further experience has been developed..."

GSA developed standard procedures and contracts modeled after the HUD turnkey method. GSA's first turnkey project in 1971 involved five small Social Security office buildings

worth a total of approximately \$1.5 million (ENR 12/2/71). No follow-up accounts on the project could be located, but apparently GSA did not make extensive use of turnkey after the initial experiment. GSA officials indicate that more recently they have begun to use a modified form of turnkey involving leaseback financing of some office buildings.

8.2.3 Military Design-Build Projects

In 1967, the General Accounting Office (GAO) conducted a study of military housing which found that military housing was of higher cost and lower quality than comparable private housing due to uneconomical standards, specifications and inspection practices which were not in keeping with prevailing FHA standards in the industry (ENR 12/21/67). The military also experienced difficulty attracting experienced housing contractors and, in many cases, was forced to redesign and re-bid projects which could not initially be awarded within funding constraints. These shortcomings along with the success of the HUD turnkey experience prompted the military to adopt design-build on a number of housing projects.

Most of these projects involve design and construction only on government owned land and do not include financing. Competition is open and there is no initial prequalification and no consideration is given to the performance record or management capability of any of the proposers as long as they can meet bonding requirements. Although some officials

acknowledge that it might be more convenient from the military's point of view to prequalify or at least take performance and management into account during proposal selection, it was felt that this might be considered unfair discrimination (Messino, 1986) . Technical requirements are quite detailed, based on a combination of HUD minimum property standards, and prescriptive specifications for certain portions of site work. (NAVFAC, 1983)

Initially, the program generated a certain amount of controversy over using "competitive negotiation" based on alternate proposals instead of open bidding on conventional plans and specifications. On one early project, unsuccessful proposers filed protests against the government on the grounds that the winning proposal had been chosen on the basis of extra features not identified in the RFP as mandatory evaluation factors. The military had justified using the competitive negotiation under existing procurement regulations because it was "impossible to draft, for solicitation of bids, adequate specifications". Officials reasoned that it was impossible to draft conventional bid documents which would allow full competition among contractors who offered different types of systems and standardized designs. The US General Accounting Office (GAO), in reviewing the protest, claimed that this impossibility was "self imposed... and is inherent in the turnkey concept.", but stopped short of recommending that the method be dropped. (ENR 9/30/71)

The military has developed two ways of dealing with the problem of accountability in the selection process. The first, known as "one step" selection, involves an elaborate process of technical review and evaluation based on a very detailed numerical scoring system. Scoring is initially done by a team of technical experts without knowledge of price proposals or proposer identity. The scores and a written technical evaluation are then presented to a high level board. Proposal prices are revealed and a cost/score ratio is calculated for each proposal. The proposal with the best ratio is selected, subject to the judgment and approval of the board.

The second selection method, known as "two-step" selection, is similar, except technical evaluation is made on an acceptable/unacceptable basis with no scoring on quality. The acceptable proposal with the lowest price wins.

The two-step method which has been favored by the Army is less subjective, but does not take into account variation in quality. This means that the minimum technical requirements stated in the RFP become, by default, the maximum also. The one-step method which is more common on Navy and Air Force projects does account for quality, but is more subjective. (Ster, 1976).

Several studies have been made comparing one and two step design-build with traditional procurement methods. Results

have been mixed, although generally favoring one-step design-build on family housing projects. One study (Kraus and Smith, 1972), however, concluded that two-step and conventional methods achieved lower cost for similar levels of quality. No significant time savings was recognized for either design-build method. Ster (1976) has suggested that two-step design-build is most appropriate for relatively straightforward, utilitarian projects such as warehouses, small hangars, fire-protection systems, etc., while one-step design-build may be more appropriate for housing and institutional projects where design quality and esthetics are a consideration. He also notes that, in general, design-build should only be used on housing projects over 200 units, presumably due to the cost of proposal development and market considerations.

Recently, in an effort to further "privatize" housing procurement, the military has begun to include maintenance contracts and lease-back arrangements in their turnkey projects. This also provides a direct incentive for proposers to optimize life cycle economy.

Once a proposal is selected, a single design-build contract is awarded based on the proposal alone, without an intermediate design-only contract as in the HUD method. The military appears to avoid a negotiations between proposal acceptance and contract award, mainly to avoid possible protests from unsuccessful proposers.

Contracts typically provide for a limited amount of fast-tracking of site development and long lead items, however, formal design review and approval is required before construction may proceed. Most contracts also provide for a so-called "contractor quality control" (CQC) system. Under this system, the design-builder is required to carry out a rigorous and highly detailed series of quality control procedures including submittal reviews, inspections, field and laboratory testing. The contract administrator's role becomes assuring that these procedures are carried out and verifying them.

8.2.4 New York State Dormitory Authority

The Authority is an autonomous public entity which finances and builds dormitories and related facilities for the New York State university system. In the early 1970's it adopted design-build as one of its standard procurement methods. It was felt that design-build offered a better way of optimizing quality and value within a fixed budget.

From various accounts (Hasbrouck & Bobrow, 1974) (Hasbrouck, 1977), the Authority seems to have a well developed and sophisticated approach to design-build. This may have something to do with the fact that standards for dormitories are not as well established as for public housing, and that the more institutional nature of the projects makes them more complex.

A great deal of emphasis is placed on the preparation of the RFP which is regarded as the "single most important device distinguishing design-build". An outside consultant is hired to prepare the RFP and the owner/users of the future facility are intensely involved during the RFP development. This includes not only higher level administrators and decision makers, but also the actual occupants, staff, maintenance personnel, etc..

Requirements are stated in hierarchical levels of detail from overall project to individual spaces and equipment. Within each level a series of standard categories of requirements for user, function, adjacencies, technical specification, performance, etc.. A conscious effort is made to state these requirements in terms of performance so as to allow maximum design freedom and to allow existing building systems to compete with conventional construction. Requirements are defined as mandatory and non-mandatory to allow further flexibility for proposers.

The RFP stipulates a fixed price (and completion time) for the design-build contract, which proposers must confirm. As such, all proposals are based on the same price and quality becomes the sole criteria for evaluating proposals. This avoids the problem of having to weigh cost against quality. The Authority feels that in the public sector if price becomes a consideration, it will inevitably become overriding, ie. it will be almost impossible to justify not awarding to the low-bid solution which meets minimum

requirements. In such a case, the minimum requirements become the de-facto maximum and the opportunities for optimizing cost/quality trade-offs are lost. This forces the technical requirements to become more prescriptive and less performance oriented in order to assure the minimum quality level, thus constraining design flexibility and diluting the advantages of design-build, and ultimately leads back to the traditional method (ie. a totally prescriptive RFP).

The RFP requirements then become the basis of a detailed evaluation matrix which is weighted prior to issuance of the RFP, based on input from various owner/users. Hasbrouck points out that this is a highly delicate and sensitive process, since often the owner/users cannot foresee the implication of their relative weightings. Throughout the process, the RFP consultant acts as sort of an arbiter interpreting and resolving various trade-offs between demands of different owner/user sub-actors.

Proposals are solicited from prequalified design-builders and evaluated by a team of technical experts and owner/user representatives who score the proposals according to the pre-established criteria. To discourage manipulation of scoring, evaluators are not permitted to multiply scores by weight or tally scores.

A winning proposer with the highest total score is "tentatively" selected and asked to further develop his/her design. A final contract is issued upon completion of

satisfactory detailed design documents. Some further quality trade offs may be negotiated during this phase within the fixed price. By not awarding a firm contract until a detailed design is accepted, the Authority can use the threat of "lingering competition" to ensure quality is not compromised during design development. However Bobrow acknowledges that this leverage is diminished as the project progresses, especially after a formal contract is awarded, and that enforcement of quality standards set forth in the original proposal is one of the most difficult problems in design-build.

During construction document preparation and actual construction, timeliness is emphasised. Streamlined review and approval procedures and responsive decision making on the part of the contract administrator are a stated goal of the Authority. Special contract provisions also ensure conformance of construction documents with the proposal and detailed design. Field quality control may be handled in several ways including in-house inspectors, outside consultants and directly hiring the project designer.

8.2.5 Design-Build Correctional Facilities

Most of the public sector design-build applications described above have involved housing or relatively simple commercial/industrial buildings. Dormitories represent a sort of intermediate building type between housing and

institutional facilities.

Correctional facilities, especially detention centers (jails) and higher security prisons (ie. post-sentencing facilities) , like other institutional facilities, are often more specialized, complex and non-standard in comparison with the other building types discussed. In recent years the theory and practice of correctional facility design has undergone significant change with the advent of "new generation" facilities. Although various proto-types and models exist, no true consensus seems to have emerged regarding standards of design and construction, at least not to the same degree as the other projects described.

This, along with the other unique constraints and requirements associated with design-build in the public sector, make the application of design-build to correctional facilities especially challenging. Unlike the other design-build applications where the primary motive was optimizing cost and quality within a non-critical time constraint, the primary reason for using design-build for correctional facilities is to achieve accelerated delivery. Almost all of these facilities are planned to relieve serious overcrowding problems. Many of these new facilities are mandated by court orders. The following is a brief description of three current design-build correctional facility projects:

* Elmwood Detention Center, California (1985)

This 196 bed facility, according to the RFP, is required to be designed in approximately one month and ready for occupancy approximately five months after award. The RFP (Santa Clara County, 1985), which is a total of ten pages long, describes the facility requirements in extremely general terms, referring to applicable building codes and an existing tilt-up concrete prototype on the same site.

Proposal requirements include a qualification statement, implementation plan and conceptual approach to the project. Price for design is negotiated initially and a guaranteed maximum construction price is negotiated upon design completion. Evaluation criteria are very general, primarily the professional experience and expertise of the proposers based on the subjective judgment of a selection board.

Information on the outcome of the project, which was begun in May, 1985, is not available. But the accelerated schedule requirements, minimal project definition and negotiated pricing indicate the high premium and quality risk the state was willing to accept to achieve early delivery.

* Precast Modular Facility, Lorton, Virginia (1986)

This project for a 400 bed medium/maximum security prison (200 single cells/200 dormitory beds) is being built under court order. The recent riot and fire at the existing facility in Lorton underscores the urgency for the new

facility. The RFP (District of Columbia Department of Public Works, 1986) allows one month for proposal preparation, eight months for design and construction of the dormitories and twelve months for design and construction of the single cell units.

The program and definition of requirements in the RFP is significantly more detailed than the Elmwood facility, although somewhat more open than some military design-build housing projects. The RFP is performance oriented, based on modular, precast concrete construction, which apparently was determined to be the most expedient in an earlier feasibility study. Proposals are required to include a fixed price. Evaluation criteria is simply, but explicitly stated in the RFP as follows:

- 50%-- Design Approach
- 10%-- Time of completion
- 5%-- Size, financial stability and location of company
- 5%-- Experience and expertise
- 5%-- Outstanding record of timely performance
- 10%-- Cost
- 15%-- Compliance with safety, labor, affirmative action and minority enterprise program.

Ten teams were prequalified, but only two submitted proposals, apparently because of the extremely short time allowed for proposal preparation. The winning team is composed of Morrison-Knudson, one of the largest constructors in the world, and HDR, a large A&E firm whose special expertise is in prisons. The cost of the project, at \$ 17,000,000 appears comparable to similar facilities or less

accelerated schedules. The design-construction schedule is extremely fast tracked, with site work and foundations starting within a week after award in March, 1986. Within two months pre-casting and erection of superstructure had begun. (Caroy, 1986).

Both government project personnel and the contractor emphasized the need for mutual trust and cooperation on the project. The government was taking a very flexible attitude toward design review and quality control, relying almost completely on the experience and expertise of the design-build team. All parties are pleased, as of this writing, with the outcome and the unusually non-bureaucratic approach (Maloney/Lenertz, 1986).

* 500 Bed Maximum/Medium Turnkey Prison, Missouri (1986)

This project includes provision of a site and financing as well as design and construction. The RFP for the project, which was prepared by an outside consultant, is significantly more detailed and prescriptive than the other two projects described above. Program and technical requirements, apart from land and financing requirements, comprise three and a half volumes of approximately 200 pages each. Full prescriptive construction specifications are provided, including alternate specifications for different types of construction, eg. built-up and membrane roofing. Submission requirements for the proposal were also extremely elaborate, comparable to advanced design-development

documents (Norman, 1986).

At the same time, evaluation criteria were extremely general and non-specific, consisting of the following statement:

"The proposal selected by the State will be that ... in the judgement of the State, is best able to complete the project in the soundest and most workman-like way and in the most expeditious and economical manner consistent with the interests and need of the State. Proposals must be complete and satisfy the minimum criteria described in this RFP."

Apparently a more detailed point-weighting system was considered, but rejected, because it was felt that too many subjective factors were involved and that it was impractical and unrealistic to try to quantify them. (Hogue, 1986). At least one architect who participated as a proposer felt uncomfortable with this approach since it required considerable second guessing about the values and priorities of the reviewers.

The proposal selection process involved an extensive technical review by the RFP consultant who identified all items which exceeded or failed to comply with minimum requirements. This objective technical analysis was then presented to the State legislative committee responsible for the project, who made the final selection. By all accounts, this selection process was very successful. The Legislature was quite pleased and no protests were apparently made by losing teams despite the vague evaluation criteria (Hogue, 1986).

No prequalification was required and, despite estimated costs of \$100-200,000 to prepare proposals for the \$50-60 million project, eleven proposals were submitted, four of which were considered "excellent" and worthy of serious consideration. Despite the fairly prescriptive RFQ, consultants felt that proposals exhibited a considerable degree of creativity and innovation. (Silver, 1986).

Unlike the other two prison projects above, the Missouri facility is not under as extreme a delivery constraint and scheduling is not as compressed. The RFP consultant is providing detail design review and construction quality control for the State.

8.3 Summary of Key Points.

The rest of this thesis will deal with an intensive examination of a current public sector design-build project for three correctional facilities in Massachusetts. The object of this case study is to assess the viability of design-build in this relatively new and unique application and to identify the critical issues which are likely to determine the success or failure of the final project outcome.

Before formally stating the hypotheses which will be applied to this case study, the key points of the preceding chapters are summarized here:

* The so-called traditional method of constructed facility procurement has a number of weaknesses which reduces its effectiveness, particularly under certain situations. The principle shortcoming lies in the lack of integration of design and construction which can result in uneconomical designs, inability to develop and use rationalized building systems, extended delivery schedule, and inefficient risk allocation and adversarial contract relationships.

* In response to these shortcomings a number of alternate procurement methods have been developed. The major categories of these include management methods (CM/PM), systems methods and design-build. These methods all involve some alteration of the the roles and relationships among different actors during different phases of the procurement process.

* The key feature of design-build is combining the role of designer and contractor in a single entity, under a single contract with an owner. The designer no longer acts as the owner's agent, but is associated with the contractor as a potential adversary to the owner. Design-build is often associated with fast-track scheduling.

* The process of determining the best procurement method for a given set of project, owner and market requirements and constraints is a complex one. A decision model which relates independent contingency factors with dependent procurement method attributes can be used as a tool for selecting a procurement method.

* Within this model, design-build is associated with certain contingency factors including:

--The ability to define a project in terms of performance rather than prescriptive requirements .

--The need to maximize integration of design and construction under a single responsibility contract.

--The need to establish an early, fixed price and level quality through competitive means without a fully developed design.

* The critical issues associated with design-build include:

--Lack of owner control of the process.

--Risks associated with basing a proposal and contract on limited level of project definition and the risks of disputes over cost and quality arising from differing interpretations of proposals.

--The cost of preparing competitive proposals.

--The problem of quality control, owing to the fact that the designer has a potential conflict of interest between professional responsibility to assure quality and contractual interest in maximizing profit.

-- Certain professional ethical problems related to the altered relationship between designer, owner and contractor.

* Design-build originally has been used by the private sector, especially for certain industrial and manufacturing applications. Since the late 1960's, design-build has been used in certain public sector applications, notably housing.

The unique problems associated with public sector design-build projects stem from the need for accountability, especially in the competitive selection of proposals and subsequent contract negotiations and administration.

* The primary motivation for using design-build for public sector projects has been to optimize cost and quality by allowing alternate building systems and designs to compete based on performance standards.

* More recently, design-build has been used to procure correctional facility projects primarily in the interest of accelerating project delivery. This represents a new step in design-build applications because correctional facilities tend to be difficult to define in terms of established performance standards, and difficult to evaluate in rigorous, quantitative terms. The emphasis on early delivery precludes certain accountability protections and requires certain unique bureaucratic responses on the part of the owner.

PART III

A CASE STUDY OF DESIGN-BUILD IN THE

PUBLIC SECTOR TO PROCURE CORRECTIONAL FACILITIES

A Case Study Approach

The decision to investigate design-build through the intensive examination of a single case was made mainly on the basis of an opportunity which presented itself to this author. Various other, more extensive methods may have been used involving surveys, questionnaires and the like. The advantage of focusing on an individual case is the ability to observe the detailed dynamics and workings of a complex set of actors and organizations over a period of time. Although some observations will be unique to the particular case and not a basis for generalized conclusions, it is hoped that a more subtle, deeper understanding of the problems surrounding design-build may be gained.

The primary vehicle for observing the case was through direct participation as a researcher/analyst on the owner's project management team. This participation mainly involved assisting with the prequalification process and development of the RFQ. These activities included sitting in on numerous meetings and planning sessions with all of the major owner and consultant sub-actor as well as drafting

portions of the RFQ and RFP documents.

This direct participation was supplemented by interviews with key individuals within the owner organization various designers, contractors, consultants owner's in-house representatives familiar with design-build. A review of literature was also conducted, the results of which are largely contained in the preceding chapters.

It is important to note that the case study is not complete and the observations presented in the following chapters are interim one only. As such, the conclusions are not definitive, but more along the lines of working hypotheses for continued investigation.

Hypotheses

In order to provide a more meaningful framework within which to examine the case, a number of hypotheses are proposed. These hypotheses are based on the discussion contained in the previous chapters, in particular chapters 6.0, 7.0 and 8.0. These hypotheses will be addressed on different levels throughout the discussion of the case in chapters 9.0 through 15.0. Chapter 16.0 will then attempt to summarize this discussion and relate it directly back to the hypotheses in the form of tentative conclusions and directions for further investigation.

HYPOTHESIS ONE:

Design-build is most appropriate in the public sector when early delivery through integration of design and construction and fast track scheduling is desired and a competitively obtained fixed price is required prior to construction.

HYPOTHESIS TWO:

Because of the technical complexity and lack of well established performance criteria for correctional facilities, the design-build request for proposals (RFP) and evaluation criteria become especially critical and problematic. A high level of prescriptive detail and rigorous, explicit evaluation criteria will enhance accountability and ensure quality, but will constrain proposals. A lower level of prescriptive detail and broader, implicit evaluation criteria maximize flexibility in both solutions and selection, but raise potential accountability problems.

HYPOTHESIS THREE:

Design-build, involving a fixed price contract and accelerated scheduling, is especially intolerant to changing project requirements. This further increases the need for good definition of project requirements in the RFP and good internal communication among sub-actors within the owner organization. It also requires exceptionally responsive decision making and project administration within the owner organization.

HYPOTHESIS FOUR:

Design-build in the public sector involves a number of trade-offs not only between time, cost and quality, but also accountability. Accountability becomes increasingly difficult to maintain as the project becomes more complex, and especially as the delivery schedule is accelerated as in the case of correctional facilities. But despite these trade-offs overall efficiency is higher under design-build than the traditional or other alternate procurement methods. These trade-offs include:

H4.A--More detailed proposal submission requirements to ensure quality and reduce cost risk of project vs. speed and cost of proposal preparation.

H4.B--More detailed, explicit and rigorous proposal evaluation criteria and method to ensure fairness and competition, vs. looser, more general evaluation methods and criteria which provide maximum flexibility for owner in selection process.

H4.C--Sequential design-construction process and "lingering threat of competition" after "tentative proposal selection" to ensure design-development conforms to proposal and to allow additional cost and quality optimization before committing to construction vs. fast-tracked design and construction which saves time, but increases risk of disputes and diminished quality.

H4.D--Quality control/quality assurance during design and

construction by owner or consultant to avoid possible conflict of interest, vs. design-builder "contractor quality control" system which is more efficient and involves less time consuming bureaucratic procedures.

CHAPTER 9.0

BACKGROUND ON THE MASSACHUSETTS

DIVISION OF CAPITAL PLANNING AND OPERATIONS (DCPO) AND THE DESIGN-BUILD PROJECT FOR CORRECTIONAL FACILITIES

This chapter will provide general reference background on DCPO and its design-build correctional facilities program: the creation and overall mission of DCPO; the prison overcrowding problem which generated the need for new correctional facilities; and the investigation of alternate procurement methods undertaken by DCPO-- which lead to the decision to use design-build. For additional background on the case, refer to appendix B, a chronological summary of major activities and events pertaining to DCPO and the design-build project.

9.1 The Creation of DCPO

DCPO was officially created in 1980 by Chapter 579, also known as the Construction Reform Act of the Commonwealth of Massachusetts Code. The stated goals of the act are:

1. state buildings are to be designed and constructed according to the highest professional standards;
2. there will be proper maintenance and maximum use of the existing resources of the Commonwealth;
3. excessive costs, unwarranted delays and the use of outdated methods and materials will be eliminated;
4. all participants will be held accountable for their actions;
5. the opportunities for corruption, favoritism, and

political influence in the award and administration of public contracts will be reduced.

(Chapter 579, 1980)

Chapter 579 is the product of an extensive investigation into the practices of construction procurement in Massachusetts by a task force known as the Ward Commission (named after its chairman). The investigation covered all aspects of procurement, including designer selection, project management, technical quality and administration, on approximately five billion dollars worth of construction projects carried out by the former Bureau of Building Construction (BBC) and other state agencies from 1968 to 1980. In its final report (Ward Commission, 1980), the Commission states that corruption had become a way of life, permeating all aspects of the procurement process. The Commission was especially critical of graft and kickbacks associated with the designer selection process, building suppliers, and an outside construction management firm involved in a large university project. The Commission also cited the high incidence of quality defects in state buildings, which it attributes to systematic failure of accountability at all levels within the BBC.

Chapter 579, which embodies most of the Ward Commission's recommendations, abolished the old BBC and a number of offices in other agencies which had previously handled procurement of state buildings. All functions and responsibilities associated with state building procurement

were consolidated in the new Division of Capital Planning and Operations (DCPO). (Note that DCPO does not handle major civil construction such as highways, sewer, water, etc.) DCPO does not directly serve the public at large, but rather provides facility procurement services on behalf of other agencies within the state government. Additional legislation, complementing Chapter 579, creates the Office of Inspector General (IG) which is charged with overseeing the procurement practices of DCPO and other State agencies. This office plays an important role in terms of assuring accountability which will be discussed in more detail later, in chapter 11.0.

Chapter 579 mandates a number of organizational and procedural requirements which were specifically designed to address the problems cited in the Ward Commission. Figures 9a and 9b show the location of DCPO within the overall state government organization and the general organization of DCPO. Figure 9c outlines the standard process for procuring state buildings. This process and the function of major DCPO offices are described here:

9.1.1 The Office of Programming and Designer Selection Board

Under DCPO's standard method the Office of Programming (OP) is responsible for managing pre-design studies for all projects. Unlike many other public and private owners who handle pre-design and programming informally or as part of

Figure 9 a. Massachusetts Government & Agencies

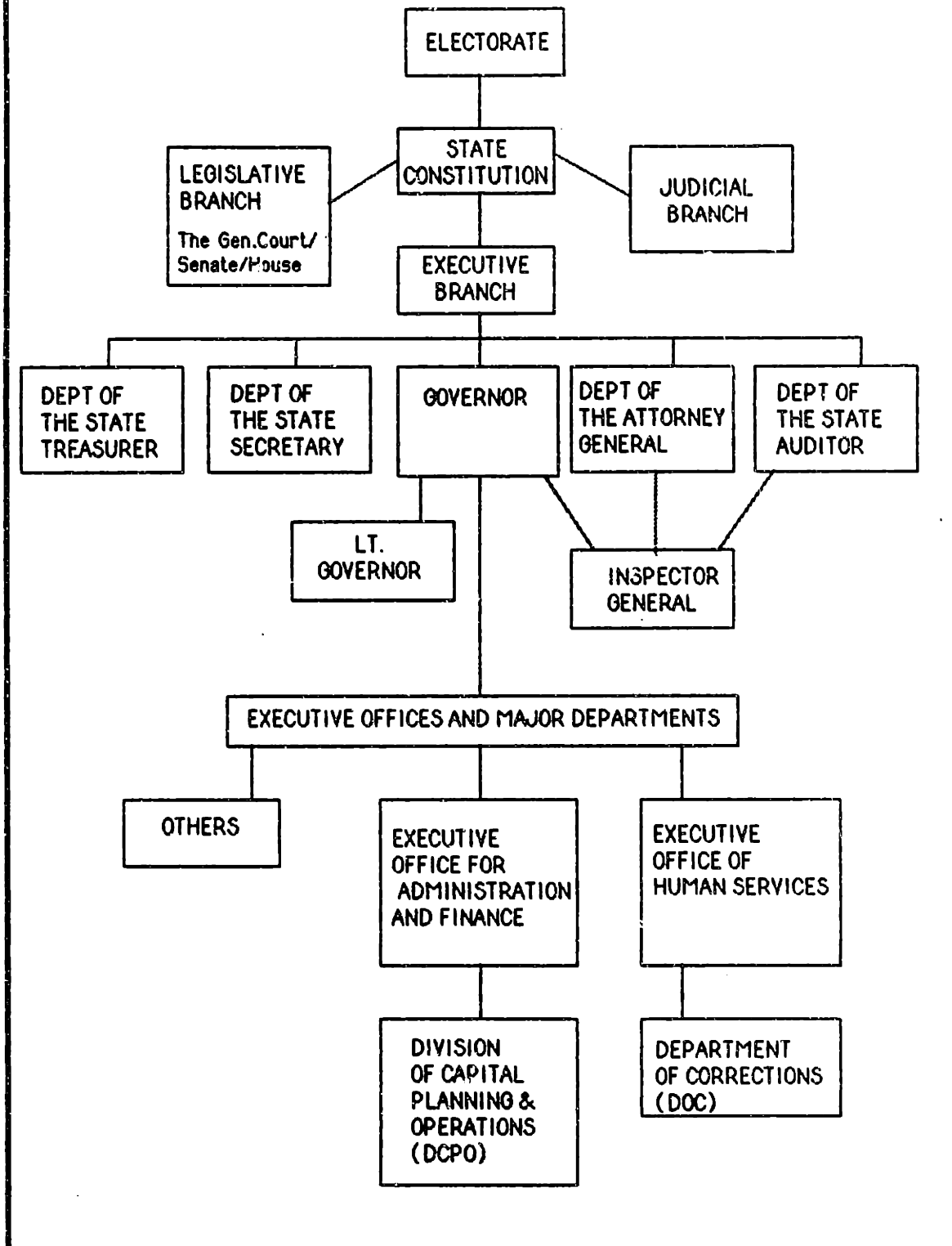
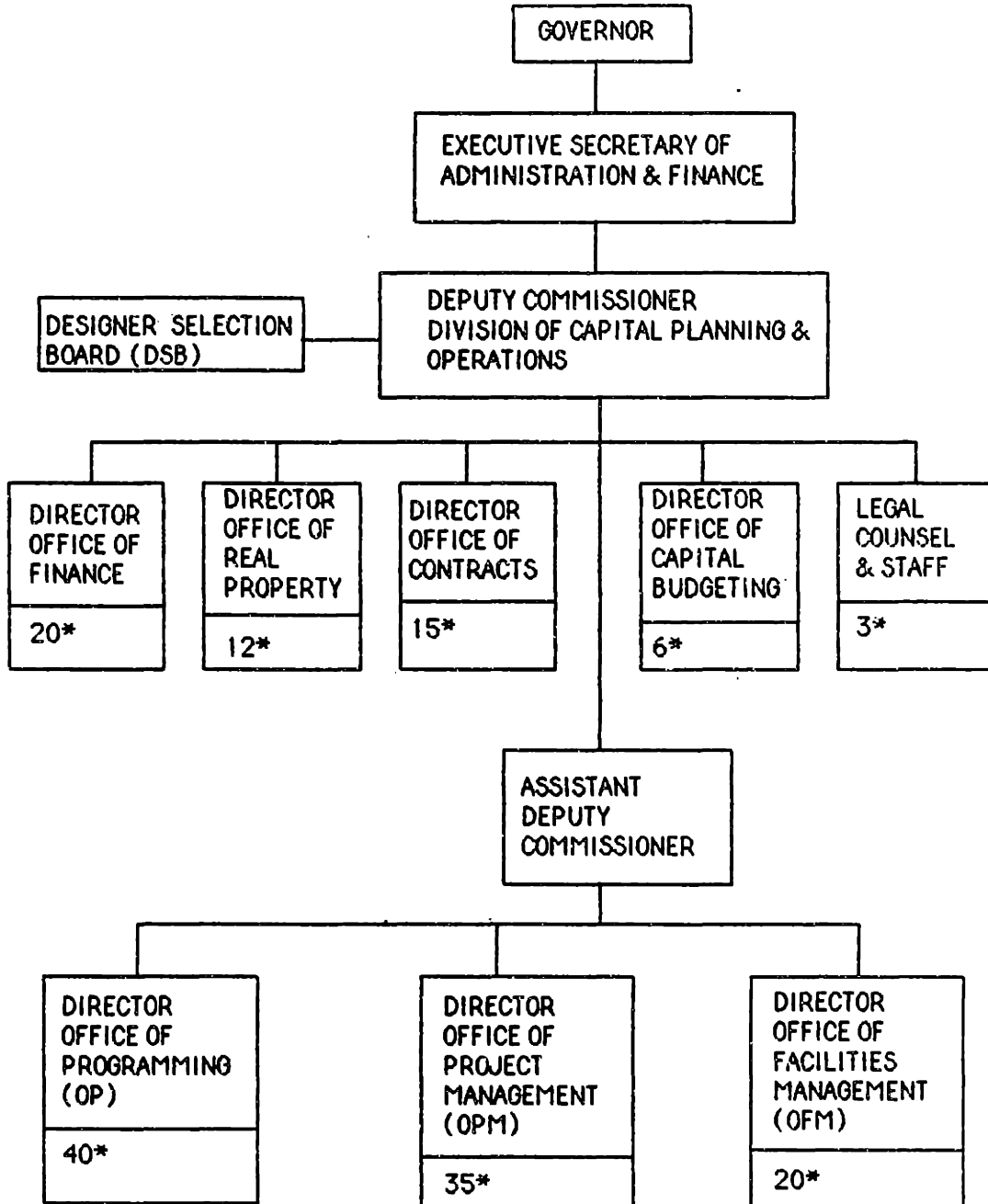
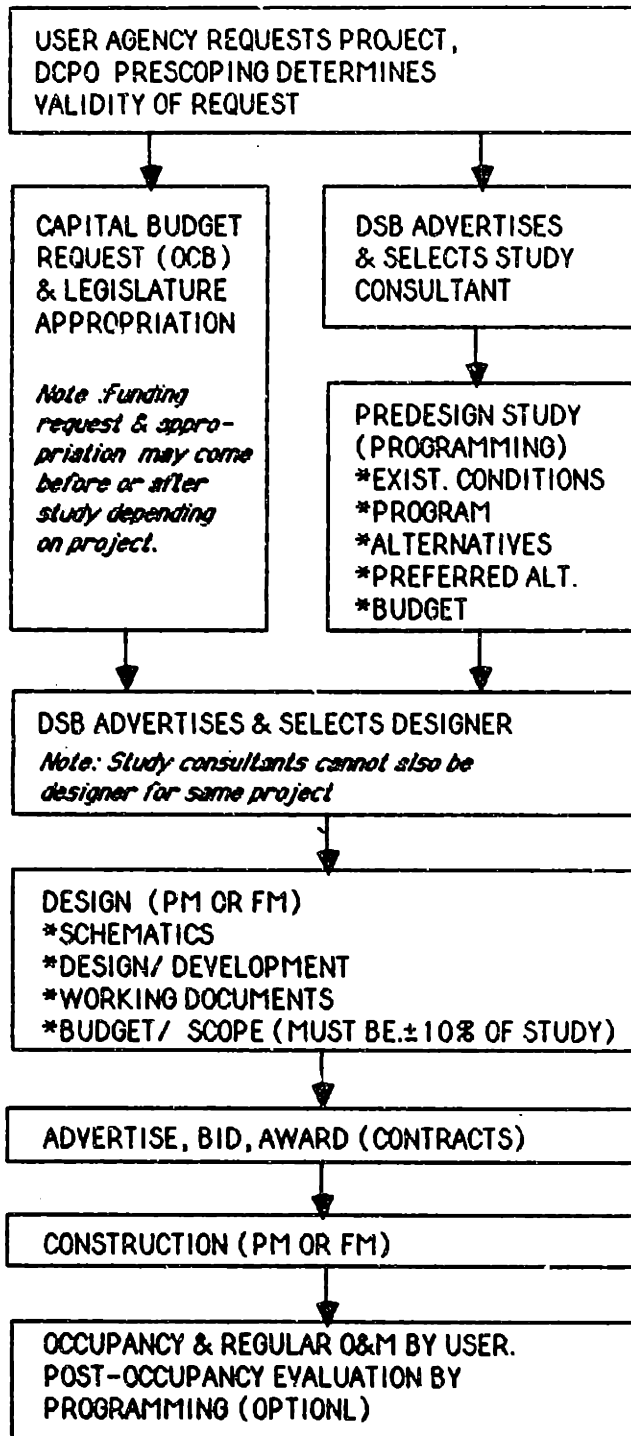


Figure 9 b. DCPO General Organization



* Indicates approximate number of employees in office

Figure 9 c. Legally Mandated Facility Procurement Process



the prime designer's contract, DCPO is legally obliged to carry out a separate pre-design study for every project. (See Figure 9c for diagram of typical project process).

Typically, a study will include:

- description of existing conditions at a site or facility, and an analysis of user needs
- detailed program including requirements for each room or functional area
- analysis of alternate solutions
- preferred solution developed to the level of a conceptual design, including outline specifications and a cost estimate.

The user agency must certify that the study accurately and completely represents the project program. Neither the program nor the estimated construction cost, (ECC) which is the basis for the total project cost (TPC) budget can be altered more than 10% once a study is certified.

Furthermore, the consultant who prepares the study cannot be hired for the design of the project itself. The theory behind these provisions is to ensure that the consultant has no interest in creating an unnecessarily extravagant program (thereby increasing later design work for the project); and that projects do not become inflated beyond their original requirements and budget. Chapter 579 makes the Director of OP, not the Deputy Commissioner of DCPO as a whole, personally accountable and legally responsible for all studies. This provision is meant to prevent the kind of systematic lack of personal accountability cited in the

Ward Commission report. It also has significant implications in the organization of the design-build project Special Unit in DCPO, which will be discussed in Chapter 11.0.

Once a study is certified, assuming funds have already been appropriated, a new designer is selected by a special, Designer Selection Board (DSB--not to be confused with the separate Design Build Selection Board, DBSB, which will be discussed in chapter 11.0). The price of the design contract is fixed prior to advertising, and designers compete on the basis of qualifications, work plan, and interviews. Programming may also give input to the DSB regarding designer selection.

9.1.2 Office of Project Management and Office of Facility Management

From this point the project becomes the responsibility of either the Office of Project Management (OPM) or Facilities Management (OFM). Generally, OPM handles new construction and major renovation projects, while OFM handles small renovation and deferred maintenance projects. (See Figures 9c and 10c for diagrams of the design-construction process). Like the Director of OP, the Directors of OPM and OFM are also personally accountable for the design and construction phases of the projects they administer.

The design process involves developing the preferred solution from the feasibility study into a set of working bid

documents. OPM/OFM oversees and reviews the design, in conjunction with the user agency. In particular, it assures that technical aspects of the design and specifications conform to appropriate standards checks for constructability. Soils investigations, site surveying, as-built record documentation of existing facilities and detailed cost estimates are normally done during this phase of the project.

The project is then bid and a construction contract awarded. OPM/OFM provides general contract administration, including submittal tracking, on-site inspection, progress payment approval, change-order negotiations and project close out. The project architect is responsible for review and approval of construction submittals (ie. shop drawings, product data, samples, etc.), as well as quality control testing, periodic and final inspections.

9.1.3 Impetus for Alternate Procurement Methods

The standard procurement method prescribed by Chapter 579 is essentially a variation on the traditional method. However, the legislation also calls for DCPO to "undertake research on innovative methods for the design and construction of capital facilities". This provision serves as the legal basis for DCPO to undertake the design-build project. The former (1/83-6/86) Deputy Commissioner of DCPO, Tunney Lee, also deserves credit for his visionary interpretation of

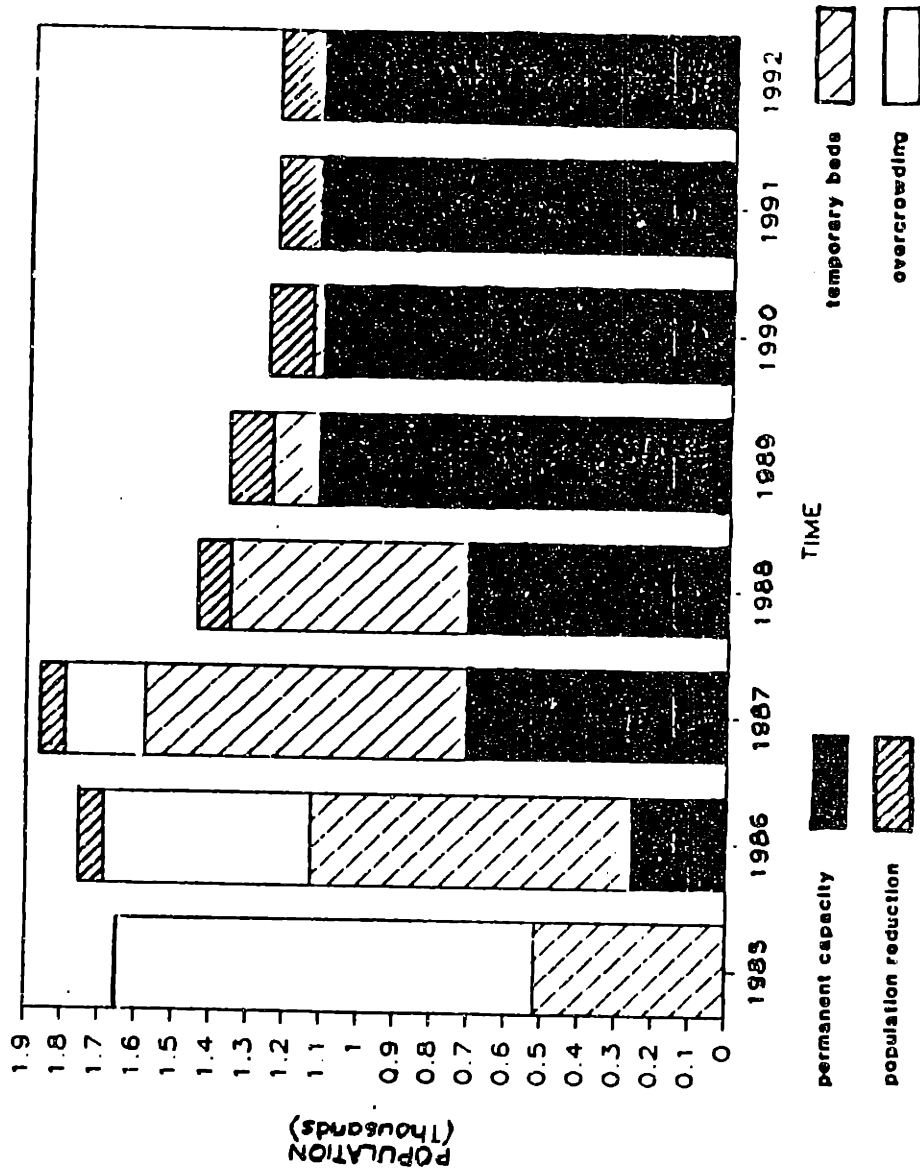
this legal mandate (Forbes, 1986). Lee strongly believed that DCPO should gain experience with alternate methods, even if the standard or traditional procurement method was considered adequate, in order to diversify its available options in the future (Lee 1986). With this conviction, Lee actively encouraged not only research, but also the idea of implementing an alternate procurement method on a test project.

9.2 The Prison Overcrowding Problem

Despite the fact that the Commonwealth of Massachusetts has one of the lowest rates of incarceration in the country, it is currently experiencing a severe prison overcrowding problem. Figure 9d shows projections of the State prison population. The prison population is presently averaging around 5200, as compared with a rated prison capacity of 3500. These figures do not include the county jails and prisons, which house 3700 prisoners within a rated capacity of 2700.

A number of factors have contributed to this situation. The "at risk" population of 18-29 year old males who constitute the bulk of new commitments peaked in 1983. Despite a falling crime rate, average lengths of sentences have been growing, as have the percentage of sentences requiring longer mandatory incarceration prior to parole. This pattern of longer sentencing reflects a "get tough" sentiment on the part of the public and the judiciary. Ironically, new

**Figure 9d. State Prison Overcrowding Reduction Strategy
(from Governors Special Message, 1985)**



prison construction has been politically distasteful until recently. The same people who advocate stricter criminal justice often oppose increased spending on correctional facilities, while liberals also oppose such spending on principle (Clark Foundation, 1983).

The impact of overcrowding is not hard to imagine. The general level of tension and potential for violence increases. Spaces normally devoted to program activities such as vocational training, classrooms, counseling and recreation are converted to makeshift dormitories thus, limiting rehabilitative programs. The net effect is a less humane and safe environment which inhibits the mission of the State's Department of Corrections (DOC) and goes against modern correctional theory (Gallegher, 1986)

In 1984 the Governor of Massachusetts directed DCPO and DOC to study the overcrowding problem and recommend a plan for dealing with it. After several months of study, a multi-dimensional approach emerged. First, alternatives to incarceration-- such as intensive parole, half-way houses and community service, were identified and maximized. Secnd, the remaining prison population was broken down and analyzed to determine the maximum number of inmates which could be accommodated at lower levels of security. (Lower security level facilities are considerably less expensive to build and operate than higher ones.) Finally, after maximizing "non-building" solutions, a program of new construction was developed. (Schectman, Gallagher, 1986)

This plan was presented by the Governor to the Legislature in the form of a "Special Message" in April 1985 (Dukakis, 1985). The message contained specific recommendations for new legislation to implement the plan. In addition to requesting funds for new construction, the message also directed DCPO to investigate alternate methods of design and construction in order to expedite delivery of new permanent facilities.

This was of particular importance to the correctional facility program, not only because of the immediate overcrowding situation, but also because the Governor was trying to get new "presumptive sentencing" legislation passed, which would set mandatory sentencing according to certain guidelines and would have the effect of increasing inmate population projections. Under presumptive sentencing, the population would peak around 1987 and drop off steadily thereafter due to the demographics of the at-risk population.

Some new prison projects were already in progress at the time of the Special Message, but to meet the goals for new prison capacity within the time frame outlined in the Special Message, an accelerated program was required. The normal delivery time for design, bidding and construction of state projects is four to five years. Clearly, this would be inadequate to deal with the revised population projections, especially the peak population

projected in 1986-88.

9.3 Alternate Method of Design and Construction

Investigation

While the State Legislature was considering funding the plan for ending prison over crowding contained in the Governor's special message, DCPO began investigating alternate procurement methods. The findings of this investigation were presented in a report titled "Alternative Method of Design and Construction for Correctional Facilities" (referred to hereafter as the "Alternate Method" study or report; excerpts are contained in appendix C).

The study considered a number of alternate methods, including design-build, turnkey, fast-track, construction management, prefabricated and modular systems and inmate labor, and came out strongly recommending design-build for several facilities. A detailed discussion of how this decision was made and how DCPO originally conceived the design-build process will be covered in the next chapter. A brief overview of the process is presented here.

The study was carried out primarily by the Programming section of DCPO, with input from the Project Management and Contract Administration sections as well as DOC. The primary method of research consisted of interviews and group meetings with knowledgeable professional designers, contractors and housing developers. Some literature

investigation was made, particularly in the area of performance specifications and standard AIA and other contract documents. This research was supplemented and synthesized by numerous in-house brain-storming sessions among the top officials in DCPO.

Early in the study process, a consensus developed around using design-build (Gisiger, 1986). Once this tentative decision was made, the efforts of the study concentrated on defining the particular procedures and features of the method which would be recommended, and on which projects would be built under design-build. Special emphasis was given to public accountability and time savings since these were the two issues of greatest concern to the Governor, Legislature and various public "watchdog" entities.

The Alternative Methods report recommending and describing design-build for three of the projects proposed in the Special Message was submitted in October, 1985. It was accepted shortly thereafter and incorporated into the legislation, known as Chapter 799, which authorized the correctional facility program recommended in the Special Message. This established a clear legal and institutional basis for using design-build for procuring correctional facilities.

In a certain sense, the adoption of design-build as an alternate method represented a final step in the reform process which had begun five years earlier, with the passage

of Chapter 579 and the creation of DCPO. The fact that DCPO had been able to reestablish its integrity and credibility to the extent that such an alternate method could be accepted was a sort of vindication for the young agency. At the same time it was a challenge that had precedent setting ramifications far beyond the scope of the initial facilities involved (Forbes, 1986). If DCPO could make design-build succeed it would permit wider use of alternate methods and greatly enhance the agency's stature. If the experiment failed, and particularly if accountability was compromised, it would make it difficult for any other alternate procurement methods to be adopted and it could destroy much of the trust and goodwill DCPO had built up.

CHAPTER 10.0

DCPO'S ORIGINAL DECISION MAKING PROCESS AND CONCEPTION OF DESIGN-BUILD

This chapter will examine the original analysis and decision making process which DCPO went through to arrive at the recommendation to use design-build. The procurement decision making model described in chapter 6.0 will be used as a framework for comparison with the actual process DCPO used. The project will be described in terms of contingency factors and decisions on procurement method attributes will be examined, with reference to the model. Finally, DCPO's detailed conception of how the design-build process would be applied and adapted will be described, with reference to some of the critical issues discussed in chapters 7.0 and 8.0.

Reference sources for this chapter include the "Alternative Method of Design and Construction for Correctional Facilities" report (Lee, 1985), meeting notes, memos and other file documents compiled by DCPO Programming staff (Gisiger, Park, 1985) and interviews and informal conversations with DCPO staff and officials and others involved with the process (Lee, Carlson, Poodry, Garity, Baxter, Gisiger, Park, Binda, Irwig, 1986).

10.1 Contingency Factors

10.1.1 Project Characteristics and Constraints

Early project delivery was the overriding contingency factor which drove the decision making process. As described in the previous chapter, the need for additional prison beds had reached the crisis stage and appeared to be getting worse. The target date for delivery of new beds was set as 1987, roughly two years from the anticipated funding approval. This represents about half the normal delivery time under the traditional process used by the state. The need was particularly acute for MCI Concord which was at over 200 % capacity.

Figure 10a shows the six projects under consideration in the initial correctional facility program. All involve additions to existing facilities on sites which have already been developed. All but one of the facilities are classified as minimum or pre-release security levels. Security in these facilities is controlled primarily by the internalized behavior of the inmates who are given strong positive and negative incentives to follow rules and not to escape. These facilities are quite open, with few physical security barriers. There are no perimeter walls, no cells in the conventional sense, and minimal surveillance systems. Inmates are provided with individual bedrooms (most currently double-bunked due to overcrowding). The facilities also include institutional-style kitchens and dining areas,

Figure 10a. The Six Correctional Facilities Considered in The Alternate Method Study

	FACILITY	BED EXPANSION	EXPANSION SIZE in K SQ.FT. (K = 1,000 SQ.FT.) & DESCRIPTION	ESTIMATED COST (\$ MIL.)
CONVENTIONAL	M.C.I. CONCORD (medium)	250 addition	50 K new residential only	\$7.6
	BAY STATE CORRECTIONAL CENTER Walpole, MA (minimum)	76 addition 72 replace 148 TOTAL	44 K new residential & support 28 K renovation 72 K TOTAL	\$10.5
	SOUTH MIDDLESEX PRE-RELEASE CENTER Framingham, MA	50 addition	30 K new residential & support	\$3.0
	M.C.I. PLYMOUTH (minimum)	50 addition	44.2 K new residential & recreation	\$3.6
	NORFOLK PRE-RELEASE CENTER Walpole, MA	50 addition	13.5 K new residential 3.0 K renovation 16.5 K TOTAL	\$2.7
	M.C.I. WARWICK (minimum)	100 addition	16.1 K new residential & gymnasium 12.0 K renovation 28.1 K TOTAL	\$3.8
DESIGN - BUILD				

administrative offices and various classrooms, recreation and visiting spaces.

In terms of building type, these facilities are comparable to college dormitories or military enlisted personnel housing and are classified as high residential or low institutional type construction by building codes. As such, they are technically fairly straightforward and do not require exceptionally specialized know how to design or construct. The logistics of doing construction work at the facilities is also not a significant constraint owing to the low security levels.

The most difficult and risky aspect of these projects is the renovation work on the existing facilities. All of the facilities have significant defects with waterproofing, utilities, mechanical, electrical or life-safety systems. Moreover, documentation on existing conditions is very poor. Few as-built drawings are available and many of the facilities are over fifty years old, and were built in a piecemeal fashion often with inmate labor. Overall, this renovation work accounts for about 15-30% of the total scope of the projects, but because of the nature of the proposed expansions, it is very difficult to separate it out from the new construction.

The sixth facility, MCI Concord, is a medium-maximum security prison with very different requirements and characteristics from the rest. It is a stand-alone facility to be

constructed within the existing walled compound at the site. It is planned as a "hard" facility consisting of a series of "pods" of 25-50 individual cells surrounding a day-room. Security is maintained by sophisticated physical barriers and systems featuring highly specialized detention doors, windows, hardware, fixtures and equipment. General construction materials and details must also meet special durability and security requirements.

MCI Concord presents a number of additional problems and risks. The logistics of site access and work inside the perimeter wall are difficult because of the high security requirements. Although no renovation is involved, site conditions and existing utilities are poorly documented and numerous remains of old, demolished structure below grade are a source of significant risk and uncertainty.

The facilities, especially MCI Concord are somewhat difficult in terms of design standards. In the last fifteen years a new approach to correctional facility design and operation has emerged known as "new generation" prisons. This approach is characterized by many features which directly contradict older, more traditional approaches. Yet, many practices advocated by this new approach have not been fully accepted and incorporated into existing standards. There also is a certain amount of debate about old versus new generation facilities among corrections professionals. This will be discussed in later chapters, but for now it is relevant to point out that standards and generic types are

probably less well defined and established for modern correctional facilities than for many other institutional building types.

The six sites are scattered throughout Massachusetts (see map in figure 10b.) None are less than a thirty minute drive from each other and the two farthest ones are over two hour's drive apart. This makes it somewhat difficult, from a logistical point of view, to package the facilities under a single contract.

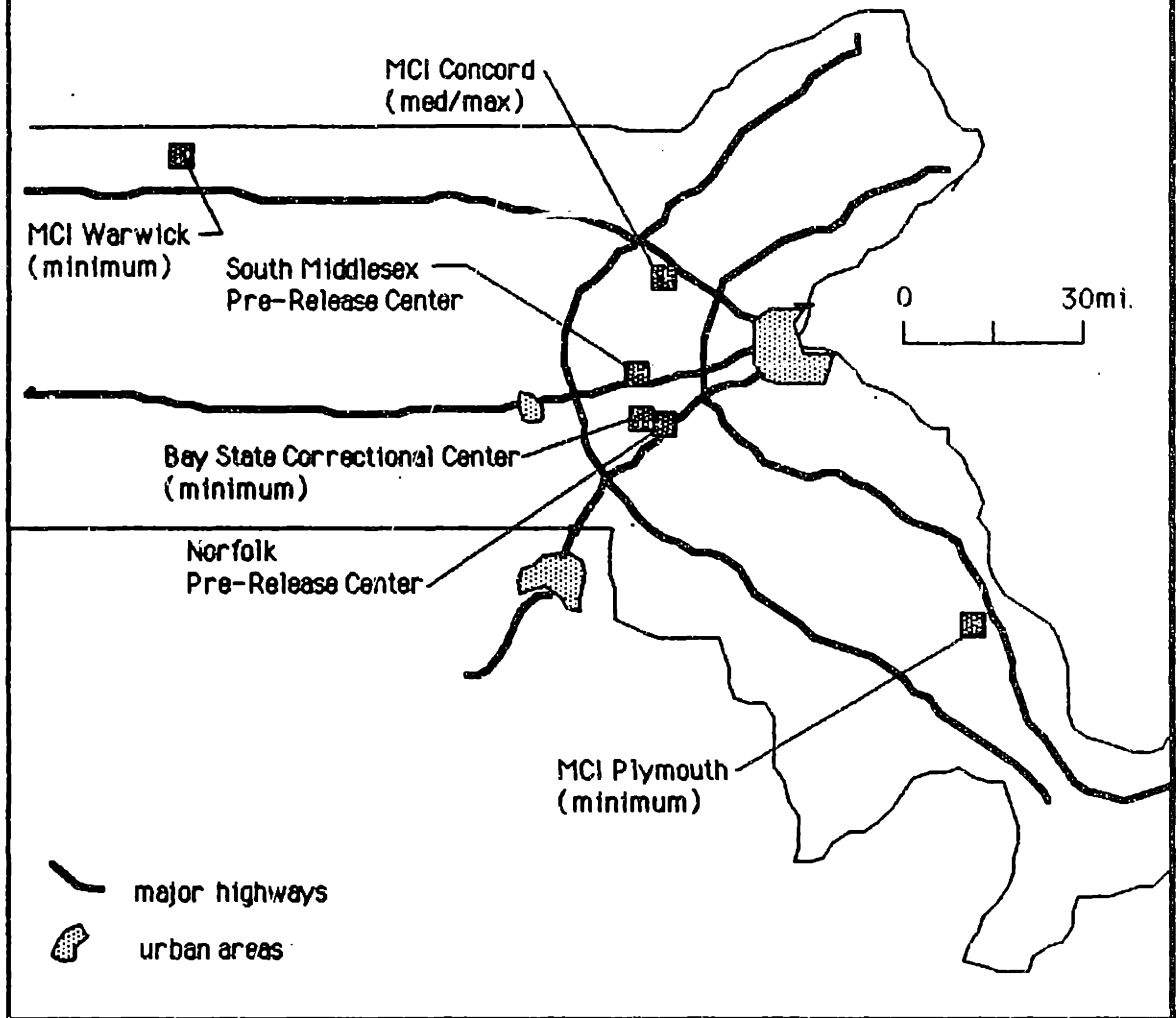
Budget is not considered as important a factor as time and quality for these projects. It appears that the budget is basically adequate and the State appears willing to pay a slight premium for early delivery, although DCPO is still obliged to stay within budget guidelines given in the project funding appropriation.

10.1.2 Owner Resources and Constraints

The Owner sub-actors and organization will be discussed in detail in the next chapter. This subsection will concentrate on critical contingency factors.

DCPO has extensive management resources in all areas of planning, design and construction administration. Its staff is broad and diversified and can probably be considered quite sophisticated in technical knowledge and procurement ability. Through work on earlier correctional facilities,

Figure 10b. Geographical Location of Six Correctional Facilities



DCPO has gained a certain amount of experience and expertise in this particular building type. What DCPO does not have, in terms of management capability, are skills, staff and other resources required to directly manage construction as a general contractor or CM would, ie. coordinate multiple prime contracts, purchase and handle material, etc..

One of DCPO's particular strengths is in pre-design planning and programming. The Programming section that handles these functions has expanded significantly in the last four years and has attracted some very talented personnel. The Office of Project Management is currently handling a very heavy work load and is slightly understaffed. For various reasons it has not been able to expand its staff as quickly as the Office of Programming has.

Like most public sector owners, Massachusetts and DCPO are quite limited in terms of negotiating ability. The need for accountability is more acute for DCPO than for other agencies because of the history of corruption and mismanagement which preceded its creation. Any sole-source negotiated contracts for design or construction would be considered unacceptable except in an extreme emergency.

As previously noted, DCPO is especially sensitive to the need for public accountability. Normal requirements and procedures for designer and contractor selection are, if anything, stricter than for other similar public agencies. However, DCPO is not strictly bound to award contracts on a solely low-bid

basis as long as selection can be justified as competitive, fair, and not subject to "waste, fraud or abuse". A recent program involving energy saving improvements for state buildings featured a selection method based on multiple, qualitative and quantitative selection criteria and has established a sound precedent for non-low-bid contractor selection.

DCPO is basically quite risk adverse in terms of cost. Once a program and preliminary construction estimate are established, DCPO is legally required to stay within 10% of both through award of the construction contract and no more than 10% additional change orders are allowed during construction (Chapter 579, 1981). This does not absolutely preclude fast-tracking and the award of direct, multiple prime contracts, but in practice, entails risks which officials, who are used to more conservative procurement methods, are very reluctant to take.

10.1.2 Market Conditions

Eastern Massachusetts has been experiencing a construction boom over the past few years, although recently overall volume appears to be levelling out. Competition is not exceptionally strong and government work does not appear to be a preference of most designers and contractors. However, the improved reputation of DCPO has attracted certain designers and contractors to do state work, which they had previously shunned (Poody, 1986).

The correctional facilities market is somewhat unusual both in supply and demand. There is a limited number of contractors and especially designers with experience and qualifications in correctional facilities work, particularly work in higher security level facilities. These firms compete on a regional and national level. By all accounts, correctional facilities work is booming throughout the country further weakening competition. This is somewhat offset by the fact that many firms are trying to enter or improve their position in this growth market.

A significant market consideration is total contract value. In order to attract the most qualified and experienced correctional facilities contractors, DCPO feels it has to be able to offer a single contract on the order of \$ 15-20 M. This poses a problem, since none of the individual facility budgets were close to this. It strongly suggests packaging of multiple facilities under a single contract. However, such packaging must be weighed against the logistical problems associated with the scattered facility locations described above.

Systems building is also a potential option. Various precast concrete systems have been applied to correctional facilities in other parts of the country. It is not clear if such systems would be competitive for the particular project, but it would be advantageous to allow for the

possibility of such systems to compete with conventional construction methods.

10.2 DCPO's Decision Process

The following section will outline the various alternatives which DCPO considered, how they were assessed and what lead DCPO to the decision to use design-build.

10.2.1 Traditional Method and Possible Modifications

Figure 10c shows the typical duration of each major step in the DCPO's standard procurement process. This process does not include selection of pre-design consultants and pre-design study which typically add an additional six to twelve months to the process, bringing the total project delivery time to 45-60 months.

Various opportunities exist to shorten the duration of many activities while still maintaining the traditional design-bid-build method. Designer selection can be expedited. Design time can be reduced both by accelerating it and by holding concurrent, rather than sequential design reviews. Bid and award time can be reduced, especially through faster contract processing once an award is made. Finally, construction can be expedited in many cases, even without fast-track scheduling through efficient contract administration; change order processing; pre-qualifying contractors with superior track records for fast

completions; early completion bonuses; and stricter enforcement of liquidated damages for late completion.

Some of these measures have been successfully taken at DCPO. Designer selection time has been reduced to as little as one month. On a recent \$ 30 M hospital project, design was completed in five months by holding intensive concurrent reviews, adapting documents from a previous job, and providing a bonus to the designer for early completion. Similar bidding and construction time savings have been achieved on other isolated projects.

The main constraint to this sort of acceleration of the traditional method is lack of the exceptional resources and effort required. The example of the five month design for a \$30 M project involved using the very best project managers from DCPO and one of the best design firms in the area. Everybody involved devoted themselves almost exclusively to the project, at the expense of others. The feeling was that it might be possible to accelerate a few exceptional projects in this manner, but that it would be impossible to do it routinely (Poody, 1986).

Although, in principle, the other reforms and modifications to DCPO's traditional method might have been possible, they would have required very difficult, time-consuming institutional change, and, in some cases, legislative action. DCPO felt that it would be more practical to effect change through a new, radical departure

Figure 10 c. Duration of DCPO Traditional Process

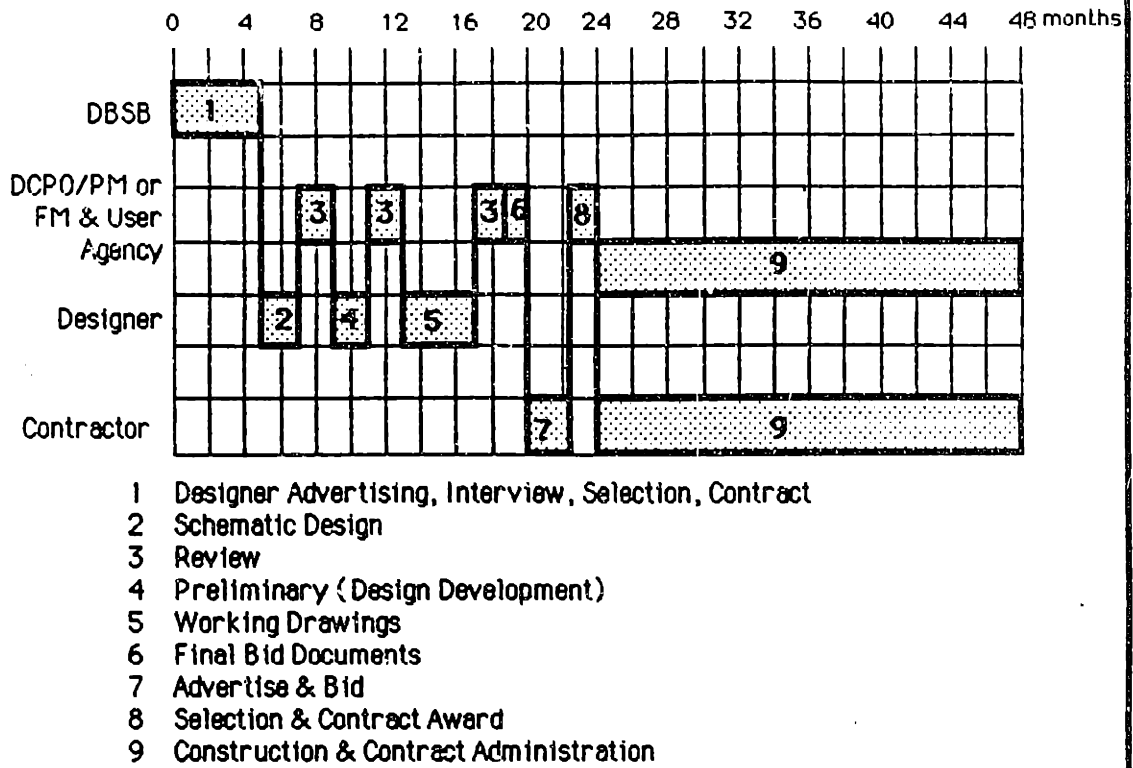
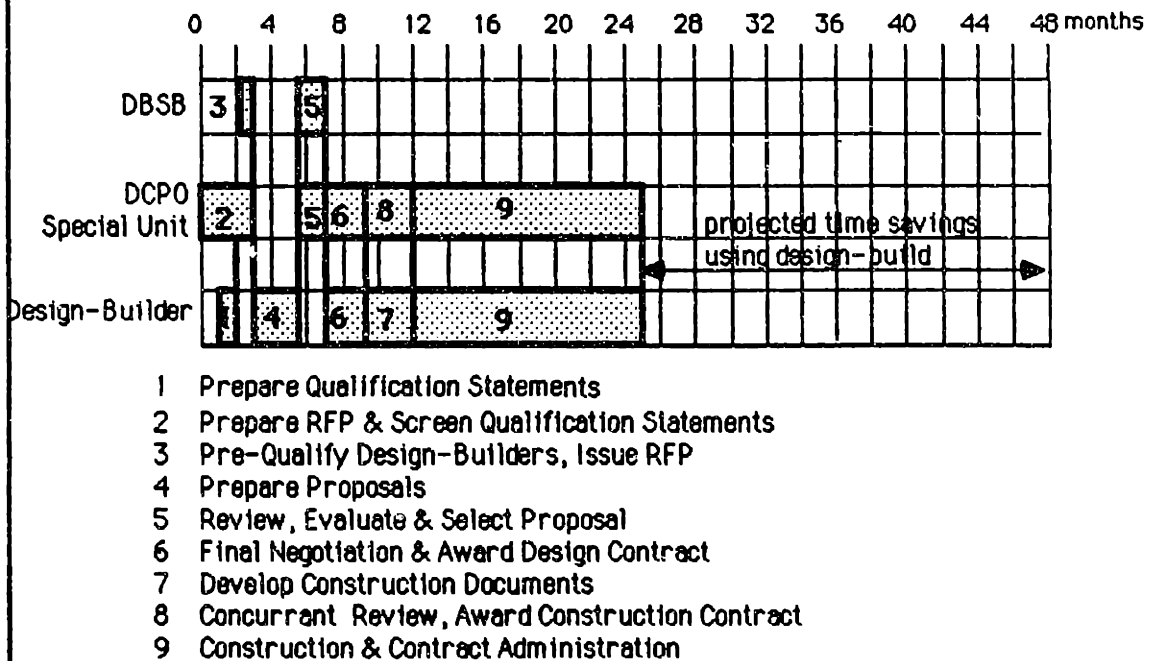


Figure 10d. Design-Build Process as Proposed by DCPO



from the status quo,-- a true "alternate" procurement method, rather than through incremental reform of existing practices.

10.2.2 Fast Track and Construction Mangement

Fast track scheduling with and without an outside CM were considered and rejected. Although DCPO estimated that fast track could potentially save as much as eight months on the projects, it felt that the process would be difficult to control and too risky. This was based on previous experience with fast-track jobs, which resulted in excessive change orders and claims stemming from late design changes and lack of coordination between prime contractors. The general feeling was that the state simply couldn't handle fast-track in this form. (Lee, 1986)

CM was also rejected because of negative past experiences, the most notable of which was a very large CM contract which was given to the firm of MBM to manage a \$ 130 M project for the Boston campus of the University of Massachusetts in the mid-1970's. The CM arrangement was similar to the one used by GSA. The MBM contract was the subject of two volumes of the Ward Commission Report, which documented extensive corruption involved in obtaining and negotiating the CM contract. This gave CM an extremely bad reputation not only within DCPO, but among the legislature and with public at large.

In fairness, it should be pointed out that the Ward

Commission concluded that MBM's actual performance was good. The project was completed within budget and basically on time at an acceptable level of quality. The Commission felt that MBM's services were generally a benefit to the project. Most of the criticism cited in the Commission's report dealt with the corrupt way in which the CM contract was obtained and negotiated, not with the CM's performance.

In spite of this, DCPO felt that CM would not be politically acceptable at the time. DCPO officials also echoed some of the same problems with CM that GSA experienced, such as confusion over responsibility and authority between government PM and outside CM. The contractor-CM approach with a GMP was also rejected because of accountability problems associated with negotiating a GMP with a sole source, the CM. The officials felt that DCPO was not in a strong enough negotiating position to effectively deal with a large contractor-CM. Some officials indicated that CM, possibly using some sort of contractor/GMP approach may be considered for certain projects in the future. (Lee, Carlson, 1986).

10.2.3 Prefabricated and Modular Systems

From the research which DCPO carried out on existing industrialized systems for correctional facilities, it appeared that some of these systems offered maximum time saving potential, possibly reducing total delivery time to as little as eighteen months. The problem with using a

single proprietary system was seen as lack of fair competition. There was also a question of how cost effective the systems would be compared to conventional construction. In the end, systems were not rejected as such, but the design-build approach using a performance oriented specification in the RFP was seen as allowing for possible systems application while still maintaining competition.

10.2.4 Design-Build

The "decision tree" used by DCPO which led to design-build seems to have resembled the one shown in figure 6e.2. This process was not explicitly stated in any of the formal documentation available, but was implied through various interviews and conversations with people involved in the decision process.

Summarizing this decision tree yields the following sequence:

--DCPO was not bound absolutely to use the traditional method and had an explicit legal mandate to investigate alternate methods.

--Early delivery was extremely important. Indications were that the desired delivery schedule could not be achieved using the traditional method. Although it might have been possible to modify and accelerate the traditional method on

a limited number of projects, it was considered unfeasible to do it on the scale required for all the projects being considered due to limited resources and institutional constraints which could not be modified without considerable time and effort.

--Fast track was identified as a potential means of saving significant amount of time.

--The DCPO felt that it could not handle fast-track using in-house construction management owing to cost uncertainty and other risks associated with multiple prime contracts.

--CM based on the designer/GSA model was rejected partly because it was politically unacceptable because it had been associated with graft and corruption in the past and partly due to the difficulty of integrating an outside CM with the DCPO in-house organization.

--CM based on the contractor model using a GMP and having the CM bear the risk of multiple specialty contracts was rejected because it involved essentially a sole source negotiation. DCPO felt that it could not negotiate a GMP without raising accountability questions. This option however was reserved as a possibility in the future.

--Systems could also potentially save time, but again, sole source negotiation was considered unacceptable. The only way to use existing systems would be to allow competition based on some type of performance specification.

--The only remaining way to achieve early delivery through fast-track and/or application of existing systems was design-build. The critical issue was the extent to which the scope and technical requirements of the projects could be defined in terms of performance specifications and generic standards. Although DCPO recognized that the projects were not ideal candidates for design-build in this sense, decision makers felt confident that an adequate RFP could be developed. DCPO's strong programming capability was seen as an advantage in this area.

The primary appeal of design-build was in the single responsibility contract and full integration of design and construction. It was felt that even without fast-tracking, design-build would be inherently faster due to strong motivation to accelerate design, enhanced time/value engineering and constructability input during design, and better construction pre-planning, if not actual fast-tracking.

A secondary issue concerned the packaging of the projects. Since none of the projects alone were felt to be large enough to attract the caliber of design-builders DCPO felt it wanted, DCPO decided to package multiple projects in a single contract. DCPO considered packaging all the low security facilities together under a single design-build contract and do MCI Concord as a separate contract using traditional procurement. This made sense programmatically,

since the minimum security and pre-release centers were more straight forward and had common technical requirements. However, DCPO decided that the geographic dispersion of the different project sites made this logistically impractical. The only way to obtain the required aggregate contract value and maintain reasonable proximity between sites was to include MCI Concord and Bay State Correctional Center. Since South Middlesex Pre-Release Center was between the two sites, it too was included. It was then decided to procure the remaining facilities under the traditional method, assuming that small, local contractors would be most competitive on this basis.

10.3 Specific Features of DCPO's Recommendation for Design-Build

Once the basic decision to use design-build was made, a number of specific issues had to be addressed. These mainly concerned the need for assuring public accountability. Top DCPO officials and staff attempted to carefully "think through" each step to the design-build process, anticipating critical issues and potential problems.

The RFP was recognized as the most critical component in the process to assure quality and value. This message came out repeatedly in meetings and interviews with various professionals familiar with design-build and turnkey projects. The RFP was envisioned as a detailed, "tight"

document. DCPO was not looking for innovation, per se, in this case, but primarily efficient use of existing technology and speed within an acceptable level of quality. In light of this, DCPO felt that it was better to err on the side of being overly prescriptive, rather than too open in defining project requirements in the RFP. As one official from the California Department of General Services half jokingly put it, when contacted by DCPO about his agency's experience with design-build, "Make sure you go out with a good set of working drawings in your RFP." (Lee, 1986). In hindsight, DCPO may have underestimated how difficult it would be to actually develop a workable set of performance requirements for the projects. This will be discussed in detail in chapter 13.0.

The problem of assuring fairness and accountability in the selection process was addressed through several features. First, DCPO proposed creating a special Design-Build Selection Board (DBSB) modeled after the existing Designer Selection Board (DSB). The DSB had proven to be a workable and effective instrument for ensuring accountability in the subjective, non-quantifiable designer process. The DBSB would be comprised of experts in the areas of public sector development, design, construction and corrections. Board members would be from outside the state government and with no outside interest in the project. Second, DBSB would prequalify up to six design-builders prior to issuing the RFP. This to ensure a minimum level of performance and

integrity in the teams . As a practical feature, this also would limit the number of proposals to review while still maintaining reasonable competition. Third, proposals would be evaluated by a set of explicit weighted criteria stated in the RFP. Fourth, as a show of good faith and to enhance the quality of proposals, DCPO proposed compensating all teams making proposals for a portion of their proposal development expenses.

After the winning design-build proposal was selected, DCPO originally envisioned separate design and construction contracts, similar to the approach used by HUD and the NYS Dormitory Authority described in chapter 8.0. DCPO emphasized that this would guarantee that working documents conform to the original proposal. In the unlikely event of a serious misunderstanding over interpretation of the proposal, DCPO stated that the contract could be terminated and a new contract made with the second ranked proposal. (This feature was subsequently dropped for reasons which will be discussed in later chapters.) Other proposed contract provisions included: lump sum, fixed price made with proposal which would not be subject to later negotiation; design-builder to assume full liability for design errors and omissions; full bonding (despite prequalification); liquidated damages for late completion, full warrantee, and other standard construction contract provisions.

To implement the entire process, DCPO would create a dedicated "Special Unit" headed by a Project Director who would be in charge of the project from prequalification through contract completion. This represented a departure from the functional-based organization DCPO normally uses with separate project managers for each major phase of a project. The Special Unit Project Director would have full authority for the project and the entire Special Unit staff. This staff would consist of personnel from various sections of DCPO as well as the user agency, DOC. Outside consultants would also be used to supplement in-house staff. This original conception of the project organization was subsequently modified and will be further discussed in the next chapter.

This concludes the background and original conception of design-build which preceded the implementation of the design-build program. The following chapters will document the actual implementation of the program to date and speculate on future outcomes as it progresses.

CHAPTER 11.0

OWNER SUB-ACTORS AND ORGANIZATION

This chapter will examine the sub-actors and structure of the owner organization for the design-build program. A general overview of this organization will be presented, followed by a detailed analysis of individual sub-actors, sub-organizations and relationships. The chapter will attempt to focus on the unique communication and internal organizational issues created by the design-build project and how they were addressed.

11.1 Overview of the Owner Organization

Figure 6a shows the general, non-phase-specific organization of the design-build Special, Unit in relation to its larger parent organizations. The two major components of the special unit are the Department of Corrections (DOC), the user, and DCPO, the owner's representative and administering agency. The role of the DOC, as user agency, toward DCPO, is basically one of informability (see chapter 2.0). DOC does not implement any procurement tasks or deal directly with any outside consultants or contractors, but rather provides information and feedback to DCPO regarding its facility needs. DCPO is directly responsible for the project and works essentially as an agent on behalf of the user, and of the State as a whole.

organization whose members would report to a Project Director with considerable authority, as well as to their respective regular, functional managers. For various reasons which will be discussed below, the actual organization is a somewhat weaker matrix, with a Project Coordinator, not a Director, acting primarily to facilitate administrative procedures among the unit's members, rather than to actually manage and direct. This organizational pattern is exhibited both at the overall unit level and within individual components of the unit.

The issue of functional versus project orientation of the owner organization is significant in light of the design-build process. Just as design-build implies a high level of integration between designer and contractor, it requires a corresponding level of integration within the owner organization. This is because of the way the programming and design process is restructured in design-build. The user must determine and communicate its needs with more precision, earlier in the programming and design process. Similarly, technical and contractual expertise normally associated with later design and construction phases, must be incorporated into pre-design RFP. The strong, project-oriented matrix originally proposed was meant to promote this kind of integration. The weaker matrix, dominated by lines of functional responsibility, represented a compromise which reduced disruption of the existing, statutory, bureaucratic structure while still addressing the unique

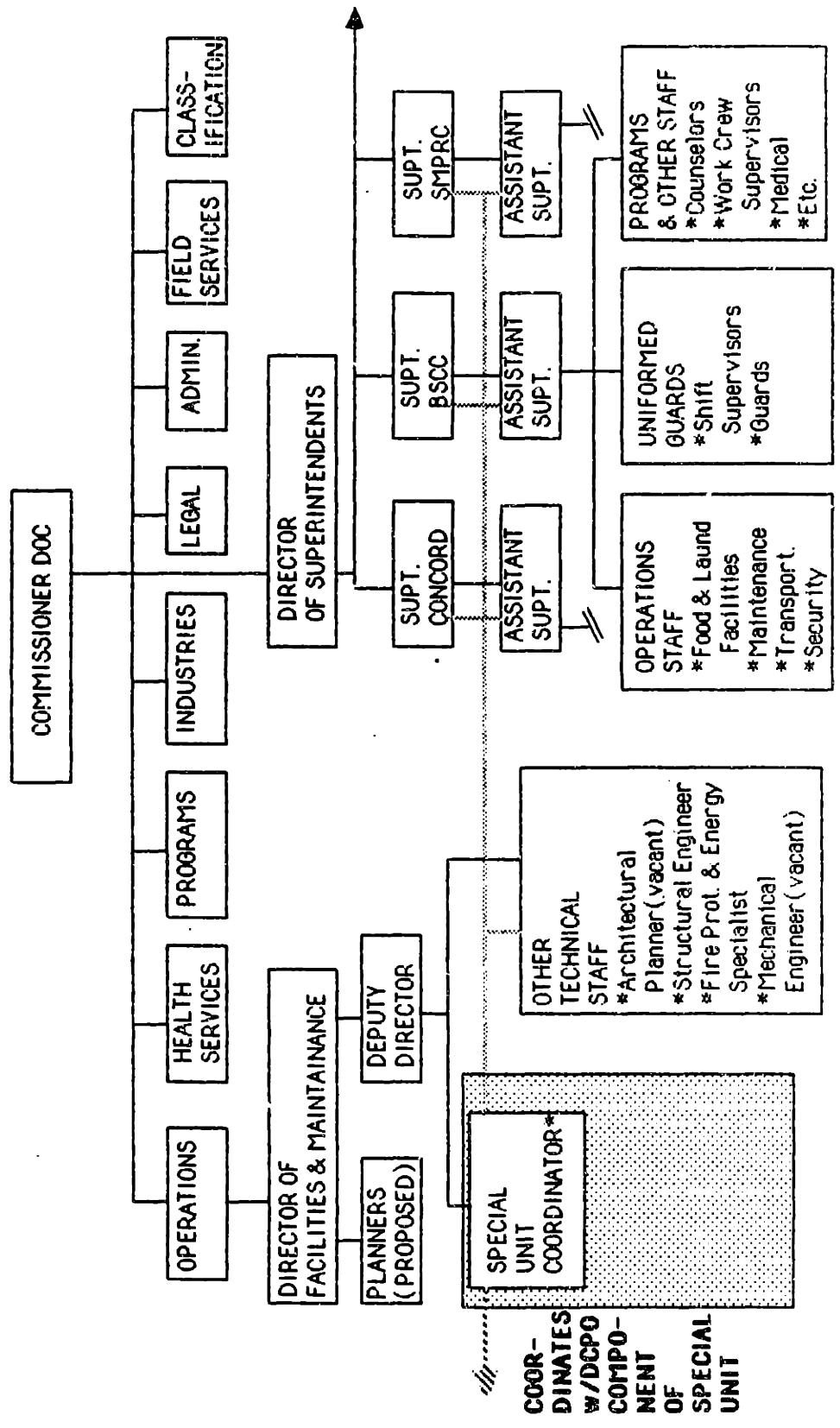
requirements of the design-build project.

11.2 The DOC Organization

Figure 11b shows the detailed organizational structure of DOC and the DOC's portion of the Special Unit. The primary liaison between DOC and DCPO is the Capital Management section of the Operations division. This section is responsible for long range planning, operation and maintenance of DOC facilities, and serves as a point of contact and coordinator to DCPO for new construction. According to the Memorandum of Understanding (MOU) for the design-build project between DOC and DCPO, DOC was to designate a special project coordinator to represent the agency on the Special Unit. This person would be responsible for coordinating programming, technical reviews and site visits-- and other activities related to the project-- among the technical staff within the facilities section, officials at the individual facilities and top management at the division and department level.

Decisions about new program and technical requirements for new facilities are made at a number of levels within DOC. The Commissioner and Deputy Commissioner of Operations set general policy, review and give final approval for all pre-design studies and plans. Much of the detailed information about program requirements comes from the superintendents of

Figure 11 b. Organization of DCPO Divisions Involved with Design-Build Program and Special Unit



the individual facilities and their staffs. Capital

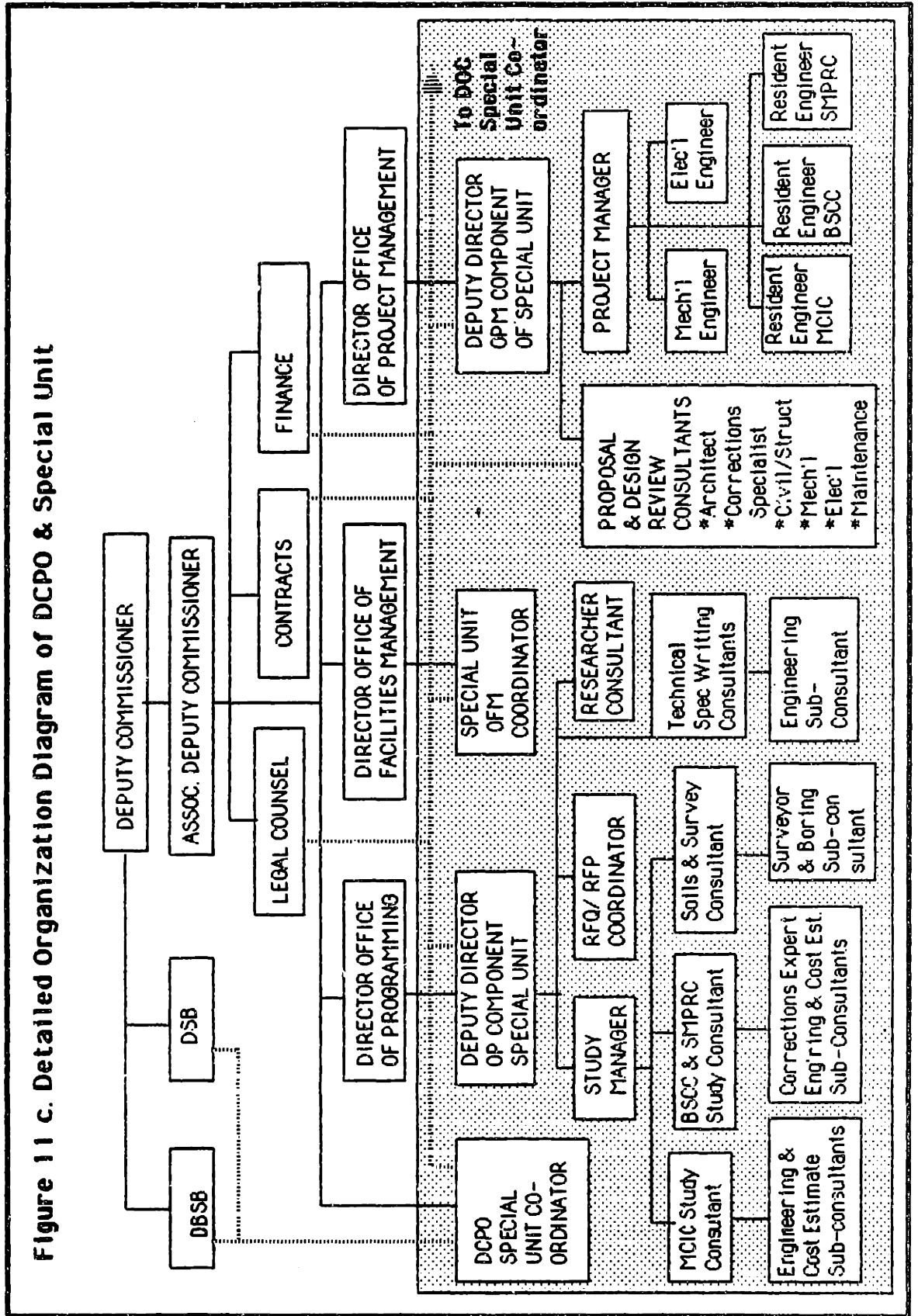
Management has a small technical staff of planner/architects and engineers who also give input into programming and design decisions.

As with any such bureaucratic decision-making process, channels of communication are sometimes distorted and contradictory information is sometimes transmitted. On past correctional facility (and many other) projects, misunderstandings about program and technical requirements have resulted in significant, often costly, changes in late design or even construction. The special DOC design-build Project Coordinator and formal MOU are seen as mechanisms to avoid such problems. Early in the RFP preparation process some minor problems and confusion were experienced. But, since then, new lines of communication and standard procedures both within DOC and between DOC and DCPO have been improved.

11.3 The DCPO Organization

Figure 11c show the detailed organizational chart of DCPO's portion of the Special Unit. The DCPO Special Unit is made up of members from the Office of Programming and the Office of Project Management. These two offices normally carry out quite distinct functions under the DCPO's traditional procurement method. The two offices also have distinctly different types of staff, approaches to work, and general "cultures". Under the design-build process, the functions

Figure 11 c. Detailed Organization Diagram of DCPO & Special Unit



and roles of the two offices overlap, creating the need for

new organizational patterns. This section will discuss these new patterns under design-build, with respect to DCPO's standard functional organization described in section 9. The unique challenges and constraints which the Special Unit faced, and how they were dealt with, will be highlighted.

11.3.1 The Differring Nature of OP and OPM/OFM

The skills, experience, systems, management style and values of OP and OPM/OFM correspond to their functional responsibilities and differ significantly.

OP is a new section that had no counterpart in the old BBC organization. Only two members of its staff worked for the old BBC; the rest of the forty odd staff have been hired in the last four years, over half since 1985. The Director and most of the staff have a background in planning and architecture. Many have advanced degrees and have been educated at MIT. The staff is also fairly young, with few over forty. They are for, the most part, not career civil servants. OP prides itself in its professionalism and has won much praise for the high quality of work it produces. The management style is very open and ad hoc. Free exchange of ideas is encouraged, and there is a certain exuberance and excitement which permeates the office. It is not uncommon to find staff working extra hours to get an important study or special message out.

In contrast to OP, OPM and OFM are largely a reincarnation of the old BBC. Their staffs tends to be older and more experienced, with backgrounds in engineering and construction. Most of the OPM and OFM staff are career state civil servants, many of whom worked for the BBC. The management style of OPM and OFM is much more that of of a typical bureacracy with a clear, hierarchical chain of command. Most activities are governed by standard procedures. In recent years these offices have also made significant progress in raising professional standards and adopting sophisticated management techniques such as automated project control and facility managment systems.

11.3.2 Integration of the Office of Programming and Office of Project Management Components Within the Special Unit

The sequential breakdown of DCPO's traditional program corresponded clearly with the functional breakdown and respective character of OP and OPM described above. However, the sequence of the design-build process and, in particular, the RFP phase, cut across these functional lines.

In theory, DCPO's normal pre-design studies for the three design-build correctional facilities might have served as an adequate basis for the RFP. In practice they were insufficient. This issue will be covered extensively in chapter 13.0, but briefly, the level of project definition required corresponded more to the early and, in some cases,

later design phases of a normal project. The RFP also had to address many unique administrative and contractual issues associated with the design-build process which were not covered by DCPO's standard documents. Since most of DCPO's technical expertise and the ultimate responsibility for administering the design-build contract lay with OPM, it was essential that OPM be integrated into the Special Unit early in the process, while the RFP was being developed.

Originally, DCPO had planned to hire Jack Carlson, a member of the Special Advisory Group for the Alternate Method study, as Project Manager for the Special Unit. It seemed that his background as former owner and CEO of a large design-build firm coupled with his knowledge of DCPO and the projects, made him ideal for the job. Through his involvement with the Alternative Method study he had already established a good working relationship with OP and his understanding of technical design and contracting issues gave him a strong rapport with OP.

Several factors, however, prevented him, or anyone else, from assuming this role. First, there was a problem with the State civil service union. Apparently, union rules prevented an employee who is hired only for a specific project, as Carlson would be, from supervising any other regular civil service employees (Baxter, 1986). A second, more fundamental problem was the issue of legal responsibility for different phases of the project. As described above, Chapter 579 specifically delegated responsibility for certain project

phases to individual Directors rather than the Deputy Commissioner for the whole Division. DCPO officials interpreted this as precluding a single manager having authority over an entire, vertically integrated project team like the Special Unit. (Poodyrey, 1986). In the end, Carlson was hired to be the new Deputy Commissioner, but at the same time, the position of Special Unit Project Manager was changed to Project Coordinator, which, as the title implies, has a lesser degree of responsibility and authority.

Another practical problem which initially prevented OP from actively participating in the RFP was a simple lack of staff. OP had been able to staff its portion of the Special Unit fairly quickly, by using project funds to hire staff members as "03 Consultants",-- temporary consultants hired for a specific project and paid on an hourly basis. OPM which was already somewhat understaffed, could not readily hire 03 consultants due to certain internal policies, and because most potential employees wanted a more permanent status. As a result, the actual project manager for OPM's component of the Special Unit was not hired until a month before the RFP was complete. Prior to that time, the Deputy Director of the Special Unit for OPM, who was already responsible for a number of other large, important projects, could only devote a few hours a week to the Special Unit.

Despite these constraints the Special Unit appears to have developed into an effective project team, successfully

integrating OP and OPM components. Several factors may account for this tentative early success . First, the top management of DCPO, including the Deputy Commissioner(s) and the Directors of OP and OPM, has been very committed to the design-build project as described in previous chapters. Although they did not directly supervise the Special Unit, they did monitor its progress and provided valuable support and guidance when necessary. Second, the OP component of the Special Unit actively sought out the advice and participation of OPM during the development of the RFP. OPM, in turn made a concerted effort to give input and feedback, within their staff constraints. Once a full time OPM Project Manger was hired, this involvement was significantly increased. Third, the Special Unit Coordinator and his assistant facilitated communication and helped with troubleshooting on various administrative tasks. Finally, the DCPO Legal Council's exceptional understanding of legal, institutional and practical aspects of the design-build project and of DCPO's organization proved to be invaluable in drafting the actual design-build contract included in the RFP.

11.4 The "Watchdogs"

In addition to the user agency, DOC and the administrative agency, DCPO, several other key sub-actors are involved in the owner organization. Their primary role is to assure public accountability. These sub-actors include the Design-

Build Selection Board (DBSB); and their counterpart, the regular Designer Selection Board (DSB); the Inspector General (IG); and the Press. By the nature of their role, these sub-actors remain somewhat detached from the main project organization. This section will briefly describe the specific role and character of each of these sub-actors and their relation to the design-build project.

11.4.1 The Design-Build Selection Board (DBSB) and the Design Selection Board (DSB)

The DBSB was created specifically for the design-build project, as a board of distinguished outside experts who would review, evaluate and rank design-build teams for prequalification and, later, for proposals themselves. Technically, the DBSB does not have direct authority to prequalify or select winning proposals. This power remains with the Deputy Commissioner of DCPO himself. However, the DBSB has defacto authority since the Deputy Commissioner would only override the DBSB's recommendation in an extremely unusual situation, and for very good reason.

The members of the DBSB were invited to serve on the board and recommended to the Governor for approval by the Deputy Commissioner. A major constraint in forming the DBSB was finding potential members who were knowledgeable in the issues surrounding the design-build project, yet were not interested in actually participating in it as consultants or members of design-build teams. Eventually, a group of highly

qualified individuals was assembled. The members are:

Peter Forbes, FAIA: a private architect with his own firm. He served on the Ward Commission, the Alternative Methods Advisory Group and currently serves on the DSB.

Gary Mote, AIA: former Assistant Director of the Federal Bureau of Prisons, now a private consultant and expert on correctional facility design.

Henry G. Irwig: an architect, now a senior executive for the construction subsidiary of a large Boston based development and construction firm and part time lecturer in construction management and organizational theory at MIT. He also served on the Alternative Methods Professional advisory Board.

Richard Gourdeau: President and owner of a medium sized local construction company which has done numerous design-build projects.

Lewis Harry Spence: an attorney and project director for a large private real estate developer. Previously he was Director of the Boston Housing Authority which had procured a number of projects on a turnkey basis.

Of all the "watchdogs", the DBSB is the most actively and directly involved with the Special Unit and with DCPO as a whole. The DBSB is, in a sense, a voluntary, internal check for DCPO. DCPO officials regard the relationship with the DBSB as very delicate and sensitive. On one hand, they must

maintain a kind of arms-length relationship in order to preserve the Board's objectivity. Yet the DBSB and DCPO must also have a fundamentally cooperative and supportive relationship to ensure that each understands the other's requirements and acts consistently with them. In particular, DCPO was concerned about not giving enough guidance and direction to the DBSB, for fear of possible misunderstanding which could result in sub-optimal decisions. At the same time, DCPO was wary of over-directing the DBSB which could alienate the members or diminish the Board's value as an objective, independent decision-making body.

DCPO dealt with this potential problem through a series of meetings between the Special Unit and the DBSB prior to prequalification and issuing the RFP. The DBSB has a very active and positive interest in the project and was quite responsive to these efforts, by developing evaluation criteria and giving feed-back about the RFP in general. The Special Unit, in turn, has attempted to provide as much support as possible to the board by pre-screening and summarizing the extensive amount of information which the board has to deal with.

The DSB emerged as a more significant sub-actor in the pre-qualification process, than was originally anticipated. As part of the design-build prequalification process design components of design-build teams were screened by the DSB. This step, which had been seen as a formality by DCPO, turned out to be a major part of the process-- with the DSB

holding extensive interviews and actually disqualifying one designer. In part, this may have been a subtle way for the DSB to assert its own authority and, in a sense, the importance of design professionals in the design-build process. In the future DCPO will probably try to better integrate the DSB into the design-build process.

11.4.2 The Inspector General (IG)

The IG is a sort of general "watchdog" over public procurement practices within the state. The Office of the Inspector General was created, on the recommendation of the Ward Commission, as an independent office dedicated to preventing "waste, fraud and abuse". The IG is appointed by a majority vote of the Governor, Attorney General and State Auditor, and serves for a five year term. The IG has had a special interest in DCPO, owing to the Ward Commission Report, and tends to scrutinize DCPO more closely than it normally would other state agencies. DCPO has similarly developed a heightened sensitivity to this scrutiny and has made an extra effort to respond to the concerns of the IG. The relationship between the IG and DCPO is necessarily an "arms length" one, but despite occasional friction, it appears to be cooperative and non-adversarial.

The IG's involvement with the design-build project began with the Alternate Method study. The IG reviewed the Alternate Method Report, and recommended certain that

accountability measures be incorporated in the design-build process outlined by the report.

Since the project formally began, the IG has monitored the project on three levels: managerial, legal and technical. To date this monitoring has specifically included review of the RFP, sitting in on DBSB meetings, review of pre-qualification selections, and review of the RFP. The IG has been especially active in reviewing the evaluation criteria in the RFP. (This will be discussed more in chapter 14.) It will continue to monitor the project intensively, especially during the proposal selection and early phases of the contract.

11.4.3 The Press

The public press remains the ultimate "de facto" watchdog over all government activities, including DCPO and the design-build project. Tunney Lee once remarked that he regarded the true test of public accountability was not defending his actions before the IG or the Legislature, but before a group of cynical reporters! (Lee, 1986)

A thorough discussion of the complex relationship between DCPO and the press is beyond the scope of thesis. But it is mentioned here because it is considered a very important factor by top DCPO officials. Even when the press has not become actively involved in a particular issue or project, DCPO officials must temper their actions and decisions with

the knowledge that they may be held accountable by the press. At the same time, the press also represents a potential channel of appeal when agencies like DCPO face opposition to their intentions from within the government. In this respect, the press can be seen as an alternate standard of accountability which may actually be more liberal than certain actors within the government.

CHAPTER 12.0

THE DESIGN-BUILD TEAMS AND THE PREQUALIFICATION PROCESS

This chapter will deal with organizational issues surrounding the design-build team and the prequalification process. Critical issues will be discussed. Then the prequalification process will be described including the Request for Qualifications (RFQ), the design-build teams themselves and the final prequalification selection by the DBSB.

Due to the author's role within the owner organization, it was not possible to gain an insider's point of view of the teams. Most of the information on the teams came from the qualification statements submitted in response to the RFQ. Reference material on the prequalification process came from working on the RFQ, summary reports on the DBSB decision and conversations with individuals on or involved with the DBSB (Irwig, Nally, 1986). In order to preserve confidentiality, the actual identities of the teams will be concealed when discussing specific team qualifications and DBSB evaluations.

12.1 Critical Organizational Issues

12.1.1 Skills, Resources and Logistics

Perhaps the most important factor in determining team composition and organization are the set of skills and resources required for the project. These included not only general architecture, engineering and construction capabilities, but also special capabilities in correctional facilities as well as local presence and knowledge.

The corrections capability appears particularly critical for the design component of the team, especially given the accelerated proposal development and design schedule. The consensus among DCPO decision makers which was also reflected by the team compositions, was that a good general contractor does not necessarily need prior experience to build a prison since its main role is to manage the overall project, and that specialized prison construction such as security systems and hardware would be done by trade sub-contractors and suppliers. However it was considered essential that the designer, or some component of the designer sub-team, have strong past experience with correctional facilities.

Conversely, local knowledge and presence is considered more essential for the contractor component of the teams. The contractor must have contacts and established relationships with local specialty sub-contractors, trade unions and suppliers. Logistical support during the construction phase

of the project is also more difficult and suggests close physical proximity to the project site(s). Whereas design activities can be more easily accomplished in a removed location using telecommunication and limited travelling for key individuals. Assuming that the contractor provides overall project management and team leadership, it is more essential that he/she be easily accessible to the owner organization on a day to day basis.

12.1.2 Motivations

The motivations of the design-build teams are difficult to assess, since they are not explicitly stated or transparent to the owner. It is possible to speculate, however, on what these could be. The immediate, short term motive of the overall team as well as its individual components is financial profit on the project. The aggregate value of the contract is estimated to be approximately \$17M. Assuming roughly 5% design fee, this revenue would be split \$ 0.9/15.8 M between the designer and contractor. With profit on construction of the order of 5%, this translates to a \$ 0.8 M profit for the contractor. Design profit margin may be higher. While the above analysis is, admittedly, oversimplified superficial, it gives an idea of the magnitude of financial risks and rewards involved.

There are also a number of possible long term strategic and non-financial motives. As previously mentioned, corrections

facilities appear to be a growing construction market nationwide. In Massachusetts alone, approximately \$ 250 M has been appropriated for correctional facilities capital improvements over the next five years. In particular, a design-build contract for a \$60 M new Suffolk County Jail is expected to be awarded in 1987. It is quite possible that various design-builds team view the present project as a way of entering or improving their positions in the corrections facilities market in general and for the Suffolk County Jail in particular. Besides corrections facilities, Massachusetts will be spending on the order of \$ 200M annually on new construction over the next several years. Participation in the design-build project, even if a team loses, is apt to create a certain amount of goodwill and gain exposure to top DCPO decision makers which, may improve chances for getting other state jobs in the future.

For the designers, a secondary motivation may be professional challenge. Although prisons are not glamorous, high visibility projects, many designers are genuinely excited by the unique problem of creating more humane and positive correctional environments. The AIA. has a special Criminal Justice Committee devoted to this problem and various awards are given out regularly for outstanding correctional facility designs.

12.1.3 Relationships Among Team Members

The idealized design-build team was considered by DCPO to be a single, vertically integrated design-build company which has both corrections experience and local presence (Carlson, 1986). Since no such organization apparently exists, prospective designers and builders had to assemble teams or joint ventures made up of separate design and construction firms. In fact, no team was apparently able to assemble all the necessary skills and resources between a single designer and contractor. In all cases, the teams include either two major design firms or contractors.

Given the composite nature of the teams, past joint experience among team members becomes very important to ensure compatibility and integration of the team. Ideally, this should be experience working under similar design-build relationships in the past, but may also include working on the same project under other relationships such as CM or traditional. Moreover, individual key personnel as well as the firms as a whole should, ideally have prior experience working as a team. DCPO is especially concerned about this in light of the much-publicized Worcester Centrum project several years ago. This project involved a "package deal" in which the city of Worcester, MA contracted with a joint venture comprised of a designer, developer and contractor to build a large convention center. Midway through the project the joint venture apparently experienced some serious internal disputes which ultimately led to bankruptcy and default on the contract. (Corriea, 1986)

Overall team leadership and project management is an important issue. In all cases, this role is assumed by the contractor component, with the designer acting as a sub-contractor and essentially a subordinate to the contractor. The strong versus weak matrix issue described in chapter 11.0, in terms of the owner organization, is also applicable to the design-build team. The need for overall project management and integration of different team members must be balanced by the need for a certain amount of autonomy among the members. The designer, in particular, is in an inherently weaker position within the organization and runs the risk of being overly dominated by the contractor.

Mechanisms for achieving balanced integration of team members must be provided both on a strategic and functional level. Strategically, this may include mechanisms for top management of each team member to monitor the project and confer among each other. Functionally, this includes clear channels of communication among the middle and lower managers, and between individual team members. Such channels may include standard reporting procedures, project control systems for time, cost and quality, standard project reviews, meetings as well as various physical communication systems and networks.

Finally, the design-build team organization must address the specific project and facilities involved and the owner organization. The three facilities with distinct programs,

technical requirements and locations suggest at least a partial differentiation of both design and construction team members. The unique features of the owner organization, including the distinct user and administrating agencies, the somewhat fragmented decision-making authority and process, and other considerations must be recognized by the design-build team.

12.1.4 Risks

The design-build teams face a number of risks; foremost is the chance of making an unsuccessful proposal. The cost of proposal development has been estimated at anywhere from .5 to 2% of the total contract value, or \$ 80 to 380 K. The \$ 50 K honorarium which DCPO plans to give to each team for its proposal will only partially offset this. Applying the risk analysis decision tree shown in Figure 7e and assuming also that the teams have a fairly linear utility function for this range of potential profits and losses, making a proposal would have a positive value as long as the number of teams making proposals does not exceed about five. Of course this number may vary according to the team's actual assumptions about costs and profit and the actual utility function of the team.

The costs of proposal development must also be offset by other marketing costs which would otherwise be incurred to obtain work. For the contractor this includes

competitive bidding and negotiation; for the designer it is also likely to include a considerable amount of expenses for developing presentations, publications and entertainment. Moreover, even if the proposal is unsuccessful, some of the strategic and non-financial benefits described above still may be realized.

If the proposal is successful, a whole new set of risks must be considered which will determine the final profitability of the job. These include the risks discussed in chapters 7.0 and 8.0, most notably the risks resulting from basing a fixed price on a lower than normal level of design definition, and the related risks of disputes over interpretation of the proposal during design-development.

There is also a question as to how these costs and risks will be shared between the designer and contractor. It would appear that the designers are being asked to bear most of the proposal preparation costs, assuming that the contractor is not actually paying the designers to prepare the proposals (which DCPO does not know for sure). If this is the case, one would expect the fee for design work, if the proposal is selected, to be calculated to compensate for the extra risk and expense the designer incurs during proposal development.

This relates to the ethical issues discussed already in section 7.3. The designers are not exactly providing "free" work since, at a minimum, they will receive an honorarium.

But there is no pretence that this honorarium will cover true costs of the work or is in line with a normal scale of professional fees. To justify this situation in terms of professional ethics, the designers must view the designbuild proposal as a design competition. Yet it is not really a true design competition since selection will be based on cost, time and other factors as well as design quality. In this respect, the designer must view the contractor as a client, analogous to a developer, who is marketing a product to a third party, ie. the State. In strict ethical terms, the designer has no business providing work at discounted prices under these circumstances. It is not clear if, or how, this subtle ambiguity will affect the the designer-contractor relationship, but it would seem to be a potential problem.

Once a contract is awarded, the successful team must determine how risks and rewards will be shared. Based on the concepts put forth in section 6.4, one would expect the designer and contractor to accept the cost risks of their respective activities, implying some sort of fixed price sub-contract between the contractor and the designer, with the contractor accepting most profit risk for the project. However-- to the extent that construction costs will be affected by design work, especially errors and omissions; and scope of design may be affected by the contractor, in terms of design revisions for value engineering-- the designer may also be asked to share a certain amount of

profit or equity risk for the overall project. Such sharing in profit risks and rewards by the designer may provide a strong incentive for the designer to perform in terms of timeliness and constructability of its design work. However it also would tend to create more potential conflict of interest for the designer as described in section 7.3. Unfortunately, DCPO, as the owner, is not in a good position to know the details of this aspect of the designer-contractor relationship.

12.2 The Prequalification Process

Having described the critical issues surrounding the design-build team organization in general terms in the previous section, this section will apply these issues to the actual prequalification process for the project.

12.2.1 Developing the Request for Qualifications (RFQ)

Developing the RFQ was a fairly straightforward process which was carried out primarily by the OP component of the Special Unit. The DBSB did not actively participate in developing the RFQ because the actual appointments of its members was not finalized until after the RFQ was issued. This resulted in certain prequalification evaluation criteria contained in the RFQ being slightly modified during the DBSB review. This will be discussed below.

Despite an attempt to keep the volume of the RFQ and

submission requirements to a minimum, the final requirements were fairly extensive. In addition to standard DSB and DCPO Contractor Qualification statements, the RFQ required the following submission documentation:

	DESIGNER =====	BUILDER =====	D-B TEAM =====
* Listing of relevant past projects -correctional facilities -institutional facilities -public projects -Massachusetts projects	X	X	X
* Time/cost performance on same -time and cost variance between original estimate, bid and completed project	X	X	X
* References (client and business)	X	X	X
* History of firm or team	X	X	X
* Financial relationship for project			X
* Financial relationship in past			X
* Automated systems for project	X	X	X
* Other resources for project	X	X	X
* Organizational chart and description of project team	X	X	X
* Offices working on project and their role	X	X	X
* Key personnel and consultants	X	X	X
* Time, Quality and Cost control systems for project	X	X	X
* Financial Statement/legal status pending claims, etc.	X	X	

The stated prequalification evaluation criteria in the RFQ was as follows:

	DESIGNER =====	BUILDER =====	D-B TEAM =====
* Relevant experience -correctional facilities -similar size projects -design-build projects	X	X	X
* Quality of work/reputation	X	X	X
* Project management capability	X	X	X
* Available resources	X	X	X
* Working relationship among team members	X		
* Firm stability (financial, legal)		X	
* Design-build approach			X
* Project organization & mangement			X
* Key personnel			X

None of these factors where specifically weighted or prioritized in the RFQ. Obviously certain factors also overlapped.

In addition to the written submission requirements, the design-build teams were also interviewed. The interviews were officially conducted by the DSB for the designer components of the teams, however the interview sessions were also attended by members of the DBSB and the builder components of the teams. Members of the design-build board reported that the interviews were extremely useful and that in many cases the teams projected a significantly different

image than they did through their written submissions.

12.2.2 The Design-Build Teams

The RFQ was publicly advertised in leading trade publications.

Approximately forty RFQ were picked up and seven were actually submitted. This was a somewhat smaller number than was originally anticipated. It is possible that prospective teams were either put off by or unable to complete the extensive submission requirements (Feldstein, 1986). It is also possible that teams purposely held off in anticipation of the much larger Suffolk County Jail design-build project and because the present design-build project was not attractive enough due to the multiple sites/facilities, renovation work, mixed security levels, etc..

With the exception of one team which was disqualified during designer screening, all the teams which did submit qualification statements appeared to be highly qualified, with well established, in many cases nationally recognized, designers and ENR "Top 400" contractors. All had worked together on previous projects, although not necessarily in a designbuild relationship.

The following is a brief description of the four teams which were prequalified. (Note: To preserve anonymity, the teams will be referred to as I, II, III and IV. Contractors will be

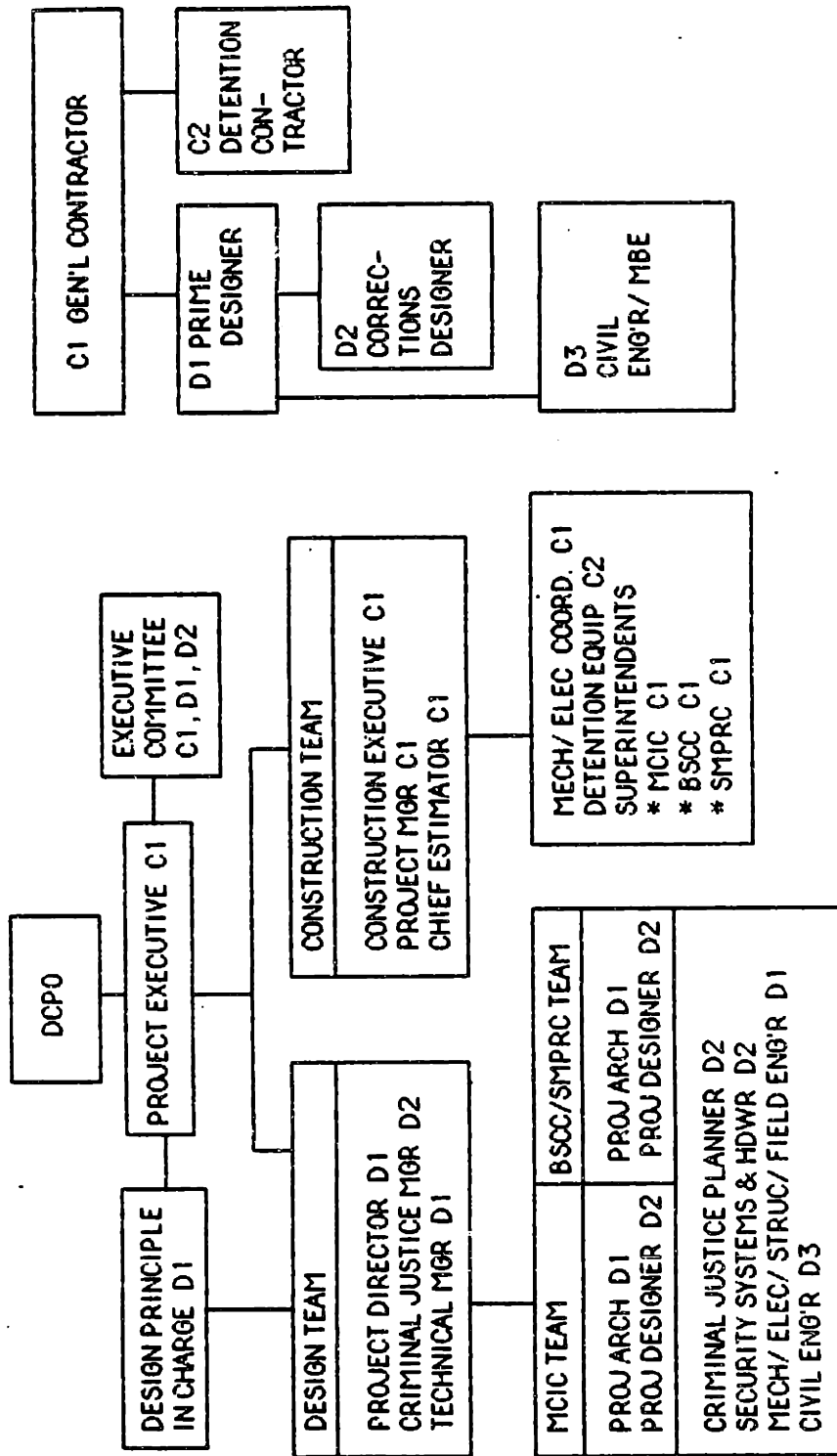
C1..n and designers D1..n)

* Team I: This team consisted of a locally based general contractor, C1; a locally based detention equipment specialty sub-contractor, C2; a locally based prime designer, D1; a national corrections specialist sub-designer, D2 and a locally based minority business enterprise (MBE) engineering specialist sub-designer, D3.

C1 handles overall project management and prime liason with DCPO. A special executive committee comprised of top executives from C1, D1 and D2 provides support and guidance to the project executive from C1. Although technically D1 is the prime designer and D2 a sub-designer, the organization indicates a strong team approach. D1 handles detailed architectural design and general mechanical, electrical and structural engineering, while D2 is primarily responsible for general schematic design, and all detailed design and engineering related to security and detention specialties.

C1 provides cost estimating, scheduling, value engineering and mechanical/electircal engineering coordination during preconstruction phases. During the construction phase, C1 provides general purchasing, construction administration, time/cost/quality control and field supervision. C2, the only identified sub-contractor provides similar functions relating to security and detention specialties.

Figure 12 a. Organization/ Contractual Arrangement: Team I



Contractual Arrangement

Organizational Structure

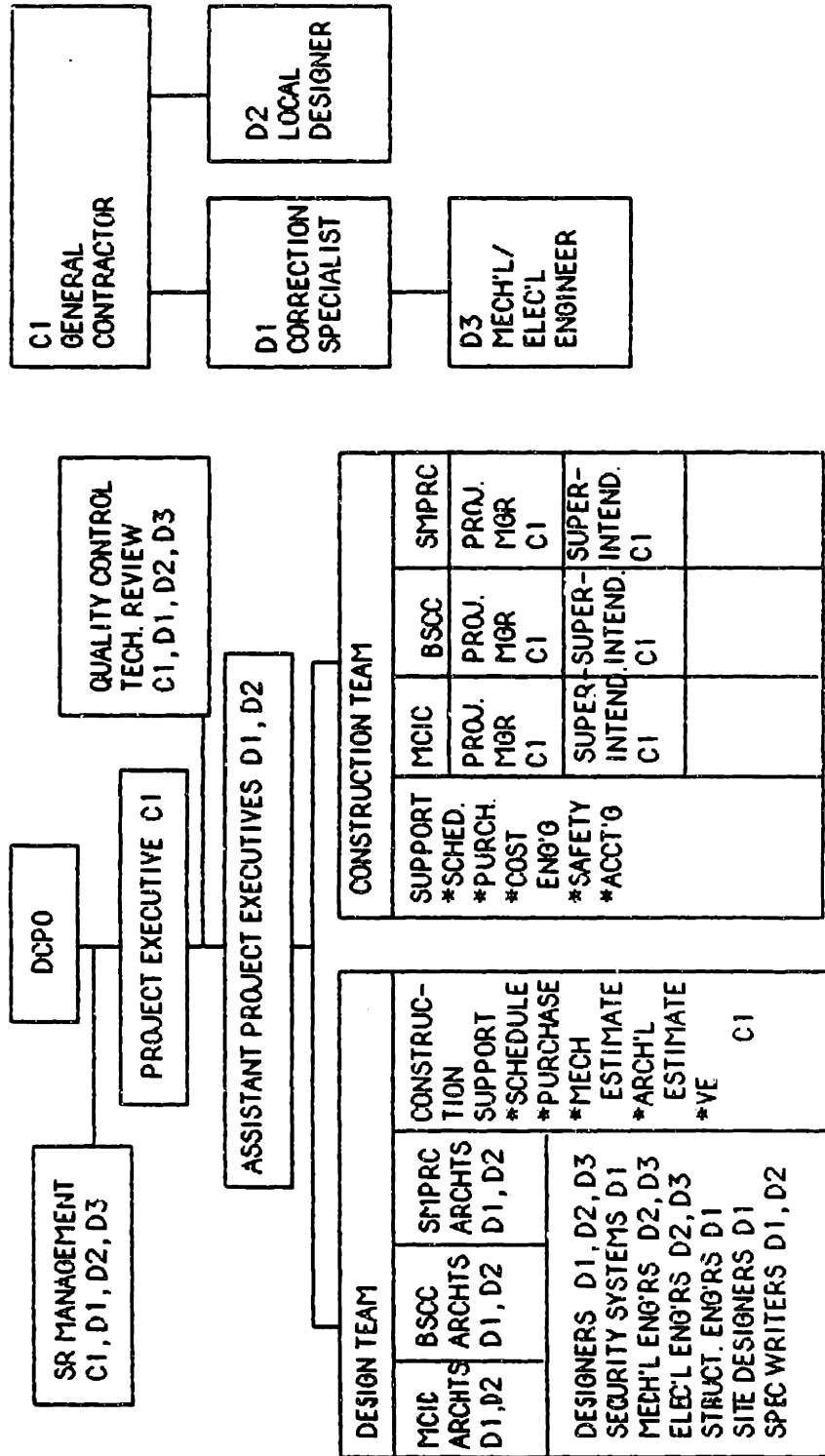
* Team II: This team is similar to Team I except no

security/detention equipment specialty sub-contractor is named. Presumably this is because the prime contractor, C1 has fairly extensive corrections experience, unlike the prime contractor in Team I. The other major difference is that C1 sub contracts with both local designer, D1 and corrections specialty designer, D2 directly. A mechanical/electrical sub-designer under D1 is also shown. Like Team I, Team II also indicates a high level executive project committee with representatives from C1, D1, D2 and D3 as well as a separate high level quality control and executive review committee.

The breakdown of functional responsibilities is almost identical to Team I, with D1 providing general design and engineering and D2 providing schematic and specialized corrections design and engineering. C1 provides a similar set of CM-like pre-construction functions as in Team I.

* Team III: This team also has C1, a locally based general contractor as prime contractor and overall project manager with two designers, D1 a local A&E and D2 a national corrections specialist which is technically a sub-designer under D1. There are no formal executive project committees indicated as in Teams I and II. However, C1's organization is somewhat more articulated, with a formal project planner/estimator and separate support staff for preconstruction functions. The breakdown of functional responsibilities for Team III is almost identical to Team II's.

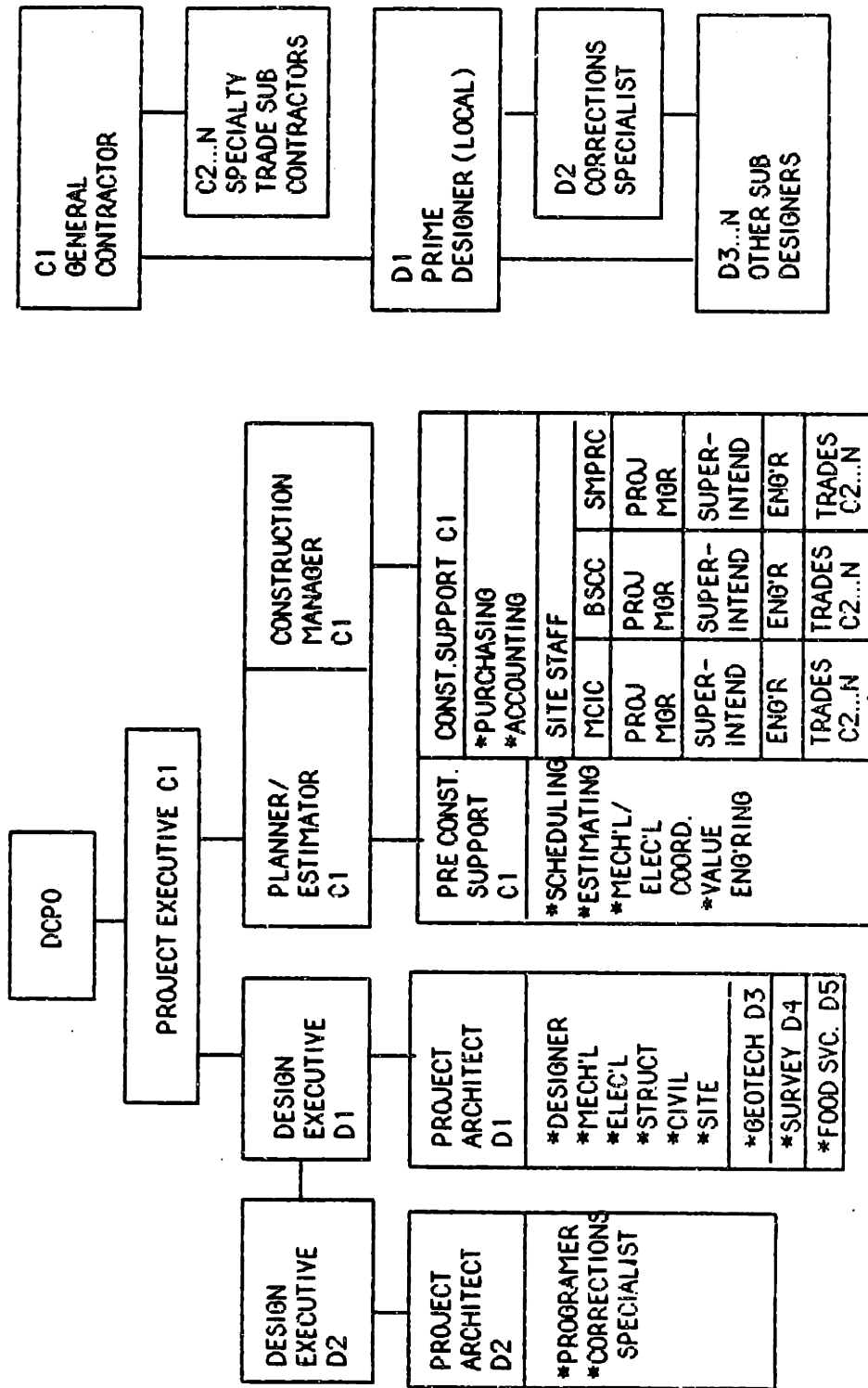
Figure 12 b. Organization/ Contractual Arrangement: Team II



Contractual Arrangement

Organizational Structure

Figure 12 c. Organization/ Contractual Arrangement: Team III



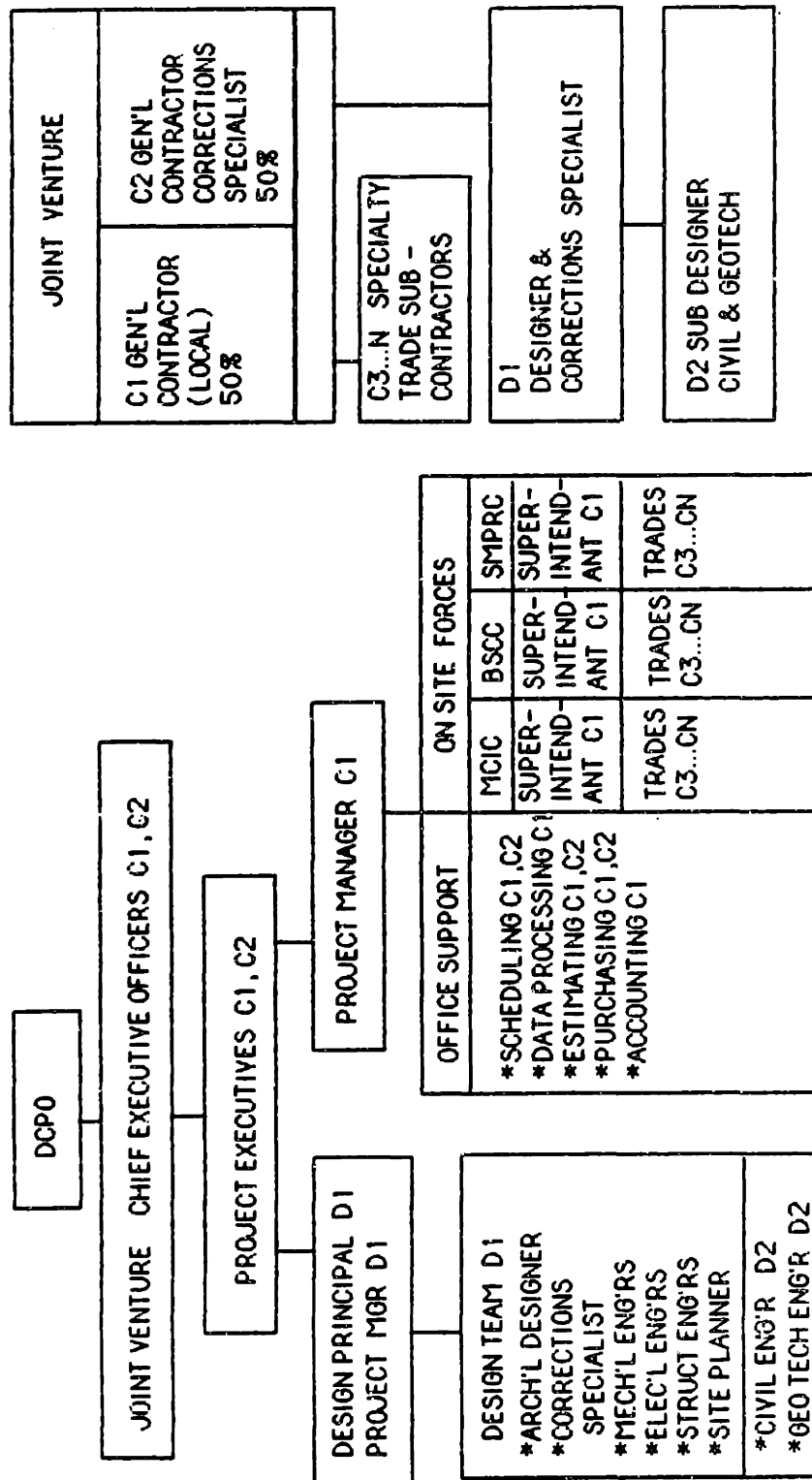
Organizational Structure

Contractual Arrangement

* Team IV: This team's organization is somewhat distinct from the other three. Two general contractors, C1 and C2 have formed a joint venture for the project. Profit will be apparently split 50/50 but overall project management responsibility is indicated as 51/49 respectively. C1 is a well established locally based contractor which lacks correctional facility experience. C2 is a regional contractor with extensive experience in corrections work. There is only one major designer, D1, which is also regionally based and specializes in corrections work. C2 and D1 have an extensive history of working together on corrections projects and appear to have established a good working relationship. C1 is new to the team in this sense. The team is strongly dominated by the two contractors whose personnel occupy all the top project executive positions.

Functionally, C1 and C2 have largely overlapping responsibilities, but in general C2 is responsible for preconstruction functions such as estimating, value engineering and project scheduling, as well as specialized construction activities relating to corrections, notably purchasing, while C1 is responsible for construction activities such as cost accounting, construction scheduling and general field supervision. D1 is responsible for all design activities except for civil and geotechnical engineering, which are handled by sub-designer D2.

Figure 12 d. Organization/ Contractual Arrangement: Team IV



Contractual Arrangement

Organizational Structure

When the DBSB made its final evaluation of the different teams it identified a number of special evaluation criteria. These criteria were not different from the original criteria contained in the RFQ; rather, they overlapped and recombined the the original criteria in a way the Board felt was more meaningful and which highlighted the distinctions between the teams. These revised criteria were:

- * Program focus: the degree to which the team addresses the objectives of the design-build program

- Design-build balance: ability to appropriately weigh design and construction decisions.

- Project specific focus: the degree to which the team addresses the unique aspects of the project in terms of the three facilities.

- * Organizational Orientation: the team's structure and organization with respect to the the project issues

- Coordination within the design team

- Management clarity: orderly structure and channels of communication and lines of accountability

- * Local presence/knowledge: accessibility of team to DCPO and DOC during the project and knowledge of local conditions.

- * Design quality: demonstrated designer ability

- correctional facility experience

- flexibility and responsiveness of approach with respect to DOC's unique philosophy

- sensitivity and respect for existing architectural and environmental context

- * Commitment and compatability of design-build team's approach and the DOC Philosophy

In terms of the six teams being considered, the DBSB found that local knowledge, design-build balance and design team

coordination were not significantly distinguishing features, in that all or most teams were comparable in these areas.

Instead, the DBSB found that the other revised criteria: project-specific approach, clear organizational structure, high quality design emphasis and commitment to DOC philosophy were the primary distinguishing attributes which governed the Boards final decision.

(Note: the above is a paraphrase of the Summary Report of the DBSB: Evaluation of Design-Build Team Qualifications, DBSB, 1986)

It is interesting to note that even though the contractor component of the teams provides overall project management and in a sense is the dominant team component, it was not a distinguishing factor in any case, ie. all the contractors were considered more or less equally capable . Instead it was the team organization as a whole and, in particular, the quality of the designer, which was regarded as the key distinction between teams. Although not explicitly stated, this may have reflected the concern of the DBSB that the design-build process, coupled with the contractual arrangement of designer as sub-contractor, could potentially overwhelm the designer and devalue the importance of good design.

Once the teams were ranked, The DBSB was confronted with one more difficult decision, namely how many teams to recommend for prequalification. This decision did not really have to

do with the number of acceptable teams, since all were probably legitimately qualified. The real issue was the level of competition. One team executive had already expressed a strong reluctance to compete with an excessive number of other teams. There was also concern that teams might not put as much effort into proposals if they felt their chances of winning were too slim. Yet, at the same time, DCPO wanted to ensure that competition was adequate, if not maximized. The DBSB as well as other top DCPO officials seemed to feel that a minimum of three responsive proposals was required to achieve this minimum level of competition and ensure full accountability. But there was also a risk that one or more teams might drop out during the proposal phase or might submit unresponsive proposals. In the end, four teams were qualified: three to provide minimum competition plus one more in case one dropped out.

CHAPTER 13.0

DEVELOPING THE REQUEST FOR PROPOSAL

The Request for Proposal (RFP) was considered by DCPO and the DBSB as the single most most important element in the design-build process. Developing the proposal has proved to be difficult and complex . The essential problem was to define the project for three correctional facilities to the degree necessary to ensure responsive proposals, establish the required level of quality and performance which can be contractually enforced and to ensure full public accountability, especially in the selection process. At the same time, all this had to be done without actually designing the facilities. This chapter will discuss the process and issues surrounding the development of the RFP: the activities and responsibilities associated with the process; issues concerning the programming of the facilities; developing supplemental technical requirements and information; and finally, formatting and packaging the RFP document.

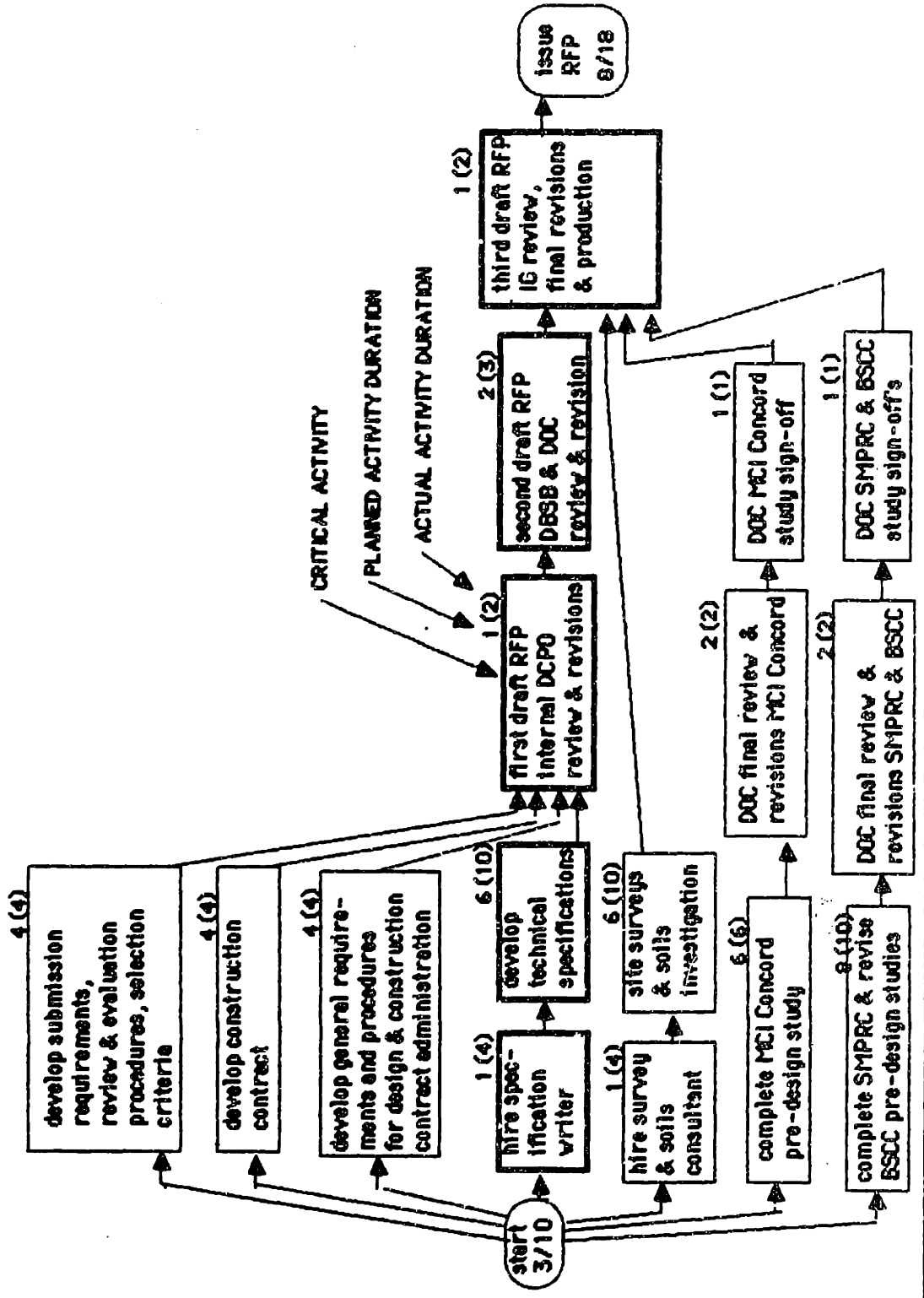
A number of other important issues and decisions which were dealt with during the RFP development will be covered more extensively in chapters 14.0 and 15.0. These include the proposal development and selection process (chapter 14.0) as well as the post-contract award design and construction process (chapter 15.0).

Reference material for this chapter was largely gathered through direct personal observation. The author was actively involved on a day to day basis with the the Special Unit working on the RFP and had extensive opportunity to interact with other DCPO personnel, the user agency and consultants. Notes from meetings, site visits and a personal journal were used to document this experience.

13.1 The Process: Activities and Responsibilities

Figure 13a shows the general schedule of activities and responsibilities for RFP development. Probably the greatest challenge associated with this process stemmed the fact that no model really existed for the kind of RFP which DCPO was trying to develop. A number of other design-build RFP's were collected from various sources, but none seemed appropriate as an example which addressed DCPO's particular needs and conception of the design-build process. Some sample RFP's for public sector housing projects appeared thorough and fairly refined, but did not provide a workable framework to convey the very different requirements of correctional facilities. Samples of recent designbuild correctional facilities were either too open and sketchy or overly detailed and cumbersome (eg. The Elmwood Detention Center and Missouri Prison described in section 8.2). As a result DCPO was forced to not only develop a document describing the programmatic and technical requirements for the three facilities, but also a whole new generic type of document.

Figure 13a General Schedule for RFP Development



DCPO also had to develop procedures governing the proposal phase including submission, evaluation and selection requirements. This was done in close collaboration with the DBSB. A whole new set of general requirements and contract conditions governing design and construction phases also had to be drafted. This involved the OPM component of the Special Unit, the DCPO Legal Counsel and top DCPO officials. These procedures and requirements will be discussed in chapters 14.0 and 15.0.

Another significant challenge associated with this process was coordinating the work of multiple consultants and sub-actors within the user agency. Five separate prime consultants were involved with the three correctional facilities. These separate consultants were hired for the following tasks:

- * original pre-design study for BSCC in 1983.
- * pre-design study for MCI Concord.
- * pre-design study for SMPRC and updating the BSCC study.
- * technical requirements and specifications for the three facilities.
- * site surveying and soils investigation work for the three facilities.

Ideally, this scope of work would have been handled by a

single consultant in order to be consistent with packaging of the three facilities as a single design-build project. The distribution of tasks among the five consultants came about because the individual facilities were originally identified as separate projects to be built under the traditional method. As such, the study consultants were hired separately. The last two consultants were hired to develop supplemental technical material for the RFP which was not included in the scope of work of the study consultants. Administrative procedures associated with packaging, processing and modifying consultant contracts were also a constraint which further complicated the process.

Coordination took place on several levels. Among the study consultants, it was important that study methods, programming and documentation was done consistently in terms of both content and form. The technical specifications and site studies also had to be coordinated with the studies as well as each other to make sure, for example, that detailed specifications were consistent with outline specifications developed in the study and that the preliminary cost estimates were consistent with these specifications. Aside from the consultants' work itself, there was also a considerable amount of administrative coordination and expediting associated with the individual consulting contracts and DCPO's extensive contract administration procedures.

The entire RFP had to be reviewed by a number of

individuals, including the Inspector General, top DOC officials and Superintendents of the three facilities. Coordinating these reviews was not easy, especially given the tight project schedule. The review and revision process proved more extensive than originally anticipated and added almost a month to the overall project schedule. This extra effort which was put into the RFP appears to have paid off. Not only have DCPO and other State officials expressed satisfaction with the document, but it has won early general praise from the design-build teams.

13.2 Programming and Pre-Design Studies

Programming and developing pre-design requirements for the three facilities proved less straightforward than, perhaps, was originally contemplated. The facilities all have complex and unique requirements, and programming them entailed a number of difficult decisions. The design-build process required that the program stated in the RFP be especially well developed and correct, because of the difficulty of making subsequent modifications during the proposal and post award phases of the project. There was also intense time pressure to complete the RFP quickly, which further complicated the process.

The programming and pre-design studies for the three facilities were carried out according to the DCPO's standard

method described in section 11.3. In the case of this particular project, the budget for each facility had been essentially fixed, prior to the studies, by Chapter 799, the legislation which appropriated the project funds. These figures had been based on the very preliminary estimates developed in the Special Message on Prison Overcrowding. This was a strong constraint in programming, especially for MCI Concord.

Essentially, the facilities' programs had to be adjusted around these budget figures. At the same time, they had to provide minimum numbers of additional beds and associated support facilities. One problem which emerged, especially for MCI Concord, and to a lesser extent for the two other facilities, was limiting the scope of existing facilities upgrading. All of the facilities suffer to some degree from deferred maintenance. In some cases existing utilities and systems could not support additional new construction. Yet at the same time, the budgets were not originally intended to cover this additional scope of work. Eventually, separate funds were identified and essential upgrades will be carried out under other projects. But in the meantime, this proved to be a considerable complication and source of uncertainty during the studies, as program requirements were adjusted to try to makeup for the unforeseen additional scope of work.

Another problem was the difficulty of making accurate cost estimates at the pre-design phase. Cost estimates for the

same facility done by different independent cost estimating sub-consultants sometimes varied significantly. This may have been partly because good parametric cost estimating data is not as available for correctional facilities as for other, more common and building types. It also may have been due to problems establishing a definitive scope of work, coupled with the rough, conceptual nature of the estimates.

As mentioned in earlier chapters, there is a certain lack of well developed design and construction standards for correctional facilities. The American Corrections Association (ACA) is the primary source of these standards. However the ACA standards mainly deal with operational practices, rather than facility design and construction. The standards which do cover this tend to be limited to minimum square footages for cells, certain support spaces and basic environmental standards. Additional standards and guidelines for correctional facilities are put out by DOC, the Department of Public Health and various building codes, but these also tend to be quite limited.

Within these standards there is an extremely broad range of potentially acceptable design approaches. The major issue in contemporary prison design is between high levels of physical security associated with traditional "lock-ups" versus less institutional, normalized prison environments (section 10.1 supra). The concept of a normalized prison environment and the related "direct supervision" model of security control was

popularized in the early 1970's, and articulated in a number of publications, notably a book entitled, The New Red Barn (Nagle, 1973) in which the author argued that he could run a successful, secure prison even in a barn by using new supervision techniques and creating a more humane, less institutional prison setting. This approach has been successfully tried in a number of correctional facilities, the foremost example is the Contra Costa Prison in California (1975). Despite an almost total lack of physical separation between staff and inmates, the rates of assaults on staff, as well as inmates, and the general level of negative behavior, was significantly lower than for conventional prisons with similar inmate populations and staffs (Clark Foundation, 1984).

Decisions about "New Generation" versus traditional facilities and required security features can have a significant impact on program, design approach and budget. New generation prisons often entail qualitatively different layouts, spaces and planning relationships which must be fixed early in the design process. Construction details, finishes, hardware and fixtures also differ and can have significant cost impacts.

DOC and DCPO went through considerable soulsearching before programs and requirements for the facilities were finalized. The MCI Concord facility was the most problematic. Some officials felt that, "new generation" theories not

withstanding, security at MCI Concord could not be compromised and should take precedence over other considerations. The argument for this is that, because the facility will serve mainly as a classification center, the inmate population will be very transient and unpredictable and therefore the housing units must be designed for the worst type of offender. Moreover, since most inmates will only spend a few weeks at the facility before being classified and transferred, a normalized is not as important as it would be for a facility with a more stable, long term population.

The counter argument holds that since the facility will be most inmates' first exposure with the State correctional system, it is important to try to minimize the negative and stressful aspects of their experience. While some inmates will require very high security housing units, most will not. These inmates may be preclassified during their first few days after arrival and placed in lower security level units. Not only will this permit at least a portion of the facility to be run on a "new generation" model, but it will also result in considerable construction cost savings, since the lower security units are significantly less expensive to build.

Similar discussions took place about the other two lower security level facilities. Here the concerns did not focus so much on security features, but type of construction. Some officials advocated very high, institutional grade

construction, characterized by very high requirements for lifesaftey systems, structure, hardware and fixtures. Others felt such standards were excessive and that good quality, but residential grade, construction would be more appropriate and economical.

Eventually, a consensus was reached on these issues. Many of the final decisions were tempered by hard budget realities. But the considerations outlined above give an idea of the difficulty and complexity of the choices which DCPO and DOC faced.

Many of the problems described in this section are not unique to the design-build process, per-se, and are typical of almost any procurement method. What makes them relevant to this discussion is that they point to some of the difficult decisions which must be made at a very early point in the procurement process using design-build. Under the traditional method or CM, many of these decisions could be deferred until more information was available; for example: a more developed design which could help the user better visualize the implication of decisions; more accurate cost estimates which could better inform the cost impact of decisions; and better engineering analysis which could more precisely determine upgrading requirements of existing facilities.

Design-build forced the user to make very important decisions in pre-design. These decisions will be quite difficult to

change after the RFP is issued. Yet, it is not clear that DOC is completely satisfied and comfortable with the decisions it has made. In view of the critical issues concerning design-build which were put forth in previous chapters, two questions are raised: First, is the nature of the three correctional facilities too complex and non-standard to permit the project to be adequately defined in a pre-design RFP? And, second, have DCPO and DOC been able to establish effective enough channels of communication and flow of information to allow necessary pre-design decisions to be made effectively? Unfortunately, these questions cannot be answered as of this writing, pending the proposal and design phases of the project.

13.3 Supplemental Technical Requirements and Information

The pre-design studies included very preliminary outline specifications and short, narrative descriptions of existing conditions at the facilities. In the traditional method, these are adequate because the designer develops full, detailed specifications and makes necessary site investigation, as-built drawings of facilities, etc.. Under the design-build process used by DCPO, the RFP along with the proposal becomes the basis for a fixed price contract. To reduce the risks of disputes over quality after the contract is signed, the level of quality must be established within the RFP and the proposal (see section 7.3).

Theoretically, it might be possible to leave specifications very "loose" in the RFP, but to require detailed specifications in the proposal. The problem with this is that it requires an exceptional amount of proposal documentation and may not fully convey DCPO's quality requirements to the design-build teams, thereby resulting in unresponsive proposals and/or excessive revisions and resubmissions. The other problem is that it would require very extensive and detailed review of the proposals to ensure that there are no "holes" in the proposed specifications which could result in later disputes.

In order to ensure accountability in light of the above, DCPO felt it was necessary to expand upon the study outline specifications in order to better establish minimum levels of construction quality. There was also a need for more information on existing conditions in order to reduce risks of unforeseen conditions, again, because of the fixed price nature of the proposals.

13.3.1 Technical Specifications

In the Alternate Method report, DCPO had envisioned the technical specifications as a type of rigorous performance specification. The report actually included some sample specifications based on the Construction Specification Institute (CSI) recommended performance specification guidelines (CSI, 1980, 1981). Performance specifications were seen as a means of overcoming the dilemma of allowing design flexibility and at the same time ensuring a level of quality.

However, subsequently a number of problems were encountered with the performance approach which lead DCPO to drop it in favor of a more traditional, prescriptive type of specification. A detailed discussion of the theory of construction specification is beyond the scope of this thesis, but the following is a brief account of DCPO's practical experience with specifications for the project.

The first problem with performance specifications is that, in fact, there is no such thing as a pure performance specification. Rather, all specifications must be seen as a mix of performance and prescriptive attributes. CSI defines a spectrum of nine different degrees of specification ranging from very broad nearly pure performance characteristics at the total building level to a purely prescriptive specification of individual materials, fixtures, etc.. Most specifications are actually a combination of performance and prescriptive attributes, eg. "galvanized steel wire hangars capable of supporting 60 lb.s each ". In general, the more detailed the level of specification, the more prescriptive it becomes. Since in many cases DCPO and user requirements were quite detailed, the specifications tended away from performance, towards prescription.

Performance specifications are based on three basic elements: a requirement or attribute like "resistance to misuse"; a criterion like "resists impacts from hard objects"; and a test like "will not break when subjected to a 10 lb. steel ball

dropped from 10 ft.". If any aspect of the building cannot be practically described in these terms it is unsuitable for performance specification. In many cases, testing was impractical either because no good, standardized tests exist or because they would involve building mock-up systems which would be very costly for the size of projects considered. In other cases, it was not practical to specify all the criteria for a given attribute, without getting into exhaustive detail or running the risk of overlooking a critical criterion.

Once it became apparent that pure performance specifications were not practical for the project, the problem was how to allow flexibility for legitimate alternate types of construction within the framework of prescriptive specifications. The logical outcome of this line of reasoning is to prescriptively specify every possible alternate. For example, partitions might contain full prescriptive specifications for drywall, plaster and concrete block; roofing might include built-up, membrane and various type of sloped roofing. This "universe of possibilities" approach was similarly deemed impractical, except for a few cases.

The final approach to specification which DCPO used was based on a hypothetical model of construction. That is, a detailed, prescriptive specification was provided based on a single type of construction. At the same time, the RFP explicitly states that alternate materials and methods would be favorably considered, provided the proposer could demonstrate that they

were comparable or better than the items which they would be substituted for.

Within this framework, the mix of performance and prescriptive specifications was tailored to the particular area of construction being specified in terms of its overall importance, cost impact and likelihood of having potential alternates. For example, security hardware and fixtures, which were very important and not likely to be subject to many innovative alternates, were specified in great prescriptive, even proprietary detail, eg. "Folger Adams series 52MS electric locks... with two position toggle switch with status indication lamps...jamb mounted...paracentric locks...etc.". Structural systems, on the other hand, which were not deemed as critical and yet very possibly subject to cost-saving alternates, were specified almost entirely by code reference. Cladding, finishes and waterproofing were specified more prescriptively, but in some cases alternates were explicitly specified. Mechanical systems were specified by a combination of environmental performance standards, codes and brand names "or equal" for major equipment.

13.3.2 Documenting Existing Conditions

Site surveys and soil investigations for the three facilities were fairly straightforward, however, documenting conditions of existing facilities for the RFP was difficult. BSCC and SMPRC both involve extensive renovation work as well as new

construction. MCI Concord involves tie-ins and extensive relocation of existing utilities on the site. These existing conditions potentially can have a significant impact on the project cost. Yet very little reliable "as-built" information existed about any of these conditions. The facilities had all been built and renovated in a piecemeal fashion over fifty or more years. What drawings did exist were often contradictory and inexact. Use and loading of existing utilities was often not known since most services are unmetered. This made it difficult to determine with certainty that existing utilities had enough unused capacity to support additional loads of the new construction.

Time did not permit full investigation and documentation of existing conditions. It was also difficult to make limited investigation meaningful because even preliminary design solutions were not known when the RFP was being developed. The problem is analogous to the "universe of possibilities" problem for specifications described above.

DCPO attempted to do as much investigation and documentation of these conditions as was possible, trying to anticipate potentially critical problems. The final documentation of existing conditions contained in the RFP consisted of brief narrative descriptions, limited quantitative data and 1/16"=1'-0" scale drawings of general plans and elevations of the existing facilities. 1"=40" scale site plans included topographic data and approximate location and sizes of utilities, where known. A number of important data were not

provided, including construction details, exact dimensions and mechanical electrical systems drawings of existing facilities. Much of the risk and burden of collecting this missing data is shifted to the design-build teams. The details of these contract provisions will be discussed in the next chapter.

13.4 Formatting the RFP

DCPO and, in particular, the OP component of the Special Unit, were very concerned not only with the content of the RFP, but also the form in which it was presented. The document contains an unusually large amount of diverse information which must be presented in a comprehensible way to the design-build teams. DCPO felt that if the teams were presented with an excessively voluminous document which was not clearly formatted, they would be overwhelmed and put off, possibly to the point of not participating. Similarly, DCPO felt that a well presented, polished RFP was essential for conveying a sense of professionalism, credibility and accountability about the project and the Special Unit.

Unlike traditional bid documents, no standard format exists for design-build RFP's. A number of examples which were considered were found to be either poorly organized, excessively redundant, too brief or too long. Initially, DCPO attempted to use a format which consisted of two major parts: the first, covering non-technical and administrative aspects

of the project; and, the second, consisting essentially of the three pre-design studies along with supplemental technical requirements and information. This document was over 800 pages long, filling two jumbo loose-leaf binders.

The main problem with this format was the inclusion of the full pre-design studies for the three facilities. These studies contained a certain amount of non-essential information, including extensive sections describing various alternative conceptual designs. There was also quite a bit of redundancy in the supplemental technical requirements for each facility. It was decided to eliminate the full studies from the RFP and instead only provide a condensed version of essential information extracted from the studies, but not sections dealing with design alternatives. The supplemental technical requirements for the three facilities were combined into a single set of requirements with certain sections which referred to specific facilities noted as such. Finally, the first part, covering general requirements, was refined and condensed. This reduced the overall document to under 500 pages. The table of contents and annotated excerpts from the RFP are shown in appendix C. To compensate for any information which may have been lost in this editing process, DCPO is also providing a reference library for the project, containing the full studies as well as other reference documents which will be available to proposers.

It is too early to make a definitive assessment of the RFP. However, preliminary indications are that it has met the

objectives it was intended to fulfill: accurately and precisely defining project requirements, intent and priorities, without unnecessarily limiting potential solutions. It is a "tight" document, as originally envisioned. But it is not cumbersome or loaded with any superfluous or unnecessary data. It is a highly professional document which will serve as a valuable prototype for future designbuild projects.

CHAPTER 14.0

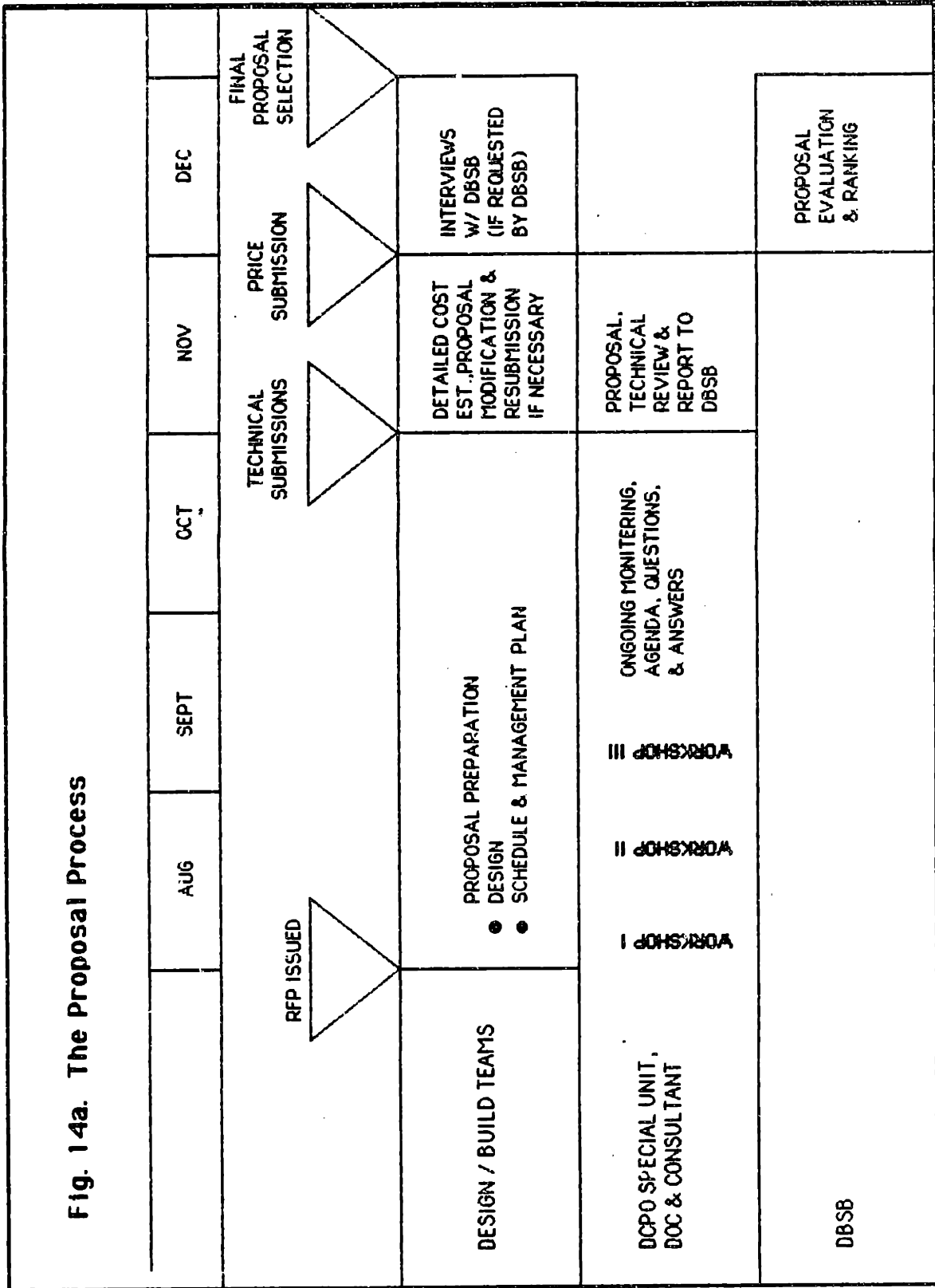
PROPOSAL DEVELOPMENT, REVIEW AND EVALUATION

This chapter will examine the proposal phase of the DCPO design-build project. A general overview of the procedures and steps will be presented. This will be followed by a more detailed discussion of the significant elements of the proposal process and how DCPO views them: the proposal development; submission requirements and documentation; and evaluation criteria and method.

As of this writing, the proposal phase has only just started and it is not possible to discuss actual outcomes. Instead, the comments in this chapter, as well as the following one, will be confined to DCPO's current conception of how this phase will be carried out, and the rationale behind this conception. The reference for this chapter, like the last, is primarily drawn from direct personal observation and participation in drafting the RFP, and from the final RFP itself which sets out the proposal requirements and procedures. Relevant excerpts of the RFP are contained in appendix A.

14.1 Overview of the Proposal Process

Figure 14a shows the projected schedule for the proposal phase. The proposal submission and evaluation process which



DCPO has chosen may be seen as a modified two-step process

(see section 8.2). Technical proposals are submitted first, without price, and reviewed for technical compliance with the RFP. Once compliance is established, price proposals are accepted. However unlike the two-step process used by the military and some other public agencies, the final evaluation is not made on the basis of price alone, but, on a combination of quality, schedule and price.

The proposal development features three pre-proposal workshops in which the design-build teams are briefed, tour the sites and have an opportunity to ask questions and make comments. In addition, teams are allowed to make supplemental site visits on their own and submit written questions. The Special Unit Project Coordinator serves as the point of contact for the teams during this period. Other members of the Special Unit answer questions and provide supplemental information as necessary.

The technical proposals include design documentation and detailed schedule and management information. Proposals are reviewed by a team consisting of Special Unit staff, including members from OP, OPM, OFM and DOC as well as a group of special outside consultants consisting of experts in correctional facility design, engineering, operations and maintenance. The team checks each proposal for technical compliance. If necessary, teams are asked to submit additional information or to revise and resubmit portions which do not meet technical requirements. Concurrently, the

design build teams develop their final, detailed price proposals, adjusting them as necessary for any revisions. Upon submission of a proposal which is judged "substantially" in compliance with RFP requirements, each team is given an honorarium in partial compensation for proposal development costs.

Price proposals consist of a lump-sum figure, broken down into design and construction line items, the latter being further broken down into major systems for each facility. A number of additive and deductive bid items may also be included. The DBSB, which is provided with a summary report of the technical review findings, evaluates the proposals initially without price. Proposals are rated "acceptable", "good", "superior" or "outstanding" and ranked in relation to each other on the basis of a pre-established set of evaluation criteria. Prices are then considered and re-ranked according to a combination of value and price.

The final selection is made by the Deputy Commissioner (see section 11.4) and the entire process is documented in a written, public report. Unsuccessful teams are de-briefed and given feedback to help with future proposals. A contract is then executed with the team that submitted the successful proposal.

14.2 Proposal Development

The critical issue in the proposal development phase is the mechanism for providing effective feedback between the design-build teams and DCPO. There is a basic conflict between a high degree of interaction and the need for absolute equal treatment and access to information for all the teams. Ideally, the teams would like to have DCPO and the user review the proposals as they are being developed in order to provide individual feedback and comments. But since the teams are competing, each team does not want the others to be privy to this proposal-specific feedback for fear of disclosing possible innovations and other competitive advantages. DCPO's dilemma is similar: it also would like to provide feedback on individual proposals in order to improve its choices, but cannot risk the potential accountability problems arising from giving different information to different teams.

Given this situation, the interaction between teams and DCPO during proposal development is limited to that of a traditional competitive bidding situation. All questions, answers and agenda are distributed to all teams. This will inevitably discourage a certain amount of questions and interaction, forcing teams to weigh the risk of proposing certain innovations or alternates which are not explicitly provided for against the potential loss of a competitive advantage if they openly ask DCPO questions about the alternate. Again, this highlights the importance of the RFP as the key reference, and in particular, the importance of

the evaluation criteria which are discussed below.

14.3 Proposal Documentation Requirements

DCPO does not want to overburden the design-build teams with excessive proposal documentation requirements. But, given the fact that the proposals must clearly establish quality and scope within a fixed price, and the associated accountability issues, there is a strong pressure to require extensive proposal documentation. The proposal submission requirements described in the final version of the RFP represents an attempt to balance and optimize these two conflicting objectives. Figure 14b summarizes these submission requirements and explains the purpose of each one.

DCPO consciously tried to avoid the temptation of asking for information for the sake of having information just in case it might be useful. Instead, it took a "zero-base" approach, whereby each submission requirement was scrutinized as to whether or not it was necessary for evaluation and accountability purposes and weighed against preparation effort. Wherever possible, requirements were eliminated or reduced. Despite these efforts, the proposal documentation requirements are extensive. This reflects not only the complexity of the project, but also the basis of evaluation which is described in the following section.

**Figure 14 b. Proposal Submission Requirements
(from RFP)**

	PROPOSAL ELEMENT	DESCRIPTION	USE
PROPOSAL SUMMARY	Proposal Summary Report	Written statement summarizing approach and major proposal features.	To introduce all members of review team and DBSB to proposal.
	Presentation Boards	Visual description: highlights of approach to each facility, including overall project management	DBSB: To highlight important features of each proposal and team approach. PUBLIC: For public presentation after contract award.
FACILITY SPECIFIC PROPOSAL DETAIL	Drawings	Detailed architectural description of proposal for each facility, including security and operating plan.	REVIEW TEAM: As the basis for detailed proposal analysis including: life cycle cost of alternative proposal.
	Outline Specifications & Product Data	Detailed description of building systems and components, materials and equipment	DOC for security & operations. DBSB: As the basis for application of building design and performance selection criteria.
	Building Performance Plan	Description of operating and energy costs.	DCPO PROJECT MGT.: As the basis for review of subsequent submission by selected team after contract award.
REVIEW MATRIX	Questionnaire	Machine readable itemized list of important characteristics of proposal for each facility, including physical and performance characteristics.	REVIEW TEAM: Uniform format for review team to compare characteristics of each team's proposal for each facility, including data for building performance evaluation and building system percentage costs.
MANAGEMENT STRATEGY	Project Organization	Detailed description of management organization, strategy, overall & for each facility.	REVIEW TEAM: To provide data for analysis of project management capacity and match to DCPO's requirements. DBSB: The basis for the application of project management selection criteria. DCPO PROJECT MGT.: As the basis for planning project supervision.
	Design & Construction Schedule	Detailed schedule for design and construction for each facility. Description of submission documents	DCPO ATTORNEY: As the basis of contract schedule & submission provisions.
PRICE PROPOSAL	Percentage Price by System	Percentage price by building systems, submitted with initial proposal.	REVIEW TEAM: As data for comparison of alternative building systems in technical analysis. DBSB: As a measure of the cost effectiveness of each proposal.
	Lump Sum Price	Guaranteed lump sum total price and price detail. Submitted by December 1, 1966	DCPO PROJECT MGT.: As the basis for review of subsequent submission of schedule of values by selected team after contract award. To provide frame work for project supervision as a basis for contract price

The level of detail of proposal plans and specifications

corresponds to well developed schematics or early design-development documents. Basic architectural information and details along with schematic descriptions of structural, mechanical and electrical systems are called for. DCPO considers this a minimal level of definition required for a realistic fixed price.

Documentation required to establish life-cycle costs is considered very important, but is not as easy to define. Originally, DCPO had planned to ask each proposal to include a detailed, discounted life cycle cost analysis. This was rejected, first, because it would entail considerable effort; and, second, because it would be difficult to verify and compare. After consultation with the operation and maintenance expert on the proposal review team, it was decided to have the lifecycle cost analysis made by the review team based on the design documents described above, plus certain supplemental data. This additional data consists of a detailed equipment schedule, energy consumption data and a brief narrative of the designers' approach to maintenance.

Since completion time and management capability are also considered important evaluation criteria, teams are asked to submit fairly extensive documentation in this area. This includes a slightly more detailed reiteration of the prequalification statement, plus a detailed critical path project schedule and management plan.

Since the RFP was issued to the competing teams, the extent of proposal documentation requirements has emerged as a significant issue. Many of the designers have complained that the requirements are excessive and make it too costly to develop proposals. There was also an apparent concern that competition might arise over which team could provide the most elaborate drawings. The designers from the different teams collectively requested that the submission requirements, especially drawings, be reduced and limited. After serious consideration, DCPO held firm and insisted that the submission requirements could not be reduced without compromising the technical review and evaluation process. However, DCPO did agree to raise the proposal honorarium from \$ 25,000 to \$ 50,000 in consideration of this problem.

14.4 Evaluation Criteria and Method

The proposal evaluation criteria and method is one of the most sensitive and critical elements of the design-build process, particularly given DCPO's heightened concern for accountability. The criteria and method described in the final RFP (see appendix D) went through a number of iterations and reflects extensive input from the Special Unit, DBSB, the Deputy Commissioner, DOC officials and the Inspector General.

The first and overriding requirement for the proposal

evaluation method is to provide a clear, "transparent" means of selecting a proposal which is in the best interest of the Commonwealth of Massachusetts. This method must be unambiguous, objective and publicly defensible. The State had to avoid the slightest appearance of abuse, especially the image of "closed doors and smoke-filled rooms". In its review and comments on the original Alternate Method Report, the IG stipulated what it felt were essential requirements of the selection method:

- * The evaluation criteria must be explicitly stated and weighted prior to evaluation. Thus criteria could not be invented ex-poste to justify a selection.

- * The evaluation priorities must be established by State officials, not the DBSB. It was strongly felt that DCPO and DOC must not give up responsibility for establishing and prioritizing overall goals of the project. The role of the DBSB would be to objectively evaluate proposals in terms of those goals. The board could define specific sub-criteria based on these goals but could not actually take on a policy-making role which rightfully belonged to officials within the government.

A related function of evaluation requirements is communicate to the design-build teams the relative importance and utility ascribed to design and project management variables so that the teams can attempt to correctly optimize their proposals. The evaluation criteria must be broad and general

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A related function of evaluation requirements is communicate to the design-build teams the relative importance and utility ascribed to design and project management variables so that the teams can attempt to correctly optimize their proposals. The evaluation criteria must be broad and general

enough so that they address the full range of potential variables and solutions, yet detailed and explicit enough so that they clearly differentiate preferences and bases for trade-offs. This is difficult, especially in the absence of an actual design or set of design alternatives.

Finally, DCPO and the DBSB were concerned that the evaluation criteria and method not overly constrain the selection process and potentially force the selection of a proposal which was not actually preferred. This tended to drive the selection criteria away from detailed specificity and toward generality.

Compounding the difficulty of the problem described above, was the fact that project schedule, design quality, building performance and management capability, as well as cost, are all variables and considered important overall evaluation criteria. As such, all these variables must be somehow related on a common scale of value. DCPO and the DBSB did not consider any kind of rigorous financial evaluation method such as net present value or quantitative cost benefit analysis. They also strongly wanted to avoid an explicit numerical point-weighting evaluation method, which they saw as being highly artificial, potentially arbitrary and overly constraining.

The constraints and requirements set forth in the RFP also have to be taken into account in the evaluation process. Minimum quality levels are already set by the technical

requirements and specifications. In many cases there is little value in exceeding them, eg. as long as a structural system meets all applicable codes, there is little value in a proposal which significantly exceeds these requirements. Similarly, time and cost are bounded by maximum completion dates and contract amounts. DCPO and the DBSB felt that in light of these constraints, the evaluation criteria should focus on the factors which are likely to vary significantly between proposals.

The evaluation/selection criteria which DCPO and the DBSB originally proposed was questioned by the IG. The IG felt that the criteria was too broad and open to differing interpretations. In a sort of eleventh hour work session just before the RFP was scheduled to be issued, the IG and top DCPO officials revised these criteria.

The IG has gained valuable experience on other similar, non-quantitative procurement selection methods through its work with other State agencies. Through this experience it has evolved a philosophical approach which was applied the design-build selection criteria. Essentially, the IG believes that there is an appropriate middle ground between the wide open, general kind of criteria (eg. "in the best interest of the State") and the exhaustive, overly detailed weighted numerical scoring methods favored by some public agencies. The IG feels the former approach meaningless in its lack of specificity, while the latter becomes equally

meaningless and falsely objective by attempting to quantify attributes which are essentially non-quantifiable. Instead of these extremes, the IG suggests a verbal, but detailed approach to describing evaluation criteria based on logic and common sense. It also believes that the best way to deal with cost/non-cost trade-offs is to first evaluate non-cost attributes qualitatively, based on verbal criteria, then compare them to costs and evaluate the trade-offs on a consensus basis among board members or other decision makers.

The final evaluation criteria which appear in the RFP apply this philosophy to the particular requirements of the design-build project (see appendix for relevant excerpts of RFP). Each major criterion is narratively described in terms of detailed sub-criteria. Major criteria are considered of equal importance by DCPO officials. Sub-criteria are ranked in terms of relative importance based on input from DCPO, DOC and the DBSB. In some cases, these rankings are different for each facility, eg. security is the first design sub-criteria for MCI Concord, whereas normalized environment is first for BSCC and SMPRC.

Schedule and delivery time posed a special problem in this context. Because early completion is so important, DCPO strongly wanted to provide an bonus incentive along with the usual liquidated damages for late completion. From a theoretical economics point of view, it might be possible to calculate the bonus/liquidated damages in such a way that

the State would be indifferent to the actual completion time, ie. that if the project is occupied early, the benefit would be offset by the bonus it would have to pay out and vice versa . This was deemed impractical because there is no way to realistically quantify the utility value of early/late occupancy in monetary terms, and also because the amount of the potential bonus might be unacceptably high. Instead, the bonus/liquidated damage rates are based on more moderate financial value of the projects, adjusted slightly to reflect the relative importance of completion for the three facilities. The bonus/liquidated damages are then calculated around completion dates proposed by the design-builders rather than a fixed date set by DCPO. This way, the value of an accelerated schedule/early completion is not double-counted in proposal evaluation and bonus award.

After proposals are evaluated, rated (good, superior..etc.) and ranked, costs are considered and weighed against each proposal. The winning proposal is then selected on a consensus decision taking cost into account. The findings of the DBSB will be documented in a narrative report which will be made public. If the winning proposal is not the highest ranked and lowest priced proposal, the Deputy Commissioner will be provided with a detailed explanation justifying the decision.

CHAPTER 15.0

POST CONTRACT AWARD PHASES:

DETAILED DESIGN AND CONSTRUCTION

This chapter will discuss the execution of the design-build contract for three correctional facilities as currently projected by DCPO. The critical issues concerning the detailed design and construction phases of the project mainly have to do with risk allocation between DCPO and the design-builder: Risks associated with interpretation and translation of the proposal and RFP into working documents; professional responsibilities and liabilities of the designer; construction risks; quality control; delays and post occupancy operation and maintenance.

Most of these issues have been discussed in general terms already in chapters 7.0 and 8.0. Here, DCPO's perception of the issues in the context of the present case will be examined. Since the contract has not been awarded yet, discussion is limited to the provisions set forth on the RFP and the considerations and decisions which shaped them. As in the last two chapters, most of the reference material for this chapter is drawn from direct personal observation and participation in drafting the RFP. This participation included various meetings and conversations with DCPO officials including the DCPO Legal Counsel, Director and Deputy Director of OPM and special unit staff.

15.1 The Two-Part Contract and Fast Tracking

One of the most significant and difficult issues concerning the design-build contract was whether or not to split the contract into separate design and construction parts. In the original Alternate Method report, DCPO emphasized that a two part contract divided into separate design and construction portions would be used as an important accountability feature. The construction part of the contract would not be signed until a full set of detailed working documents would be submitted and approved. The format and rationale for this is similar to the HUD Turnkey and New York State Dormitory Authority design-build methods (see section 8.2). By not fully committing to construction during the design-development/working document phase of the contract, DCPO felt that it would be in a stronger position in case any disputes arose over interpretation of the proposal. In the worst case, DCPO would have the option of not signing the construction contract, and would negotiate a new contract with the second ranked design-build proposer.

The problem with this contractual format is that it precludes fast-tracking since no construction or purchase of long lead items may begin until full working plans and specifications are completed, reviewed and accepted by DCPO. Originally, when DCPO proposed the two-part format, this was not perceived as a major drawback. DCPO felt that significant time savings could still be achieved through accelerated

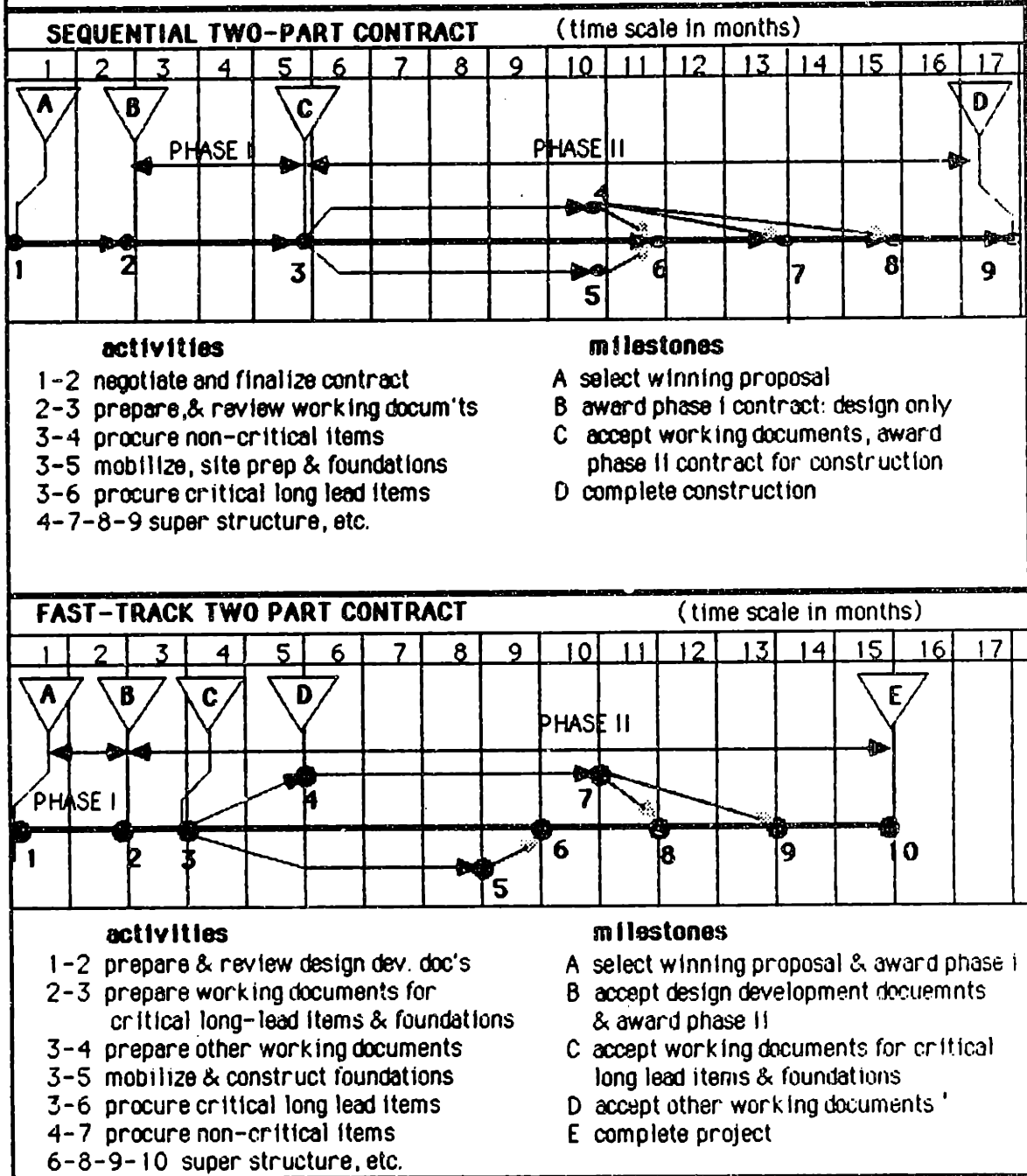
design and by enhanced constructibility and construction pre-planning which would be inherent in the design-build process.

Months after the Alternate Method report had been submitted and the RFP was in preparation, the projected design-build schedule was reexamined. A number of experienced detention equipment suppliers and sub-contractors were contacted about critical long lead items and potential scheduling problems.

It was learned that detention doors and windows are often very critical long lead items because of the lead time required between order and delivery and because delivery is required before any masonry or concrete superstructure work can begin, since the items must be embedded. Preliminary schedule analysis, based on this new information, revealed that significant time savings on the order of two to four months might be sacrificed without pre-purchasing detention items and fast-tracking foundation work. Moreover, the three months originally projected for preparing and reviewing design-development and full working documents seemed somewhat optimistic. Figure 15a shows a comparison between the schedule dictated by the original two part design-build contract and a phased design/fast-track schedule.

DCPO then reconsidered allowing fast-track or phased design and construction, at least enough to allow critical construction activities to begin early. Various worst-case scenarios were played out: What if construction was already started and a "deal-breaking" dispute arose over late design

Figure 15a Simplified Critical Path Analysis of Original Sequential Two Part Design-Build Contract vs. Final Fast-Track Two Part Contract



decisions? Would the contract have to be terminated? If so, would another design-builder be willing to adapt its proposal to the foundation work and pre-purchased materials of the terminated contract? How much of a premium in terms of time and cost would be paid? What would the probability of such a scenario be?

It was generally agreed such a "deal-breaking" dispute during late design was improbable, but had to be provided for. Moreover, termination would probably be more costly than a negotiated contract change, although such a negotiated change might also be very costly and raise accountability problems. The Legal Counsel offered an alternate scenario: In the case of a serious dispute which could not be resolved in a mutually acceptable way, DCPO could invoke an already standard contract provision which allows the government to unilaterally direct a contractor to make a change, even if the contractor protests. In such a case, the contractor may, ex-post, submit a claim to the government which may be appealed through a series of higher authorities. In the meantime, work is not suspended and the contract is not terminated.

Although subsequently modified, this approach was favored at the time it was proposed, since it provided an effective safeguard against a worst-case situation and allowed for fast-tracking. At the same time, there appeared to be a tacit agreement among top officials that the original two-

step contract approach proposed in the Alternate Method report might have been overly conservative given the urgency of the project.

DCPO still felt that it was important to establish some minimum bench-mark of design elaboration beyond the proposal before allowing construction-related activities to begin. Accordingly, the revised contract approach requires essentially complete design-development documents, but not working documents, to be submitted, reviewed and accepted prior to any construction. Once design-development documents are accepted, working documents and construction may be overlapped.

Full working drawings as well as normal shop-drawings and other construction submittals must be made and accepted by DCPO for individual portions of work prior to actual material procurement and construction. But working documents need not be complete for, say, interior finish details, before foundation work begins as long as complete foundation working documents are done. In any case, the design-builder takes full risk and responsibility for coordinating early and later phased work.

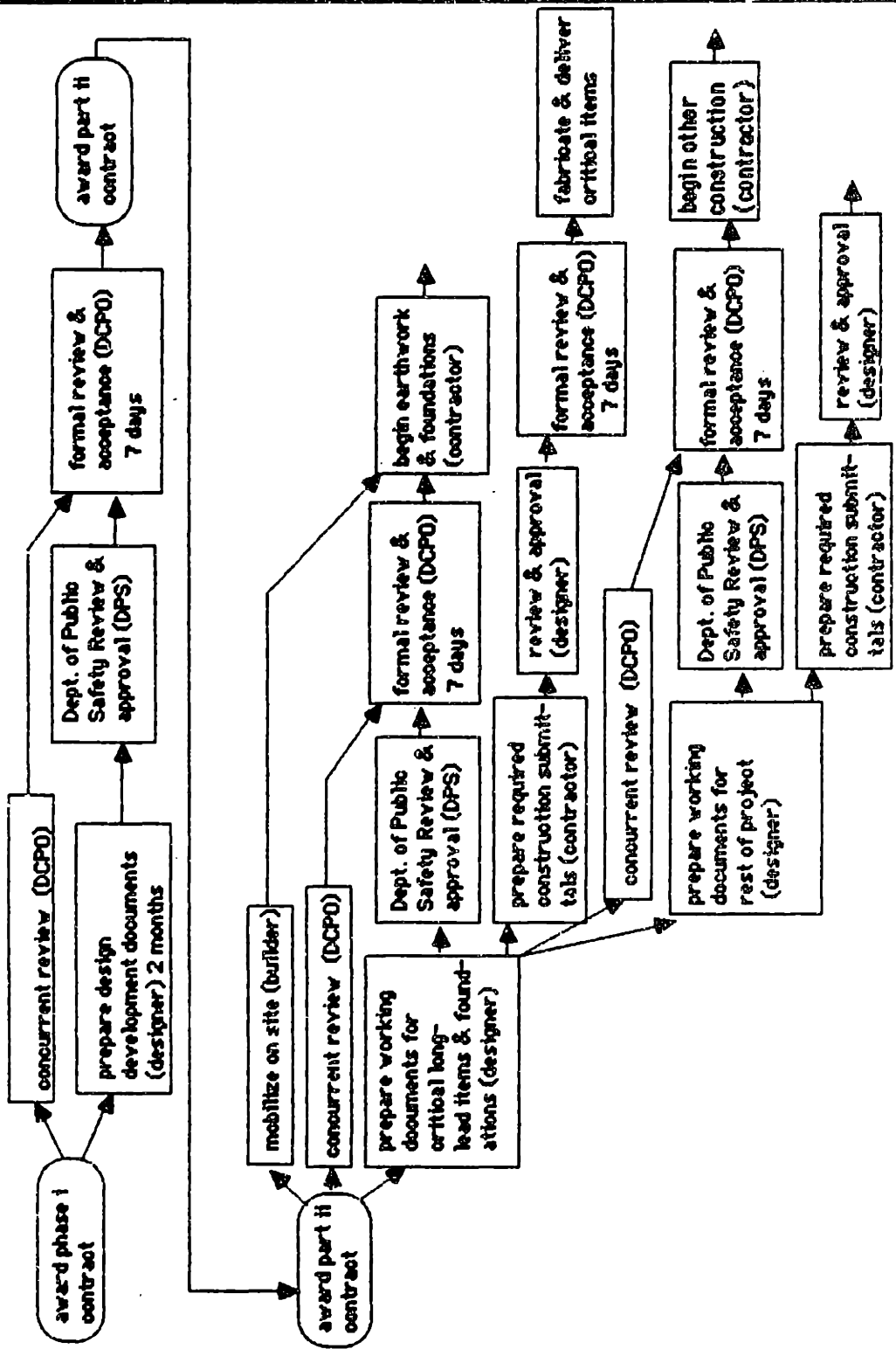
At the request of the IG, a final revision was made which represents a slight compromise between the fast-track format and the original, strict two part contract format. Although the original impetus for the two-part contract came from DCPO, not the IG, the IG was concerned about the modified,

fast-track contract. The IG felt that it was still necessary to have some provision for easily terminating the contract prior to construction in case of a serious dispute. The fast-track contract technically allowed this by virtue of a standard termination clause, but DCPO would have to actively "terminate" the contract rather than actively "approve" a second contract part. At the IG's request, the two-part contract was reintroduced, but now the first part only covers through design-development, while the second part covers working documents and construction. This should still allow fast tracking, but more formally establishes the approval of design-development documents. In a sense, it puts the "burden of proof" on the design-builder to justify continuing the contract by providing acceptable design-development documents, rather than on DCPO who would have to justify termination under the previous version of the contract. Figure 15b shows the design and early construction process in detail based on the final contract contained in the RFP. (See also Appendix D for relevant excerpts from RFP).

15.2 Design Liability and Review

Another significant issue inherent in the design-build process is responsibility, review and approval authority for design. In the traditional method used by DCPO, the designer takes full responsibility and professional liability for design. DCPO reviews designs mainly for compliance with the program and other requirements identified in the pre-design

Figure 15b. Design Review Sequence Based on Contract



study. The designer is fully responsible for technical aspects of the design and is expected make to internal technical reviews as necessary. Under design-build these responsibilities are not so clear cut, given the potential conflict of interest stemming from the designer's relationship with the contractor (see section 7.3).

DCPO feels it is necessary to perform additional review itself to ensure that technical quality of the design is not compromised. At the same time, it does not want to imply that the designer is in any way relieved of his/her traditional professional responsibility or liability. This creates several potential philosophical and practical problems which DCPO has consciously sought to avoid.

Philosophically, this situation creates a potential mis-match of authority and responsibility whereby the designer is held accountable for a design which he/she ultimately does not have authority to approve. From DCPO's point of view, particularly OPM, there was also a reluctance to exercise approval authority which might imply responsibility for technical soundness of a design. This situation was explicitly addressed at several points in the RFP, with language to the effect that DCPO review is meant only to provide an "added measure of public accountability", but that the designer is "in no way relieved of full professional responsibility or liability for the design". Even the term "approval" is avoided in the context of DCPO review. Instead,

DCPO reviews and "accepts" or "rejects" the design documents, but the designer "approves" by virtue of stamping the documents with his/her professional seal prior to submission to DCPO.

Exculpatory language is also inserted at several points to the effect that DCPO reserves the right to reject previously accepted designs or work if found defective, thus further shifting risk to the design-builder. A special addendum to the RFP was just issued which describes the designers' professional ethical obligations and the "special relationship" of trust and confidence which exists between the designer and owner. Although this does not have strict legal weight, it is viewed as an important expression of DCPO's expectations and intent.

In practical terms, technical design review places more demands on the OPM component of the design-build Special Unit. OPM feels that it will have the capability to review most portions of the designs with in-house staff assigned to the Special Unit. This staff will include mechanical, electrical and other engineers, many with experience in correctional facilities. The number of staff assigned to the project will also be somewhat greater than for a comparable project built under the traditional method. OPM is concerned, though, about potential situations where it will not have the necessary technical expertise or number of staff to adequately review certain special portions of the designs, notably specialized security systems and detention equipment.

This raises the question of whether to employ outside consultants to provide supplemental design reviews. The advantage of this is enhanced review capability and improved design quality assurance. The disadvantage of this is seen as more potential for ambiguous professional authority, responsibility and liability. Previous experience with similar third-party "peer reviews" on large projects built under the traditional method has been mixed. In less successful cases, the review consultants apparently have been somewhat overzealous in finding fault with designs out of concern for protecting their own professional liability and/or attempting to prove their own worth and competence. In extreme cases, the added review proved more of a hindrance to the project than a help. In order to avoid this for the design-build project, DCPO decided to retain several outside review consultants on an "as-needed" basis rather than for general review. The individual consultants have been carefully chosen not only for their technical expertise, but also for their demonstrated sensitivity and understanding of the project objectives. Furthermore, their contract explicitly releases the consultants from any professional liability which otherwise might be inferred.

15.3 Existing Condition Risks

A major source of construction risk under any procurement method is differing existing conditions. In the case

of the design-build project for three correctional facilities, this risk is increased owing to the lower than normal level of documentation of existing conditions (see section 13.3). Unlike a traditional bidding situation where bids are based solely on information contained in the bid documents, the design-builders are expected to make their own investigation of existing conditions in order to supplement the limited information provided in the RFP. Such additional investigation includes inspection of existing buildings which will be renovated, even exposing concealed structural conditions, as well as inspection and analysis of existing utilities to determine capacity, and any necessary upgrading.

The question here is whether such additional investigation will be feasible given the limited time and resources available to the design-build teams during proposal development. If the teams cannot or do not make enough additional investigation, how much of a risk premium will it add to proposals? DCPO feels that teams will be able to make the additional investigation and that it will be sufficient to minimize this risk premium. A carefully worded "Differing Site Conditions" section is included in the RFP which allows additional compensation for any differing conditions which "could not be reasonably foreseen" (see appendix C). The design-builders are, in effect, forced to gamble on how liberally DCPO will interpret this principle, especially given the fact that "reasonably foreseen" not only

refers to interpretation of RFP documentation, but also to what kind of pre-proposal investigation is "reasonable".

15.4 Changes and Precedence of Documents

DCPO has adopted some very strict language regarding the basis for contract changes or "change orders" under design-build. Basically, no contractor-initiated changes are permissible apart from differing site condition changes described above. Unlike DCPO's traditional construction contract which also allows changes for design errors and omissions, the design-build contract explicitly prohibits any additional compensation for such errors. The design-builder bears the entire risk of design errors.

Complementing this provision, the contract also includes a special "Precedence of Design-Build Documents" paragraph which establishes precedence of successively detailed documents over earlier ones. This is meant to prohibit any substitutions or modifications which downgrade a previously accepted design. Thus, if an item is originally proposed which exceeds requirements stated in the RFP, and the proposal is accepted (in part because of the better-than-required item), the design-builder cannot later propose to substitute an inferior item on the grounds that it still meets the original requirements set forth in the RFP.

15.5 Construction Quality Assurance and Control

In DCPO's traditional method, construction quality is assured primarily through detailed quality requirements contained in the specifications and through extensive construction shop-drawings, product data and samples which are submitted to the designer who reviews and approves them. Quality is controlled in the field primarily through a DCPO resident engineer who inspects work for conformance with contract documents and approved submittals. A number of field and lab tests are also performed, usually by a testing agency hired by the designer.

DCPO was forced to modify these procedures to accommodate certain unique features of design-build. The dilemma is somewhat similar to that of design review and approval. From a functional and professional point of view, the design-builder should be completely responsible for its own quality assurance and control. However the potential conflict of interest arising from the designer's role creates accountability problems. DCPC addresses this in two general ways: First, it requires a formal, explicit quality control program to be implemented by the design-builder. Second, it provides a number of its own quality assurance and control measures.

The design-builder quality control program is outlined in the RFP, but left up to the design-builder to propose in detail, subject to the approval of DCPO. It requires the design-builder to designate a quality control organization, within the overall project organization, clearly establishing roles

and responsibilities for key individuals concerning quality control. It also requires the design-builder to propose and implement a series of standard procedures and quality control checklists covering all aspects of the project. The designer still retains primary responsibility for construction submittal review and approval. DCPO then provides additional review and acceptance of all submittals in the same way it does for design documents.

DCPO establishes certain minimum quality assurance requirements throughout the RFP, particularly in the technical requirements/specifications which call for specific tests, certifications, submittals, etc.. The designer is expected to elaborate these as necessary as the design is developed and especially in the working specifications. DCPO will provide a Resident Engineer at each facility site who will be supported by Special Unit staff based in the office. DCPO will also directly hire a testing agency to perform or supervise field and lab tests.

15.6 Delays

The design-build process introduces a number of new sources of potential delays which are not present under the traditional method. In addition to normal construction delays resulting from low productivity, late material delivery, weather, etc., the design-builder also faces a number of potential sources of delays during design. The foremost of

these is design review and acceptance.

Traditionally, DCPO allows for three to six week reviews during the design process (see figure 10c). DCPO felt that this length of review was inconsistent with the goal of early delivery; however, the decision about how to reduce this review time was difficult. In the past, design schedules on certain important projects had been reduced by reviewing documents concurrently as they were being developed. OPM officials felt strongly that, even with this type of concurrent review, some formal review at certain points during design had to take place to ensure coordination and completeness. The consensus was that, at a minimum, these formal reviews should take place after full design development and completion of working documents. The appropriate length of such reviews was debated. Some officials favored a conservative time of 30 days; others felt that this should be reduced to the absolute minimum of seven days. Ultimately, the seven day review time was given in the RFP. It remains to be seen if this will prove to be realistic.

Another source of uncertainty and potential delay is Department of Public Safety (DPS) review and approval. DPS is an independent agency which enforces the Massachusetts Building Code. Under the traditional method, DPS approval for designs is obtained prior to bid. Under design-build this approval will be obtained during the course of design. A further complication is that DPS normally does not review documents on a piece-meal basis as is necessary under

a fast-track schedule.

During construction, a major uncertainty from the design builder's point of view is site access and potential delays due to security requirements. These requirements at MCI Concord are especially heavy: every person and vehicle must be searched when entering and leaving the site. Renovation work and utility tie-ins must be scheduled and coordinated so as not to interrupt ongoing prison operations.

Finally, the actual determination of when a facility is complete is subject to some uncertainty and interpretation. The contract requires that work be "99%" complete based on the DCPO-approved schedule of values and that the project must be "fully operational" before final acceptance. These requirements may be waived by DCPO and the user if deemed in the government's best interest, but there is no guarantee as to how acquiescent DCPO or DOC will be in this respect.

Not only are heavy liquidated damages provided for late completion, but a bonus incentive is also offered if the design-builder turns over the project before the contract completion date (see section 14.4 and Appendix A).

Given the high stakes surrounding completion, the contractual allocation of risk for delays becomes especially critical.

The allocation of "downside" ie. late completion risk is handled in essentially the same way as under traditional DCPO construction contracts. Basically, the design-builder is only

held responsible for delays within its power to control. As such, most of the potential delays cited above would not be grounds for imposing liquidated damages. To this extent, DCPO and DOC have an incentive to expedite critical activities which they influence, notably design review.

"Upside" risks associated with early completion and the bonus are not so equitably distributed. The contract does not allow any time extensions for the purpose of calculating the bonus. That is, the bonus is only based on the original contract completion date, regardless of any delays, even those caused by DCPO, DPS or DOC. In theory, this could serve as a disincentive for timely action on DCPO's or DOC's part, to the extent that delay would reduce the value of the bonus the government would have to pay. Presumably this disincentive would not actually outweigh the government's overriding incentive for early occupancy, but could diminish it. DCPO acknowledges the somewhat skewed nature of these provisions, but sees them as necessary for accountability reasons. This is the first time an early completion bonus is being used on a construction project, and DCPO wants to avoid any potential for abuse.

15.6 Post Occupancy

Post occupancy is treated the same in the design-build contract as in DCPO's standard construction contract. A guarantee/ warranty is required for one year after

acceptance of a portion of work. Certain critical building components, notably the roof, require additional guarantees. The design-builder is also required to provide a nominal amount of operation and maintenance instruction and documentation for DOC staff. Aside from these minimal provisions, the government, and DOC in particular, bear most of the operation and maintenance risks for the project.

DCPO seriously considered requiring an optional long-term operation and maintenance contract (for the physical plant only, not guards or other staffing) be included with the basic design-build proposals. The advantage of this was seen as creating an efficient incentive for design-builders to optimize proposals in terms of life-cycle costs. By shifting operation and maintenance risk to the design-builder, it might be possible to use less proven, but potentially cost-effective technology. A precedent exists for this in DCPO's so-called "Shared Savings" program, whereby firms propose energy management improvements in existing buildings and are paid out of a share of the cost savings which they propose. A number of government buildings, including one prison, have been included in this program, and the results after three years appear quite positive (Schectman, 1986).

DCPO rejected such an approach for the design-build projects mainly out of practical considerations. First, it was not certain that an outside maintenance contractor could be integrated into the existing, ongoing maintenance staff and operations at the facilities. Second, it was felt that most

contractor components of the design-build teams would not have the capability to provide ongoing facility management services, and DCPO did not want to burden the design-build teams with the added complication of a third major team participant.

These contract provisions represent the "ground rules" of a new game. It is quite possible that they will need to be adjusted slightly before the project is over. They are not a substitute for integrity and good faith on the part of the State and the design-builder, but it is hoped that they will provide a workable and fair basis for carrying out this vital project.

CHAPTER 16.0

CONCLUSIONS AND FURTHER RESEARCH

This chapter will attempt to summarize and synthesize the DCPO design-build case study which has been presented in chapters 9.0 through 15.0 and suggest directions for continued research. The problem of measuring performance and assessing design-build on the basis of the project for three correctional facilities will be discussed. Then, the hypotheses presented at the beginning of Part III of this thesis will be addressed. Since the design-build project for three correctional facilities is still in progress, conclusions are limited to those aspects and phases of the case which have been observable to date. Most of the hypotheses will not be proven or dis-proven until the outcomes of the project are more advanced. Therefore, much of the discussion about the hypotheses will consist of informed speculation and critical questions surrounding the outcomes of the project. These questions will, hopefully, stimulate and inform ongoing study of the project. Finally, a set of broader, overall conclusions drawn from the case study will be presented.

15.1 Assessing Design-Build Through a Test Case:

The Problem of a Control Reference

The design-build project for three correctional facilities is seen by DCPO and outside observers as a test case for

measuring the success and viability of design-build as an alternate procurement method. The problem is how to define and measure success in a meaningful and objective way. In particular, the assesment must distinguish between factors and outcomes which are inherent to design-build versus those which are unique to the particular project. This suggests some sort of control reference. Ideally, one would like to have two projects with identical contingency factors, apply design-build to one and the traditional method to the other; then measure the projects' outcomes in terms of the critical variables of time, cost and quality as well as public accountability.

No such ideal control projects exist. However, there are two recent/current correctional facility projects which are comparable, in some respects, to the three correctional facilities being procured under the design-build project. These are a \$ 16 M facility for sexually dangerous criminals completed in 1985 and a \$ 33 M medium security facility scheduled for completion in 1987. Both are located in Bridgewater, Masssachusetts and were procured using the traditional method. (The following observations in this section are based on conversations with Binda, 1986.)

Although the facilities are both somewhat larger than any of the individual three facilities in the design-build project, they are probably comparable in complexity or perhaps simpler than the design-build project for three correctional

facilities taken as a whole. The medium security facility is considered comparable in terms of quality and type of construction to the MCI Concord facility in the design-build project.

In terms of delivery time, the most important outcome variable for the projects, the two Brigewater projects both took sixteen months for design and approximately six months for bidding and contract award. The \$ 16 M facility took thirty months for construction, while the \$ 33 M medium security facility is projected to take thirty-six months for a total of fifty-two and fifty-eight months, respectively or total procurement time of approximately four-and-a-half years.

These figures compare with a projected total procurement time of twenty to twenty-eight months for the design-build project (depending on the individual facility). Proposal phase and Part I (ie. design development) of the contract are projected to take approximately seven months, and Part II (ie. working documents and construction) of the contract is projected at fourteen to twenty-one months.

If these target delivery times can be met with design-build, they will represent a very significant improvement over the traditional delivery times. It is difficult to directly translate such time savings into monetary terms owing to the nature of the socio-political benefits of the project (or "denial costs" of not having the project available for use).

But clearly, this early delivery represents a substantial value for the State.

The quality of the Bridgewater facilities is considered good both in terms of architectural design, technical standards and performance. It is expected that the selected design-build proposal will be of similar quality, although this may also be difficult to compare and relate to cost. The construction costs of the medium security facility at Bridgewater compute to approximately \$120/gross square foot (GSF). If this is marked-up 10% for design costs and an additional 10% for two years of cost escalation, the adjusted cost works out to \$ 155/gsf. The DCPO current working estimates for the design-build contract unit cost of MCI Concord is approximately \$ 170/gsf, based on construction estimating data for government projects built under the traditional method. The slightly higher unit cost reflects certain extra utility work and extra hardware requirements for MCI Concord. At a recent pre-proposal workshop, however, the design-builder teams indicated that they felt the DCPO price cap (which was based on the estimate) was unrealistic, and their very preliminary estimates were roughly 25% greater, or around \$ 220/gsf. Assuming this is not simply a preliminary estimating error, it is not clear why the figures vary so much. But, it could reflect the cost of the accelerated schedule and/or risk premiums inherent in the design-build. Moreover, these figures do not reflect the indirect and administrative cost premiums for

design-build which the State must bear, such as the cost of the RFP development, technical review consultants, DBSB, honoraria for proposals, etc. This issue of cost will be further discussed below.

A number of unique characteristics of the design-build project for three correctional facilities must be noted when considering it as a "proto-typical" design-build project for DCPO. First, the relatively small size of the three individual facilities, their distinct programs, security requirements, types of construction and geographical locations makes them less than ideal for design-build, and more difficult than a single, large facility of comparable dollar value. Second, the significant amount of renovation work at two sites, while not totally unique, is also unusual for a design-build project. Third, the fact that this is the first application of design-build for DCPO also distorts the project both positively, in the sense that it is receiving extra attention and effort from all involved; and negatively, in the sense that there is inevitably a learning curve effect which will diminish outcomes which could otherwise be achieved after more experience is gained.

Fortunately, the project for three correctional facilities is not the only design-build project which DCPO is implementing. As previously mentioned, a second design-build correctional facility project, the new Suffolk County Jail, is also under way. This project is regarded by DCPO and others as better suited to design-build than the three

correctional facilities project, and should serve a better design-build proto-type. It is much larger than the three correctional facilities project (approx. \$30-40 M) and consists of a single new facility on an undeveloped, open site. The facility is primarily a detention center for inmates awaiting trial or sentencing rather than an actual prison for long term, sentenced inmates. Although this makes security requirements high, it also makes programming somewhat more straightforward, and some of the traditional versus new-generation design issues may not be as difficult.

The project is currently in the pre-qualification/RFP preparation phase, lagging about four months behind the first design-build, project and will inevitably benefit from experience gained in the first design-build project. The project was identified from the outset as design-build, and the pre-design study is being made with this in mind, thus eliminating the need for multiple consultants and special contracts for supplemental specifications. The prequalification process has already been refined and improved as a result of the first project, and many portions of the first RFP will be adapted and refined for the second, rather than reinvented. Given these factors, the Suffolk County Jail project may ultimately prove to be a more favorable and meaningful project on which to base an assessment of design-build.

16.2 Measuring the Design-Build Project for Three Correctional Facilities Against the Hypotheses and Critical Outcomes to Observe

This thesis presents only an interim case study of the DCPO design-build project for three correctional facilities. The conclusions presented here are preliminary and tentative only. In order to gain full advantage of the case study approach which has been started, and to more fully test the hypotheses it is necessary to continue observing the project. The next eight to twelve months will be a crucial period for the project as it moves through proposal, design and early construction phases. The project should continue to be observed from DCPO's point of view. It may also be useful to study the project from one or more of the design-build team's perspective, since information from this point of view has not been possible until now. To help guide this continuing investigation, critical questions concerning the project outcomes are posed after the discussion of each hypothesis.

HYPOTHESIS ONE:

Design-build is most appropriate when early delivery through integration of design and construction and fast track scheduling is desired and a competitively obtained fixed price is required prior to construction.

Based on DCPO's decision making process which led to the

recommendation to use design-build, this hypothesis would appear to be true (see chapter 10.0), with the notable exception that DCPO did not originally plan to use fast-tracking in conjunction with design-build. Rather, design-build was seen as inherently faster because of the high degree of integration of design and construction it permitted. Later, after the basic decision to use design-build was made, DCPO decided to allow fast-tracking.

Although the traditional method has been significantly accelerated in the past for certain special projects, DCPO feels that this cannot be done on a regular basis due to resource limitations. Moreover, the traditional method inherently precludes true integration of design and construction and fast-track scheduling.

Construction management (CM) does allow integration of design and construction, but does not allow a competitively obtained fixed price prior to construction. If design-CM is used where the owner directly contracts with specialty contractors, the owner must bear the risk of coordinating multiple prime contracts on a single project, something DCPO was very reluctant to do. If contractor-CM is used with a guaranteed maximum price (GMP) established during design-development, the advantage of competition is lost since the price is essentially negotiated. This will be discussed more in the overall conclusions below.

Design-build allows maximum integration of design and

construction and provides strong, inherent incentives for designer and contractor to work together to optimize time, cost and quality. By soliciting multiple proposals from pre-qualified teams, competition and accountability is enhanced. Moreover, design-build allows alternate building systems to compete.

Critical Questions

In as much as this hypothesis is very broad and general, it will be supported or denied by the conclusions of the other hypotheses. Correspondingly broad questions raised by this hypothesis are:

* Although design-build may be the only procurement method which allows fast-tracking and a competitive, fixed price prior to construction, is it always appropriate when these requirements must be met? The procurement method decision model presented in chapter 6.0 suggests that another important contingency factor must also be present: The project must be relatively simple, straightforward and definable in terms of generic standards and performance requirements. If this is not true, the model suggests that no procurement method is appropriate and that constraints must be relaxed or redefined before an appropriate method can be selected.

* Will the design-build teams be able to achieve the necessary degree of integration required to perform up to

DCPO's expectations? Given the fact that the design-builder for the project will not be a single, vertically integrated entity, but rather a project-specific team composed of separate designers and contractors, how will the separate individual members of the design-build teams share risks and rewards associated with the project? Will the members be successfully integrated into a true team with common interests and purpose or will serious tensions arise out of conflicting interests? In particular, what will the role of the designer component be and will it be overshadowed by the contractor component?

HYPOTHESIS TWO:

Because of the technical complexity and lack of well established performance criteria for correctional facilities, the design-build request for proposals (RFP) and evaluation criteria become especially critical and problematic. A high level of prescriptive detail and rigorous, explicit evaluation criteria will enhance accountability and ensure quality, but will constrain proposals. A lower level of prescriptive detail and broader, implicit evaluation criteria will maximize flexibility in both solutions and selection, but raise potential accountability problems.

The "conventional wisdom" expressed by public agencies that have considered or used design-build is that design-build is best suited to projects which are fairly simple, straight-

forward and can be defined in terms of well established generic standards. DCPO's decision to use design-build implies that it either regarded the three correction facilities as meeting this criterion or, it did not feel that this criteria is an absolute prerequisite for design-build. That is, even if the facilities are complex and non-standard, a workable RFP could still be produced.

The experience of preparing the RFP indicated that the facilities are, indeed, complex and very difficult to define well in terms of generic standards and performance criteria. Generally, DCPO opted for a fairly conservative, detailed, prescriptive definition of project requirements in the RFP, feeling it is better to err on the side of quality and accountability. The RFP does, very consciously and explicitly, try to minimize unnecessary requirements and encourage alternate solutions where possible. There appears to be agreement, not only within DCPO, but also in the design-build teams, that the RFP is an excellent document, given all the factors which it has to address.

Critical Question

* Will the design portion of the proposals meet the expectations of DCPO? This will essentially test the effectiveness of the RFP and the competitive proposal process. Will the design benefit from competitive alternatives in a meaningful way, or is the project so

tightly constrained by program, existing conditions and technical requirements that inventive, superior solutions are seriously inhibited? Similarly, will design suffer from either lack of direct interaction with the user or from pressure by the contractor component of the teams to overly simplify or otherwise inhibit design in the interest of time, cost and risk?

HYPOTHESIS THREE:

Design-build, involving a fixed price contract and accelerated scheduling, is especially intolerant to changing project requirements. This further increases the need for good definition of project requirements in the RFP and good internal communication among sub-actors within the owner organization. It also requires exceptionally responsive decision making and project administration within the owner organization.

This hypothesis will be best judged after the project is complete. Tentatively, it appears to hold. Because multiple, competitive proposals are involved, it is not possible for the owner and the designers to interact directly during proposal development, when almost all significant design decisions will be made. Designers will not be able to get detailed feed-back on their proposals until after they are complete and submitted. During proposal review there will be limited opportunity for design revision. However, excessive changes and negotiation may cause delays and also

may undermine the intent of competitive procurement thus raising potential accountability problems. The fast-track schedule will make any changes after contract award, particularly after design-development, extremely difficult and costly.

All this implies that it is imperative for requirements stated in the RFP to be complete and accurate. Achieving this depends on good communication both within DCPO and especially between DCPO and the user agency, DOC. The various owner sub-actors involved in the project have worked hard to enhance communication by creating the Special Unit, designating Project Coordinators and conducting extensive reviews. However, the complexity of the DCPO and DOC organizations, the sometimes diffuse distribution of authority, and the time pressure of the project have made this difficult.

Perhaps the most critical test of this hypothesis will come during the proposal and design review phases of the project. Two months is currently allowed for review, selection and contract award. Subtracting time for possible proposal revisions and resubmissions, DBSB evaluation and contract processing-- the technical review team, including DOC representatives will only have a few weeks to check the proposals and make their assessment. A thorough technical review will be essential to avoid potential later disputes, yet there will be very strong time pressure not to delay the

process. Design reviews under the contract are even more accelerated. The seven-day turn-around provided in the contract barely allows time for submissions to go through clerical handling. This will require that most review be done concurrently as design documents are being produced. Late detection of any problems by DCPO or DOC could cause serious delays and/or disputes.

Critical Questions

* Will extensive RFP amendments and/or proposal revisions be required? Depending on the changes, this may indicate communication problems within the owner organization. In particular, have DCPO and DOC been able to communicate well enough to avoid significant DOC initiated changes after the RFP has been issued?

* Will significant changes arise after proposal selection and contract award? This may also indicate internal communication problems between DCPO and DOC. It may also indicate inadequate technical review of proposals and/or a lack of timely and/or effective review during design-development and working document phases of the project. Will DCPO be able to keep up with concurrent and seven day formal design reviews? Will DPS building code examiner review and approval be timely enough to keep up with the accelerated, fast-track design schedule envisioned? And, if not, will it disrupt the project?

* Will problems arise out of direct communication between the design-builder and DOC? Although the contract clearly requires all communication to flow through DCPO, and that only the DCPO project manager has authority to negotiate and approve changes, there is always a chance that either the design-builder or DOC might attempt to bypass DCPO for some reason. This could lead to various conflicts about changes, substitutions, requirements, etc.. While this can be a problem even under the traditional method, the accelerated design-build process may be particularly vulnerable to such disruptions.

* Will the bonus incentive or liquidated damages be applied and serve to expedite the project? Will the design-builder be more willing to compromise on changes or potential disputes in the interest of collecting a bonus? Will the skewed allocation of delay risks, especially for calculating the bonus, diminish the government's incentives to expedite the project?

HYPOTHESIS FOUR:

Design-build in the public sector involves a number of trade-offs, not only between time, cost and quality, but also accountability. Accountability becomes increasingly difficult to maintain as the project becomes more complex, and especially as the delivery schedule is accelerated, as in the case of correctional facilities. Despite these trade-offs overall efficiency is higher under design-build

than the traditional or other alternate procurement methods.

These trade-offs include:

H4.A--More detailed proposal submission requirements to ensure quality and reduce cost risk of project vs. speed and cost of proposal preparation.

This part of the hypothesis cannot be fully tested until proposals are received. Preliminary indications may suggest that this is an inherent source of inefficiency in the design-build process which is exaggerated due to the complex nature of project and heightened concern for accountability. DCPO has set very strict proposal submission requirements in keeping with its generally conservative approach to project definition. Designers have voiced serious complaints about the time and cost of proposal preparation and it is possible that some may actually drop out because of this. Yet DCPO strongly feels that it cannot reduce the submission requirements and still ensure quality.

It is also unclear what, if any, risk premiums will be added because of basing a fixed price on a lower level of design definition than would normally be used. This will depend largely on the risk aversion of the design-build teams, particularly the contractors, and also on how "comfortable" the contractor components of the teams are with the designs. Contractor risk aversion, coupled with the accelerated schedule, may push the designers toward simpler solutions than they would otherwise produce given the program and

technical requirements.

Critical Questions

* Will the extensive proposal submission requirements coupled with designers' risk aversion cause proposal costs to be so high as to force some teams to not submit proposals?

* Will price proposals be competitive with the traditional method? If prices are higher than expected, why? Two possible causes may be investigated:

Higher prices could simply reflect the cost of the very accelerated design and construction schedule. If this is the case, it would not be fair to associate this premium with design-build. In fact, the premium might be lower under design-build than it would be for comparable schedule using the traditional method (if such a schedule is attainable at all). One indication that schedule is the cause of high cost might be if schedule proposals do not indicate completion earlier than the latest acceptable dates given in the RFP.

A second possible cause for high prices may be added risk premium caused by basing prices on a low level of project definition. This could be a reflection of risk aversion and uncertainty about the designer and owner the part of the contractor component of the design-build team. This added cost would be directly attributable to the competitive design-build process and may warrant serious consideration.

* What will the total cost premium be for additional administrative costs associated with design-build? These include: additional in-house staff and consultants to prepare the RFQ and RFP, perform technical review of proposals, design-development and working documents; the DBSB; and honoraria for proposals.

H4.B--More detailed, explicit and rigorous proposal evaluation criteria and methods to ensure fairness and competition, vs. looser, more general evaluation methods and criteria which provide maximum flexibility for owner in selection process.

Again, this part of the hypothesis cannot be completely tested until after proposal selection. But currently this does not appear to be as significant or difficult a trade-off as was originally perceived. A rigorous, explicit set of proposal evaluation criteria has been developed which will satisfy strict accountability requirements without an artificial, numerical point system which might inhibit flexibility and good judgment of the DBSB (see section 14.4).

Critical Question

* Will the evaluation and selection process satisfy public accountability expectations? If the lowest priced proposal is not selected because of other evaluation criteria, will the DBSB and the Deputy Commissioner be able to justify their decisions in a transparent, defensible way? Will the

design-builder teams be satisfied that DCPO effectively communicated its priorities and basis of selection so that time/cost/quality trade-offs were not sub-optimized?

H4.C--Sequential design-construction process and "lingering threat of competition" after "tentative proposal selection" to ensure design-development conforms to proposal and to allow additional cost and quality optimization before committing to construction vs. fast-tracked design and construction which saves time, but increases risk of disputes and diminished quality.

This hypothesis will not be fully tested until the project is nearly complete or at least advanced beyond design. This appears to be a significant trade-off which was difficult to make, judging from the amount of change this aspect of the contract went through from the Alternate Method report to the final RFP. The final contract is based on a two-part format which requires sequential development of design development documents, but allows fast-tracking of working documents and construction.

From a cost and quality point of view, this appears fairly safe since construction will not begin until the design is defined beyond a level customarily required for a GMP (ie. 40-80% design development). Any "deal-breaking" disputes arising from interpretation of the proposal should be apparent by this point, leaving opportunity to terminate the contract before construction funds are committed. In any

case, DCPO may still exercise the unilateral change order provision in the contract (see section 15.1)

The question is whether the project schedule will be hurt by two-part format. Ideally, working documents and even some critical construction submittals should also be "fast-tracked" while design-development documents are being finalized. Yet with the two-part contract, it is not certain that the design-builder will be willing to gamble on approval of the second part of the contract and begin these documents during first part of the contract.

Critical Questions

* Will DCPO gain a significant negotiating advantage during design development because of the two-part contract and "lingering threat of competition"? Will any "deal-breaking" disputes over proposal interpretation actually arise, and, if so, will DCPO exercise, or threaten to exercise its right not to sign Part II of the contract?

* Will the design-builder be able to produce full design-development documents within the prescribed two month period?

* Will the two-part contract delay the project either because of the administrative time required to sign-off on part two, or, more importantly, because the design-builder will not begin working documents or construction submittals until after Part II is signed?

H4.D--Quality control/quality assurance during design and construction by owner or consultant to avoid possible conflict of interest vs. design-builder "contractor quality control" system which is more efficient and involves less time-consuming bureaucratic procedures.

Based on the quality assurance/quality control (QA/QC) requirements, and responsibilities stated in the design-build requirements DCPO is trying to hedge both ways. The design-builder is expected to provide and take ultimate responsibility for QA/QA. But DCPO also reserves authority to intervene by making its own design and construction QA/QC and retaining third-party technical consultants.

The actual outcome of this arrangement may depend largely on the degree to which a mutually trusting and cooperative relationship can be established between DCPO and the design-builder, particularly the designer component. DCPO hopes that through prequalification and careful consideration of the design-builders' management capabilities, including QA/QC, prior to contract award, the need to exercise its own QA/QC authority will be minimal.

Critical Questions

* Will the potential conflict between responsibility and authority for QA/QC during design review or construction lead to disputes or delay the project?

* How actively will DCPO exercise its QA/QC authority? Will DCPO be forced to reject a significant amount of design and construction submittals? If so, how will this affect the project?

16.3 Overall Conclusions

The DCPO experiment with design-build probably represents one of the most sophisticated and significant innovations in public sector procurement within the last ten years. This section will attempt to "step-back" and view the case study in terms of some of its broader and more far-reaching implications. Possible future development in procurement methods at DCPO, based on the design-build experience will be discussed. The larger question of innovation and change in public sector procurement will be considered. Finally, observations on the present state of knowledge and need for a comprehensive theory of procurement methodology will be made.

Future Procurement Innovations at DCPO

The consensus among DCPO officials and others interviewed is that no alternate procurement methods will be implemented until the current design-build projects are complete and carefully assessed. If design-build is judged a success at DCPO, it is quite likely that this method will be used on more projects in the future. It is also quite possible that

certain specific features and innovations introduced in the current design-build projects will be adopted into the standard traditional method. Such innovations include the bonus incentive for early completion and prequalification of contractors.

Design-build may also pave the way for other alternate procurement methods, notably construction management. CM would appear to offer many of the advantages of design-build, ie. integration of design and construction, value engineering, enhanced scheduling, constructability, cost estimating, etc.; while the same time, solving some of the problems with design-build cited above, ie. high cost of competitive fixed price proposals, lack of direct interaction between user and designer during proposal development, lack of owner control and difficulty of making changes.

These advantages would have to be weighed against the risks and/or problems of competition associated with CM described in chapters 5.0, 6.0 and 10.0. In the past, when CM was tried by the BBC and other public agencies, it was used in the professional design mode. The problems cited with this are: developing an effective selection process based on professional reputation, capability, management plan, etc., rather than price; controlling the government's risk for coordinating multiple prime contracts; and, creating a contractual incentive for the CM to control time and cost without creating an adversarial relationship or

conflict of authority and responsibility between the government and the CM.

The contractor-CM mode with a guaranteed maximum price/shared savings is an alternative which may solve some of these problems. The disadvantage with this is that the GMP would be essentially negotiated. Accountability could still be provided through careful structuring, bidding, and calculation of shared savings on individual work packages and by a good selection process. The role of the designer would also have to be carefully considered, it may prove desirable to allow designers and CM's to be selected together as a team to ensure compatibility, but enter into separate contracts with the government to prevent conflict of interest.

In any case, DCPO's ability to consider and implement any of the above alternate methods in the future will be greatly informed and enhanced by the experience gained from the current design-build projects.

Procurement Method Innovation in the Public Sector

Several significant findings are suggested by the case study. These concern competitive, non-quantitative, multiple criteria selection methodology; the nature of change within a bureaucratic, institutional context; and the organizational requirements necessary to effect such change.

In the area of constructed facilities procurement, public accountability, ie. protection from "waste, fraud and abuse" is closely associated with competitive bidding and selection based on a single, quantifiable variable-- namely price. Design-build does not inherently lend itself to this selection method because of the "apples to oranges" nature of competing proposals.

Various public owners have tried to circumvent this problem by trying to reduce and quantify selection variables. In the case of the military two-step method, differences in quality of proposals are reduced to "pass/fail" and selection is made on the basis of low price of "passing" proposals. In other methods, a detailed and often artificial point-weighting system is used, sometimes in conjunction with a fixed price. In almost all cases, delivery time and management capabilities of the proposers are assumed to be constant and do not enter the selection formula.

The selection method and underlying philosophy used by DCPO for the design-build project is based on the premises (a) that not only cost and quality, but also delivery time and team management capability can and should be used as a basis of proposal selection; and (b), that these variables can be better evaluated and related on a qualitative, verbal basis, rather than through a numerical formula. DCPO feels that this selection method can be effectively protected from abuse through mechanisms like the DBSB and through good

documentation of the selection process before, during and after the selection is made. Approach has broad implications not only for DCPO, but for public sector constructed facility procurement in general. If the approach is successful it will reduce a significant obstacle to procurement innovation. It will also help remove some of the distortions and inefficiencies associated straight competitive bidding such as lack of reward for superior contractor management and performance and the "low-bid/change-order" syndrome (see section 2.3).

Another significant generality suggested by the case is the issue of radical change versus evolutionary reform of procurement methods in the public sector. Many of the innovative features of the DCPO design-build method are not, per-se inherent in design-build, but could be applied independently to the traditional method. The bonus incentive provision is one such example. Yet DCPO consciously rejected reforming the traditional method in favor of adopting a totally new, different method.

Implicitly, there was a sort of double standard in this approach, ie. that certain innovations which were considered unfeasible or unacceptable as part of the traditional method were deemed acceptable in the context of design-build. Yet in practical terms, given the existing statutory framework and organizational environment of DCPO and the State Government, this approach was probably

justified.

This notion of change also has implications on the organizational resources required to implement procurement method innovation. In many respects, DCPO must be seen as a unique and somewhat atypical government agency in terms of its sophistication, openness to change, and human resources. The design-build project has called for an exceptional amount of creative thinking, non-standard decision making, organizational discipline, commitment and, in some cases, personal risk. Not every public agency or owner has these kinds of capabilities. And it would appear that any such agency contemplating changing procurement methods must not underestimate these important, but somewhat intangible requirements. Furthermore, when judging the success of such an innovation and its suitability for continued use, the agency must honestly determine if the innovation can be successfully implemented and institutionalized in the absence of exceptional organizational resources.

Further Research on Procurement Methodology

The background research on alternate procurement methods which was done in connection with this case study revealed a surprising lack of coherent, well documented material on the subject. Most literature on this subject tends to be anecdotal or slanted by special interests of various professional or trade associations. Little is written on

procurement methodology from the owner's perspective.

A body of literature began to appear on this during the early 1970's which includes the GSA/PBS study of procurement methods (GSA/PBS, 1970) and a number of papers published in the Industrialization Forum (IF OP/1,2,3, etc.). However, little follow-up research has appeared in the last decade. For example, GSA dropped its construction management system sometime in the late 1970's, but apparently no formal "post-mortem" of GSA's experience with CM was conducted. Most interviews conducted with various public agency officials, designers and contractors revealed a surprizing lack of consensus about when different procurement methods are most appropriate, critical problems and pitfalls associated with different methods and even basic terminology such as "construction management", "design-build" and "fast-track". The situations resembles the ancient parable about the blind men descibing an elephant (one feels the trunk and describes the elephant as a snake, the other feels the leg and describes it as a tree....etc.).

What is sorely missing is a coherrent model of the "elephant" itself, ie. a theory of procurement methodology. The model presented in chapter 6.0 of this thesis is a very preliminary attempt at the beginning of such a theory. The basic purpose of such a theory would be to develop a systematic taxonomy of procurement methods and attributes and to relate that taxonomy to external variables or contingency factors so that an optimal procurement method can

be selected and tailored for any given project. Future research towards developing this theory should be both extensive and intensive. Broad surveys and comparative studies of different owners, projects and procurement methods should be conducted in order to establish and verify patterns and trends, as well as to identify exceptional cases. Intensive investigations into specific projects will compliment these general observations and reveal more subtle, particular variables. In this light, it is hoped that this thesis makes a small contribution toward "modeling the elephant."

BIBLIOGRAPHY AND REFERENCES

Books

Blau, Judith R.. Architects and Firms: A Sociological Perspective on Architectural Practice. Cambridge, MA: The MIT Press, 1984

Boice, John R.. A History and Evaluation of the School Construction Systems Development Project 1961-1967. Menlo Park, CA: Building Systems Information Clearing House, 1972

The Business Roundtable. Construction Industry Cost Effectiveness Project Reports:

*A-6: Modern Management Systems. November, 1982

*A-7: Contractual Arrangements. October, 1982

*B-1: Integrating Construction Resources and Technology Into Engineering. August, 1982

New York: The Business Roundtable

Caudill, William W.. Architecture by Team. New York: Van Nostrand Reinhold Company, 1971

Clark Foundation Program for Justice, Cory, Bruce and Gettinger, Stephan. Time to Build: The Realities of Prison Construction.

Washington: Clark Foundation, 1984

Construction Engineering Research Laboratory (CERL) US Army Corps of Engineers. Industrialized Building Systems Guide: The Management of Building Procurement. Champaign IL: CERL, January, 1976

The Construction Specification Institute (CSI).

*MP-1-12 Performance Specifications . March, 1980

*MP-2-4 Performance Specifying Format. May, 1981

Alexandria, VA: CSI

Crozier, Michael J.. The Bureaucratic Phenomenon.

Chicago, IL: University of Chicago Press, 1967

de Neufville, Richard L. and Stafford, Joseph. Systems Analysis for Engineers and Managers. New York: McGraw Hill, 1971

Downs, Anthony. Bureaucratic Structure and Decision Making. Los Angeles: The Rand Corporation, 1966

Educational Facilities Laboratories. SCSD: The Project and the Schools. Menlo Park, CA: EFL, 1968 (?)

Foxhall, William B.. Professional Construction Management and

Project Administration, New York/Washington: Architectural Record and AIA, 1976

Halpin, Daniel W.. Financial and Cost Concepts for Construction Management, New York: Wiley, 1985

Heery, George T.. Time, Cost and Architecture, New York: McGraw-Hill, 1975

Haviland, David S. ed.. Project Delivery Approaches: an AIA Guide, Washington D.C.: AIA, 1976

Industrialization Forum (IF). Occasional Papers:
*One: Building Procurement: Proceedings of a Workshop, January, 1976
*Two: Alternative Processes; Building Procurement, Design and Construction, Glover, Michael, ed., March, 1976
*Three: Answers for the Building Community: Optimizing the Choices, Norsa, Aldo, ed., September, 1976. Montreal, Canada: IF

Lawrence, Paul R. and Lorsch, Jay W.. Organization and Environment: Managing Integration and Differentiation, Homewood, IL: Richard D. Irwin, Inc., 1969

Lifson, Melvin W. and Schaifer, Edward F.. Decision and Risk Analysis for Construction Management, New York: John Wiley & Sons, 1982

Macedo, M., Dobrow, P. and O'Rourke, J.. Value Management for Construction, New York: John Wiley and Sons, 1978

Meier, H.. Construction Specification Handbook

Nagel, Robert. The New Red Barn, New York: 1973

Raiffa, Howard: Decision Analysis: Introductory Lectures on Choice Under Uncertainty, Cambridge, MA: Harvard Press, 1965

Rosen, Harold J.. Construction Specifications Writing

Tavistock Institute, Crichton C (coordinator). Interdependence and Uncertainty: A Study of the Building Industry, London: Building Industry Communications, 1966

Articles and Papers in Journals and Periodicals

Ball, John S. "Selecting and Evaluating Contractors... and matching appropriate method of contracting to your specific project needs" Building Operating Management July, 1986

Bobrow, Philip D.. "Experimental Changes to the Architectural Process" Industrialization Forum (IF) Vol. 5,

(1974) no. 5

Building Research Establishment News. "Faster Building for Industry" No. 61, Winter, 1984

Building Design & Construction. "Government Agencies: Government increases use of alternative delivery", December, 1985

Engineering News Record (ENR)

* "Construction Managers Headed Down the Homestretch (for GSA contract)" September 3, 1971

* "GAO Raps Army Turnkey Housing Job". September 30, 1971

* "And now: turnkey (for GSA)". October 14, 1971

* "GSA launches its first turnkey building job". December 2, 1971

* "GAO rejects turnkey for sewer plant". July 11, 1974

* "Top design-builders boost share", "ENR top 400", April 17, 1986

Greenfield, Seymour S., "Turnkey Construction in the United States" American Society of Civil Engineers (ASCE) Journal of the Construction Division Vol. 108, No. CO2, June, 1982

Holden, Richard. "Procurement: The University of Alaska's Experience" IF Vol. 5 (1974), No. 1-2

Hasbrouck, Douglas." Managing the Design-Build Process Using Performance Documents: the Dormitory Authority Experience " IF Volume 8 (1977) No. 3

Law and Contemporary Problems. special issue devoted to "Construction Management and Design-Build/Fast Track Construction". Foster, C. Allan, (special editor) Vol. 46, Winter 1983, No. 1 articles include:

* Dibner, David R., "Construction Management and Design-Build: An Owner's Experience in the Public Sector"

* Sweet, Justin. "The Architectural Profession Responds to Construction Management and Design-Build: the Spotlight on AIA Documents"

Narver, David L. F. ASCE. "The Adopted Guide to Turnkey Construction Contracts" ASCE Journal of Professional Activities Vol. 101, April 1975, No. EI2

Norsa, Aldo and Davidson, Colin (editors). "Strategies for the Building Owner-- an IF Conference". IF Vol 8 (1977) No.

de Neuville, Richard. "Bidding Models: Effects of Bidders' Risk Aversion" ASCE Journal of the Construction Division, Vol 103, March 1977, No. CO1

Reports and Theses

Avelino da Silva, A. A. *****. Thesis, Massachusetts Institute of Technology, *****

Theodore Barry & Associates (TBA) "A Survey of Organizational and Contractual Trends in Power Plant Construction". Los Angeles: March 1979

Fallon, Paul E.. Architectural Documentation Required for Fast Track Projects with a Guaranteed Maximum Price. Thesis, Massachusetts Institute of Technology (MIT), May 1981

General Services Administration (GSA) / Public Building Service (PBS) "Construction Contracting Systems: A Report on the Systems Used by PBS and Other Organizations". Washington: GSA, March, 1970

Ibbs, C. William and others. "Determining the Impact of Various Construction Contract Types and Clauses on Project Performance". Champaign-Urbana IL, University of Illinois Dept. of Civil Engineering, 1986

Irwig, Henry G..The Building Design Process: An Investigation into Productivity. Thesis, University of the Witwaterstrand, Johannesburg, South Africa, 1977

Krause, D. A. and Smith, G. D.. A Study to Determine if Design-Build Procurement Methods for Family Housing are More Economical than Conventional or Two-Step Methods. Thesis, Air Force Institute of Technology, September 1972

National Building Agency, Cleeve Barr FRIBA, Managing Director. "Integrating the Building Team" conference papers. London: NBA, 17 November 1967

Ster, John W.. The Concept and Application of Turnkey Construction Contracting in the Navy, Thesis, Naval Post Graduate School, Monterey CA, December, 1972 (NTIS no. AD/A-004 257)

US Department of Housing and Urban Development (HUD).Low Rent Public housing Turnkey Handbook, HMG7425.1. Washington: October, 1973

Contract Documents

American Institute of Architects (AIA) Standard Documents. Washington, D.C.: AIA

*A201 General Conditions of the Construction Contract, 1976
*A201/SC Federal Supplementary Conditions for the Contract

for Construction, 1977

*AB801 Owner-Construction Manager Agreement, 1973

The Associated General Contractors (AGC). AGC Document No. 8 Standard Form of Agreement Between Owner and Construction Manager, 1977

Carlson Corporation. Standard contract forms Framingham, MA: (undated)

*Contract Relating to Construction Management Services
*Guaranteed Maximum Sum Contract

County of Santa Clara, CA. Invitation for the Consideration of Design and Construction Services for a 196 Bed Mens' Pre Trial Single Cell Tilt-Up Facility at Elmwood Detention Facility, Milpitas, CA. San Jose, CA, March, 1986

District of Columbia Department of Public Works. Request for Proposal for the Construction of a Precast Modular Facility, Central Facility, Lorton, VA. January 1976

Naval Facilities Engineering Command (NAVFAC) Western Division Request for Proposals N62474-82-R-0805 77Family Housing Units and Community Center in Support of Mountain Warfare Training Center, Bridgeport, CA/ San Bruno, CA September 1983

State of Missouri Department of Public Works. Request for Turnkey, Proposal for 500 Bed Maximum/Medium Security Prison Kansas City, MO, January, 1986

Commonwealth of Massachusetts Documents (in chronological order)

Ward Commission. Final Report to the General Court of Special Commission Concerning State and County Buildings, December, 1980

Massachusetts General Court, Chapter 579 Construction Reform Act (to create the Division of Capital Planning and Operations (DCPO), 1980

DCPO, Lee, Tunney, Deputy Commissioner. Guidelines for Studies of Building Projects Prepared for State Building Authorities and Counties. March, 1983

DCPO, Lee, Tunney Deputy Commissioner. Recommendations and Plans for DCPO, 1985

Dukakis, Michael S., Governor. A Balanced Plan to End Prison Overcrowding (aka "Special Message On Prison Overcrowding") submitted to the Legislature, April, 1985

DCPO, Lee, Tunney, Deputy Commissioner. Alternative Method of Design and Construction for Correctional Facilities, October, 1985 (also see Alternative Method of Design and Construction for the Suffolk County Jail, February, 1986

Interviews

Caroy, ???, District of Columbia Department of Public Works (project administrator for Lorton Va. precast modular design-build prison project) 5 June, 1986

Feldstein, Bernard, AIA, Whittney, Atwood, Norcross Assoc., Boston, MA (architect on recent correctional facilities in Brigewater MA), 17 April, 1986

Hogue, Philip, P.E., Booker Assoc., St. Louis, MO (principal in-charge for drafting RFP for Missouri design-build prison project) 17 April 1986

Lee, Tunney, Deputy Director of DCPO. , 2 June 1986

Messino, Ralph, P.E., Code 04, head of design section, Naval Facilities Engineering Command NorthDiv., Philadelphia, PA (project administrator familiar with Navy turnkey housing projects)

Norman, Michael, Ph.D., Assistant Director-Administration, Div. of Design and Construction, Jefferson City, MO (project administrator for Missouri prison design-build prison), 27 March, 1986

Poodry, Deborah, Director, Office of Programming, DCPO, 29 May 1986

Poulos, Arthur, Deputy Director, OP, DCPO, (former project administrator BBC familiar with previous U.Mass Boston, project with MBM CM contract) 24 July, 1986

Siegel, Harvey and Swagger, Eugene, AIA, Philips/Swagger Assoc. Peoria, IL (specialists in correctional facilities and participants in Missouri Prison design-build competition) 4 April 1986

Silver, Paul, AIA, Principal, Gruzen Associates, New York, NY (architect specializing in correctional facilities and design-build.) 18 April 1986

Special Unit Staff and Others Informants

The author worked with the following individuals and attended various meetings and site visits with them in the course of the case study, March-September, 1986:

Baxter, Christie, Deputy Director, OP, DCPO and head of OP component of Special Unit

Bell, Ellen administrative assistant, OP DCPO, assigned to Special Unit

Binda, Alphonse, Deputy Director OPM, DCPO and head of OPM component of Special Unit

Carlson, John (Jack), Deputy Commissioner, DCPO and special advisor to DCPO on the design-build project

Correia, Richard, Director, Office of Project Management, DCPO

De Toma, John, Facility Engineer, DOC, MCI Concord

Foran, Arthur, consultant on technical specifications for design-build project

Garrity, Robert, Legal Counsel, DCPO

Gisiger, John (Jack), Senior Planner, OP, DCPO study coordinator for Special Unit and researcher for Alternate Method study

Griegas, George, Superintendent, Bay State Correctional Center

Honeycut, Thomas, preventive maintenance consultant

Korobkin, Barry, AIA, KJA Associates, study consultant for SMPRC and BSCC

Mayer, James, Deputy Director, OFM, DCPO

Nally, Thomas, Special Unit Coordinator, DCPO

Park, Hyun-A, Senior Planner, OP, DCPO assigned to Special Unit

Quick, Jeffery, Special Unit Coordinator, DOC

Steinburg, Allan Deputy Director of Captital Management, DOC

Sullivan, Joseph, Project Manager, OPM, DCPO assigned to Special Unit

Young, Barbera, Superintendent, DOC, South Middlesex Pre-Release Center

APPENDIX A

SUMMARY OF HEERY AND HEERY CASE STUDIES OF ALTERNATE PROCUREMENT METHOD APPLICATIONS

--Fifteen Recreation Centers, New York City, 1969
(each center included a swimming pool and dressing
room/shower pavillions, cost: \$15.0 M)

Conditions

- * 9 mo for design and construction
- * multiple sites
- * repetative program
- * vandal resistant const. required
- * govt procurement regs require separate prime specialty contracts

Responses

- # designer acts as CM to analyse best (fastest) construction alternatives during design and to coordintate overall project using CPM
- # use "off-the-shelf" precast, modular concrete system, precriptively specified designed and bid early
- # early (phased) design and bid for pools
- # GC for all work except where separate plumbing and mechanical contracts required by law

--Manufacturing Plant, Georgia, 1962
(77,000 sf on story facility with office, cost \$.3M)

Conditions

- * early occupancy and competative price important
- * guaranteed lump sum price required before start of construction
- * program and technical requirements well defined

Responses

- # accelerated traditional method used
- # owners rep. works full time with designer to expidite review and approval during design, complete design in 1mo.
- # competative bidding on well developed design
- # single reponsibility general contractor

--Sports Stadium, Atlanta, 1964
(55,000 seat multi-purpose stadium, cost \$14.2 M)

Conditions

- * early delivery desirable, high public visibility, political/economic importance
- * govt regs require open public bidding, lump sum fixed price prior to starting construction which precludes fast-track schedule with multiple prime contracts
- * technically complex, excavation/foundation and structural work major scheduling constraints

Responses

- # use CM during design phase to analyze constructability and time implications of design decisions especially on foundation and superstructure
- # steel structure based on single standardized bent chosen to save time despite sub-optimal stadium configuration
- # schedule analysis indicates excavation and foundation, not structure fabrication as critical time constraint
- # since gov.t reg.s do not permit early award of excavation/foundation work, single responsibility GC required, as part of contract, to accelerate foundation work (3 shifts/day) based on CPM

--Engineering Office Building for Lockheed, Georgia, 1966
(300,000 sf flexible use office space, cost: \$ 4.6M)

Conditions

- * early, phased occupancy required
- * well defined technical requirements, but total scope of project not fixed
- * sophisticated, professional owners reps, open to innovative procurement methods
- * no competitive bidding constraint, owner in good negotiating position due to potential to offer repeat work
- * limited competition for HVAC work

Responses

- # use SCSD building system since it meets technical requirements and is available as pre-engineered "off-the shelf" system
- design generic footprint for building based on standard 5' system module #
- # early bid and award of sub systems based on unit prices to allow flexibility in scope changes
- # directly negotiate with sole source HVAC supplier
- # designer acts as CM to coordinate early sub-system contracts
- # award general contract when design complete, transfer sub systems contracts to GC

APPENDIX B

CHRONOLOGY OF DCPO AND THE DESIGN-BUILD PROJECT

- 1/80 Commission on public construction practices in Massachusetts to investigate allegations of waste fraud and abuse in the design and construction of public facilities. John Ward named chairman. Commission makes extensive investigation, various officials, designers, contractors and others testify.
- 1/81 Ward Commission submits final report-- ten volumes documenting widespread corruption and mismanagement throughout the system. Report recommends a series of reforms including reorganization of old Bureau of Building Construction (BBC), new designer selection and pre-design procedures. Also recommends that alternate procurement methods be considered for projects.
- 7/81 Massachusetts Legislature passes Chapter 579 to implement reforms recommends by Ward Commission. BBC officially abolished and replaced by Division of Capital Planning and Operations (DCPO).
- 1/83 Tunney Lee, former director of Boston Housing Authority and professor of urban planning begins as Deputy Commissioner of DCPO; includes implementation of alternate procurement method as goal of his

administration based on mandate in Chapter 579
calling for DCPO to investigate alternate procurement
methods

4/85 Governor presents "Special Message" on prison
overcrowding to Legislature. Plan proposes \$ 129
million capital spending on new and renovated
correctional facilities. Message also directs DCPO to
investigate alternate procurement methods to provide
early project delivery.

6/85 DCPO Programming section begins investigation of
alternate procurement methods. Convenes "Professional
Advisory Board" including Jack Carlson (founder of
Carlson Group design-build company), Jim Becker and
Henry Irwig (President and Vice President of Beacon
Construction Co., large vertically integrated
developer/construction company) and Peter Forbes
(architect and member of Ward Commission). Meetings
and interviews held Board and others. Design-build
emerges as preferred alternative for certain projects.
Specific features recommended to assure
accountability.

10/85 DCPO presents report "Alternative Methods for
Design and Construction of Correctional Facilities"
recommending design-build be used for three projects
worth \$ 21 million. Projects include:

--Massachusetts Correctional Institution, Concord
(MCIC),

250 bed medium security, new construction at
existing facility, \$ 7.6 M

--Bay State Correctional Center (BSCC), Walpole,
renovation and new construction to add 72 beds and
related support space to existing 72 bed minimum
security facility, \$10.5 M.

--South Middlesex Pre-Release Center (SMPRC),
Framingham, 50 new beds and related support space,
renovation and new construction, \$ 3.0 M .

Recommendation accepted and incorporated into
legislation authorizing correctional facilities
program proposed in Special Message.

- 3/86 Chapter 799 and related legislation passed
officially authorizing correctional facilities
program including use of design-build on three
projects.
- 3/86 "Special Unit" created within DCPO to manage
correctional facilities program. Special sub-unit
dedicated to design-build projects. Special unit
includes components from Programming and Project
Management sections. (Author begins working at DCPO
with Special Unit)
- 4/86 Follow-on legislation authorizes additional
correctional facilities, includes \$ 60 million jail

to be built using design-build. News of this project heightens interest among designers and contractors in design-build.

5/86 DCPO issues Request for Qualifications (RFQ) for design-builders to prequalify for first group of three projects.

Memorandum of Understanding (MOU) between DCPO and DOC outlining roles, responsibilities and procedures for design-build project is signed. Meetings and reviews held on project requirements, DOC policy on new facilities, etc..

DCPO Programming begins preparing Request for Proposal (RFP) for first group of three projects. Pre-design studies already complete or in progress. Studies done by three separate consultants. Fourth consultant hired to prepare technical specifications.

Series of meetings held with Project Management staff, legal council and others to decide on non-technical contract provisions, procedures, etc..

Design-Build Selection Board (DBSB) appointed by Governor to prequalify teams and select winning proposal. Board consists of Peter Forbes, Henry Irwig, Gary Mote (architect, corrections expert), L. Harry Spence (developer), Richard Gordeau

(contractor).

Jack Carlson officially appointed by Governor as Deputy Commissioner of DCPO to succeed Tunney Lee who returns to academia.

6/86 Qualification statements received from seven design-build teams. Number of teams fewer than anticipated but all appear strong with good reputations. One team eliminated immediately disqualified on technical grounds, six considered by DBSB

DCPO decides to postpone issuing RFP for two-weeks to allow more time to refine RFP. Programs and technical requirements for RFP prove difficult to finalize and package.

Jack Carlson begins as Deputy Director.

First complete draft of RFP completed, over 600 pages (!), extensive review conducted by staff, DOC and DBSB and others. DCPO decides to postpone issuing RFP again to allow more time to review and refine RFP.

Second draft completed, document reduced to 300 pages, more review conducted. DBSB finalizes evaluation criteria. Non-technical portions of RFP finalized.

(Author completes active involvement at DCPO)

* Dates/activities after this point are projected

8/86* RFP issued. Pre proposal conferences and site visits held. Design-build teams begin preparing proposals.

10/86* Design-Build proposals consisting of technical plans, specifications and other data as well as detailed schedule and management plan (but no price) submitted.

Review begins review team consists of DCPO Special Unit staff, DOC and outside architects, engineers, corrections specialists and maintenance consultants.

11/86* Technical review of proposals completed, proposals revised and resubmitted if necessary to achieve technical compliance. Report by technical review team submitted to DBSB.

Teams with complying proposals submit prices.

DBSB reviews proposals, evaluates quality, time and cost, rank proposals in order of preference.

Deputy Director of DCPO selects winning proposal, based on DBSB's recommendation.

12/86* Design-build contract finalized and signed.

1/87* Detailed schedule and quality control plan

submitted.

2/87* Design-development documents submitted.

3/87* Construction documents for early work submitted
and early construction and pre-purchasing begins.

12/87* Partial beneficial occupancy of first facility

1988* Completion and occupancy of remaining
facilities.

APPENDIX C

**EXCERPTS FROM
"ALTERNATIVE METHOD OF CONSTRUCTION FOR
CORRECTIONAL FACILITIES"**

ALTERNATIVE METHOD OF DESIGN AND CONSTRUCTION
FOR CORRECTIONAL FACILITIES

Submitted by
Tunney F. Lee, Deputy Commissioner of DCPO

EXECUTIVE SUMMARY

The Deputy Commissioner proposes that the Commonwealth address the current crisis of prison overcrowding by accelerating the schedule for the expansion of three State correctional facilities, using the design-build method. The goal is the design, construction, and occupancy during 1987 of 448 new permanent beds in the State correctional system, as proposed by the Governor in his April, 1985, Special Message on Prison Overcrowding.

The Governor's special message on prison overcrowding described the special circumstances dictating the modification of standard methods for the design and construction of certain State prison facilities: there is an immediate shortage of 1,100 beds at the State level and this shortage is expected to grow to 1,300 by mid 1987. The special message proposed to reduce the shortage by 1987 with the use of temporary facilities to house 350 inmates and the creation of 710 new permanent beds. Acceleration of the standard development schedule through the design-build method is essential to meet these production goals. Some of the 710 new beds can be secured through vendor contracts for the use of existing space not currently part of the State system. The remaining beds represent newly constructed space which, if produced under traditional procedures would not become available until 1989 or 1990.

The findings in this report follow an investigation of alternative methods of prison facility procurement and consultations with the Director of the Office of Project Management, the Director of the Office of Programming, DCPO Counsel, the Commissioner of the Department of Correction, the Secretary of Human Services, and a variety of persons experienced with public and private sector facility development.

Under the design-build method, the Commonwealth would have one contract with a single entity, the design-builder, hereinafter the "design-build team", instead of contracting separately with an architect and a builder. The design-build team would include both a design (architect, engineers) and a construction component that would work together throughout the facility development process. The team would provide all design, construction management, and construction services, subject to close review by DCPO project management staff.

The recommendation that the Commonwealth use the design-build method for certain prison expansion follows procedures described in Chapter 579, Chapter 579, which defines the legal and operational framework of the current public building procedures, recognizes the need for innovation in construction in certain circumstances. It authorizes the Deputy Commissioner of Capital Planning and Operations to undertake research on innovative methods for the design and construction of capital facilities. It also requires the DCPO Director of Project Management to recommend procedures, including standard methods as well as techniques such as design-build, for specific projects.

To implement the alternative procedures, and to ensure adequate staff resources for the expeditious development of other permanent State bed capacity proposed under the Governor's special message, the Deputy Commissioner of DCPO recommends:

- * that the Commonwealth contract with a design-build team to design and build the 448 new beds and related program space at three facilities, the South Middlesex Pre-Release Center, M.C.I. Concord, and Bay State Correctional Center,
- * that the Norfolk Pre-Release Center, M.C.I. Plymouth, and M.C.I. Warwick projects be developed using conventional State building development procedures,
- * that the Governor appoint a special purpose selection board to review, evaluate, and rank the proposals of interested design-build teams according to criteria which include the individual qualifications and track record of the design and contractor, the project and construction management capacity of the design-build team, the quality, project cost, life-cycle cost, and design of the proposed facility, and the project construction schedule, and
- * that a special unit be established within DCPO, which includes special staff from the Department of Corrections, to be assigned exclusively to expedite the planning, design, and construction of all State capital facility projects identified in the special message.

The recommended design-build procedures propose a four phase design and construction process. First is the open solicitation of statements of qualifications from interested design-build teams and the selection of up to six teams to submit final proposals. Second is the selection of a final design-build team through a competition in which each pre-qualified team submits a detailed proposal for expansion at the three facilities. Third is the execution of a contract and the preparation of detailed design documents. The final phase is construction.

ALTERNATIVE METHOD OF DESIGN AND CONSTRUCTION
FOR CORRECTIONAL FACILITIES

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EXECUTIVE SUMMARY

The proposed alternative procedures will allow the Commonwealth to secure high quality design and construction services, to achieve the time and cost efficiency goals identified by the legislature, and to retain critical design and construction supervision and management responsibilities within DCPO. The procedures assure high quality services through rigorous evaluation of individual designer, contractor, and team qualifications, and through State approval of construction documents prior to construction (a step not usually incorporated in a private design-build process).

The procedure achieves pre-construction time efficiency through consolidation of the designer and contractor selection and document preparation processes. It achieves construction cost and time efficiency by allowing the incorporation of innovative design and production methods and materials, to be proposed by the design-build teams, and through improved coordination between the designer and the builder and between the team and the Commonwealth. The procedure gives the Commonwealth its best opportunity to achieve completion and occupancy of 448 new permanent beds during 1997.

The establishment of a special staff unit within DCPO responsible for the expeditious development of the 448 prison beds will provide the resources necessary for more effective internal project management and decision making and the improvement of interagency coordination. The special unit will include an experienced project manager, a corrections facility and operations expert from the Department of Corrections, resident engineers for each facility, research and support staff, and professional contract and specification consultants.

The creation of an independent selection board for the qualification and final selection of the design-build team, and the use of the two phase selection and approval process described above will protect public interest by ensuring open competition. The Governor will appoint the five members of the selection board whose members will have substantial expertise in the areas of public sector development, public facilities management, construction management, design-build projects, architectural design of public buildings, and corrections facility development and management.

I. INTRODUCTION

II. CONVENTIONAL PRISON DEVELOPMENT

- A. Important Features and Public Protections
- B. Limitations for Rapid Prison Capacity Expansion
- C. Time Schedule of the Conventional Process

III. PROGRAM: DESIGN-BUILD FOR 3 PRISONS

- A. Description
 - Key Features of Private Design-Build
 - Key Features of Proposed Design-Build Prison Development
 - Comparison to Conventional State Construction
- B. Detailed Procedures
 - Participants
 - Process

IV. DESIGN-BUILD AND PUBLIC PROTECTIONS

APPENDIX A - Evaluation of Alternative Methods

APPENDICES B THROUGH H, SAMPLE DOCUMENTS

- B - Request for Qualifications - Preliminary Outline
- C - Qualifications Submission - Evaluation Criteria
- D - Request for Proposals - Preliminary Outline
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- F - Request for Proposals - Sample Performance Specifications
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I. INTRODUCTION

In April of 1985 in a special message to the legislature, the Governor proposed a plan to combat the current crisis of overcrowding in State correctional facilities. In response, the Committee on Human Services has reported out a bill that would authorize the Deputy Commissioner of DCPD to investigate alternative methods of prison facility development. House No. 6230 If enacted would authorize the Deputy Commissioner to recommend alternative methods of procurement of design and construction services which will achieve savings in the time and hopefully the cost of prison development. These alternative methods listed include construction management, fast-tracked or phased construction, turnkey procurement, design and build procurement, lease-purchase of facilities, the utilization of modular building, and the utilization of inmate work crews.

The Governor's special message on prison overcrowding described the special circumstances dictating the modification of standard methods for the design and construction of certain State prison facilities: there is an immediate shortage of 1,100 beds at the State level and this shortage is expected to grow to 1,300 by mid 1987. The special message proposed to reduce the shortage by 1987 with the use of temporary facilities to house 350 inmates and the creation of 710 new permanent beds. Acceleration of the standard development schedule through the design-build method is essential to meet these production goals. Some of the 710 new beds can be secured through vendor contracts for the use of existing space not currently part of the State system. The remaining beds represent newly constructed space which, if produced under traditional procedures would not become available until 1989 or 1990.

Projects that have lengthy building development schedules are often subjected to steep cost increases due to the inflation of construction costs. Given the severe overcrowding in the State system, there are significant other public costs related to a long development schedule. Within the prisons themselves, prisoners face personal risks through increased assaults, mental disorders, and idleness, and the reduced access to needed programs impedes their re-entrance into society. Corrections officials face the dangers of the volatile social situation within overcrowded areas, and their ability to manage the institutions is hampered by the lack of space flexibility. In other states, the courts have intervened in similar circumstances of overcrowding, a situation the Commonwealth should avoid.

The current crisis is not the result of a past failure by the State to develop and maintain modern facilities. Changing demographics, particularly the baby boom, increasing length of sentences, and a reduction in paroles have caused a rapid increase in the prison population. While the Governor's plan to end prison overcrowding recommends several programmatic solutions to the problem, the new construction of bed space is essential and the new space is needed as soon as is reasonably possible.

The accelerated expansion of the three identified facilities will relieve pressure at three levels of the corrections system. The 250 bed expansion at M.C.I. Concord will ease the pressure on medium security and classification beds. Adding 76 new beds, replacing 72 beds and creating essential program space at Bay State Correctional Center will ease the pressure at the minimum security level, and the addition of 50 beds at the South Middlesex Pre-Release Center will expand the pre-release capacity.

The analysis of alternative methods to design and build corrections facilities included three major components: an examination of the current standard procedures for building construction, an evaluation of the possible alternative methods as they relate to capital construction in general, and an analysis of the application of the current and the proposed methods to the six facilities under consideration. This report emphasizes the application of current procedures and proposed design-build procedures to proposed facility expansion.

With respect to the current procedures, the researchers drew on the substantial experience of the DCPD Office of Project Management, both regarding the construction of corrections facilities and the construction of other similar scale projects. The researchers examined both the operational and legal framework of the current procedures and management innovations developed by Project Management staff to expedite certain projects.

With respect to various methods of capital construction, the researchers defined each alternative and then brought together sources of information about each method. Primary sources of information were people who had direct experience with each method. The researchers then evaluated the alternative methods, emphasizing the capacity of each method to meet time and cost goals and the protection of the public interest. A description of that analysis and its major findings are contained in Appendix A of this report.

On the question of the choice of facilities for standard or alternative methods, the researchers first looked at each site to get a clear picture of the nature of the existing facility, the expansion plans, and the program needs. The proposed design-build procedures and the standard procedures were then applied to each site and analyzed relative to the appropriateness of the alternative to the expansion program and the effectiveness in meeting time and cost goals.

The analysis concluded that the existing procedures could be accelerated and that the design-build method was the most appropriate alternative. When applied to the six specific facilities, however, the analysis suggested that the design-build method would only achieve measurable savings for large scale facilities with standard commercial construction, within geographic proximity to one another.

In the three cases where small scale residential constructions prevail, the conventional procedures were preferred. At M.C.I. Warwick, which is geographically isolated from the other sites, a local builder would likely be more efficient in constructing the planned 50 beds than a design-build team. The scale of both M.C.I. Plymouth and Norfolk Pre-Release Center also suggest the use of the conventional method.

This report has been structured parallel to DCPPO's analysis of the use of alternative methods for facilities listed in the Governor's special message. First there is an analysis of the existing procedures and their application to the planned projects. Next is an analysis of the proposed design-build process, both as it is used in private construction and as DCPPO believes it should be modified for public construction. Following that is a detailed presentation of the key issues related to the proposed design-build method, including a description of sample documents. Finally, the report examines the question of public protections in the proposed procedures.

II. CONVENTIONAL PRISON DEVELOPMENT

The following analysis of DCPPO's current procedures for the design and construction of correctional facilities reflects a legal framework primarily created to protect the public interest, an operational framework which manages \$120-150 million in construction annually, and finite staff resources. While these procedures appropriately balance the need for high volume production and the need for public protection in most public building, the procedures are not well suited for the current correctional facility problem: the need for rapid expansion. Project Management staff have developed innovative ways to speed internal processing for some projects, specifically certain court mandated renovation and construction, but the volume of work and the unavoidable need to prioritize projects across agencies preclude the use of these special procedures on a regular basis. If the State is to achieve rapid expansion of corrections facilities, it needs to analyze the current procedures to identify potential modifications of the legal and operational framework.

The standard methods of public building construction involve three phases, feasibility study, design, and construction. In each phase, professional services are provided in discrete intervals followed by a review process and a decision to proceed to the next step. The Division of Capital Planning and Operations first selects a study designer through an open solicitation process, using the Designer Selection Board (DSB) to select designers. After the study is completed and certified by DCPPO, it follows another open solicitation process to select a final designer for the project. When the design and construction documents are complete, DCPPO then solicits bids from contractors through another open solicitation process, and the construction contract is awarded to the lowest responsible bidder. The work then proceeds under the supervision of DCPPO staff until completion. Each step is independent and, at the various review points, the process stops until a decision is made to go ahead.

A. IMPORTANT FEATURES AND PUBLIC PROTECTIONS

The intent of the separation of each phase of design and construction is to provide the Commonwealth with effective, efficient, and attractive facilities and to protect the public from potential waste, fraud, and abuse. Designer selection through an independent designer selection board insures open competition for architectural jobs and the impartial allocation of design work to qualified firms. Requiring an independent designer to prepare the initial feasibility study, building program, and cost estimate ensures that the need for and cost of a facility are established prior to a commitment to design and construct a facility. The receipt of competitive bids for the construction cost for the project is intended to ensure that the State gets the most for its construction dollar.

B. LIMITATIONS FOR RAPID PRISON CAPACITY EXPANSION

A major problem with the conventional process when applied to the State's prison over-crowding crisis is the time expended. The length of the conventional process gives maximum opportunity to each decision maker to participate, emphasizing open decision making at the expense of production efficiency. The sequential design review process leaves both the designer and the State project managers with time gaps during which they are not actively working on the particular facility.

The process also sacrifices the potential interaction of the design and construction components available in a design-build process. By separating design from construction, the process precludes potential construction efficiencies which might be proposed by contractors, such as the use of certain building systems or the phasing of material purchases. Finally, the use of the bid price as the over-riding criteria for the selection of construction services fails to credit the exceptional contractor with an established reputation and track record for meeting schedules and budgets.

C. TIME SCHEDULE OF CONVENTIONAL CONSTRUCTION

The prison expansion projects under consideration for alternative development methods range from \$3.0 million (South Middlesex) to \$10.5 million (Bay State Correctional Center) in total project cost, or \$2.7 million to \$7.4 million in estimated construction costs. Using DCPO's current procedures, design and construction schedules for similar scale projects average twenty-two to twenty-five months from the authorization of capital funds for design to the start of construction, and eighteen to twenty-four months in construction. The total development time, from the completion of the building study to the completion of construction thus averages three to four years. Well over half of that time is spent in State designer and contractor selection, document preparation and document review, with the balance representing the production time of the facility designer.

**ESTIMATED AVERAGE PROCESSING TIME
DESIGN THROUGH CONSTRUCTION COMPLETION
(Months)**

	Projects with Estimated Construction Cost \$1-5 Million	Projects with Estimated Construction Cost \$5-10 Million
DESIGN		
Designer Selection and Contract Preparation	5	5
Schematic Design Review	2	3
Preliminary Design Review	1.5	1.5
Working Drawings Review	2	3
Final Documents	1.5	1.5
Bid Advertisements and Contract Award	3	4
BID	1	1
CONSTR.		
Subtotal	21.5	24.5
Construction	18	24
TOTAL (months)	39.5	48.5
TOTAL (years)	3.3	4.0

SOURCE: Michael Sullivan, "Finalized Milestones for CAPICS", DCPO Memorandum, August 6, 1985.

The present legal framework for public construction dictates a number of discrete steps in the process. These in turn create lag time for both DCPO staff and the designer, and nearly unavoidable time delays can result.

* There is potential delay each time there is a formal review, since the development process stops at these points and does not resume until there is a decision to proceed.

* Isolation of each step and each participant from each other precludes time savings that would otherwise be realized through coordination of the planning and construction of building elements - for example - the inclusion in a project of a building technology that the contract component of a design-build team is particularly familiar with.

Modifying or eliminating some of these traditional procedures provides major opportunities for time savings and possible dollar savings through the design-build process.

III. PROGRAM: DESIGN-BUILD FOR 3 PRISONS

The proposed design-build method will achieve the following three goals: to minimize the length of time from study certification to the completion of construction for 48 new prison beds, to assure cost effective high quality design and construction, and to maintain critical public protections.

The basic design-build model comes from the private sector. This procedure is used, usually coupled with a fast-track construction process, to produce commercial or institutional buildings comparable to State buildings in one third of the time it takes the State. The proposed design-build method for prison construction modifies the private sector design-build model first to incorporate a competitive impartial public selection process and second to require the approval of design documents by DCPD prior to the start of construction. As part of the selection process, both the design and construction components of the team must qualify under existing DCPD standards. These modifications assure the protection of the public interest in the selection of the design-build team and assure construction and design quality.

The design-build method will achieve efficiencies in the State selection and review process in several areas. The designer and contractor selection process will be consolidated, and a special selection board, patterned after both the Designer Selection Board and the Shared Savings proposal evaluation board, will be established by statute to insure open and competitive team selection. The design development and State review processes will overlap, with expeditious review by a special staff unit. The proposal phase, with performance specifications based on the building study programs, calls for the competing design-build teams to propose specific building methods, allowing the State to compare the characteristics and costs of new building technologies in accordance with well-defined and measurable criteria. Finally, the joining of the designer and the builder as a coordinated unit promotes efficiencies in both design and construction; the architect can take advantage of the builder's knowledge, and the design will reflect the builder's strengths. The builder will also better understand the overall objectives of the Commonwealth by participating in the design phase.

A. DESCRIPTION

1. KEY FEATURES OF PRIVATE DESIGN-BUILD

As it is used in the private sector, design-build depends on a cooperative relationship between an architect and a builder, who jointly contract with a building owner or developer to provide design and construction services. In many cases, the owner/developer also authorizes the team to fast-track the construction, allowing the design and construction phases to overlap. On a fast-track design-build project construction proceeds in uninterrupted phases as the construction drawings are completed and approved for each phase.

Site selection and the initial financial feasibility study are usually done directly by the eventual building owner or for the owner by a developer. In some cases, the owner or developer contracts for technical architectural and engineering assistance during this early planning phase.

Using a design-build process, the owner or developer can either contract with a design-build firm to provide the full range of building services or hire individual architectural and construction firms who agree to work as a design-build team. The design-build concept implies a formal relationship between the architect and the contractor, although the early hiring of a separate construction firm to work with an architect in the planning of a building project is sometimes referred to as design-build. When the owner contracts with an architect who is part of the construction team, the owner usually retains as his agent a separate construction specialist to supervise the construction process.

The selection process is generally informal, with the owner or developer interviewing interested participants. The owner or developer selects the team based on firm qualifications, track record, and prior working relationship. Owners of large complex projects sometimes use competitions to select the development and design-build team, with selection based on quality of design, financial strength of the developer, and track record of the contractor.

The design-build firm in many cases has its own designers and project managers and produces all the proposal documents within its organization. In other cases, the architectural component of the design-build team prepares schematic designs and outline specifications in close cooperation with the contractor component, and they work closely with the owner to define the specific characteristics of the building and the estimated cost. They then negotiate a contract.

The contract between the design-build team and the owner generally provides for the owner's payment to the design build team for direct costs of labor and materials, plus fees for design and construction management, plus contractor overhead and profit. The contract also specifies a guaranteed maximum total price. If the actual cost plus fees, profit, and overhead are less than the guaranteed maximum, the contractor and the owner often share the savings.

2. KEY FEATURES OF PROPOSED DESIGN-BUILD METHOD FOR CORRECTIONAL FACILITIES

The Deputy Commissioner recommends that the private sector design-build procedures be modified to insure necessary public protections in public building.

a. DCPO Contractor Qualification and Designer Selection. Although the designer and builder will bid and work as a team, DCPO will still require that the individual designers and contractors meet its standard minimum requirements for participation in State construction projects. The Designer Selection Board will be asked to qualify all designers, including the design component of design-build firms wishing to bid. Builders, including the construction component of design-build firms, must meet the normal DCPO Contractor Pre-qualification. Design-build firms must meet this pre-qualification of individual team members as part of the Request for Qualification Phase.

b. Selection Board. A special purpose design-build selection board will be responsible for the review of qualifications of the teams responding to the Request for Qualifications (RFQ), the selection of up to six most qualified to participate in the final competition, and the ranking of the top three final proposals. The Governor will appoint the board, to include experts in public sector development, public facilities management, construction management, design-build projects, architectural design of public buildings, and corrections facility development and management.

c. Special Unit. The Special Unit will consist of experienced people who will manage corrections capital projects funded in the Special Prison Capital Outlay Act. The special unit will prepare the final Request for Proposal (RFP) documents and contract (under the supervision of the DCPO Counsel). The Project Manager will act as the owner's agent in the supervision of the design and construction process, and he or she will be able to make key decisions, including the review and approval of plans during the design phase, and day-to-day decisions during construction. The special unit may include technical consultants as needed.

d. Design-Build Team. Similar to the private sector model, DCPO, representing the state as owner, will contract with an architect and builder who will work as a team or a design-build firm. Competing architects will prepare schematic designs during the proposal stage, and after selection, the team architect will prepare detailed construction drawings. Throughout the design process, the architect will work closely with the builder to assure the availability of materials, appropriate construction methods, production efficiency, and construction schedules.

e. Team Selection. DCPO will select the design-build team through an open public competition. The competition will have two major phases: a qualification phase to identify up to six of the strongest design-build teams among those interested in participating in the project, and a competitive proposal phase to select and rank the three best project proposals. This dual process will allow the State to first narrow the field of prospective design-build teams to no more than six, based upon the qualifications and track record of the firms and project principals. Second, the qualified design-build teams will submit detailed proposals and the proposals will be evaluated based upon the quality, conformity to State standards, the cost of the proposed designs, and the ability to meet the requirements of the RFP. (See Appendices C and E).

f. Building Programs. Prior to the proposal phase, DCPO will complete certification of feasibility studies of all three facilities, including detailed building programs, cost estimates, and outline specifications for conventional construction. The studies will be the benchmark against which proposal costs estimates, schedules, and alternative building technologies will be measured. DCPO will prepare a complete list of furniture and equipment for the residential space, to be included in the proposal package. In addition, DCPO will develop performance specifications or methods. DCPO recognizes that the quality and thoroughness of the programs developed by DCPO at the pre-proposal stage is the single most important aspect of the process.

g. Proposal. Once the qualified final design-build teams are chosen, the State will award each finalist a nominal cash allowance for the preparation of the final proposal. Based on facility feasibility studies and performance specifications, each design-build team will prepare schematic designs, propose a specific building system, construction schedule, and price. Allowing the team to propose the building design method in a competitive environment allows each team to define its technological strengths, and it allows the State a unique opportunity to evaluate alternative choices of prison design and construction.

h. Contract. Approximately 30 days after the final award, the State and the chosen design-build team will sign a contract for the final design and construction of the facility. During the first three months of the contract, the designer will prepare working drawings for the facility, and the special unit will review these drawings as they are completed. The review will primarily focus on the conformance of the final designs to the proposal schematics, performance specifications, and applicable standards. Once the final documents are completed and approved by DCPO's Project Manager, the team will be authorized to start construction. The proposal price and schedule will become part of the contract, with a penalty clause for late completion. If the design-build team fails to perform satisfactorily during the first phase of the contract, i.e., development of working drawings and specifications, that contract will be terminated and DCPO will proceed to contract with the next ranked design-build team.

3. COMPARISON TO CONVENTIONAL STATE CONSTRUCTION

The consolidation of the designer and builder represents the major difference between design-build and conventional State construction. It allows greater interaction and coordination in both the design and construction phases. It also changes the selection process, requiring the teams first to be qualified on the basis of their firm and individual qualifications, project management capacity, and their record of performance. The successful team is selected on the basis of the quality, production schedule, and cost of its proposed building.

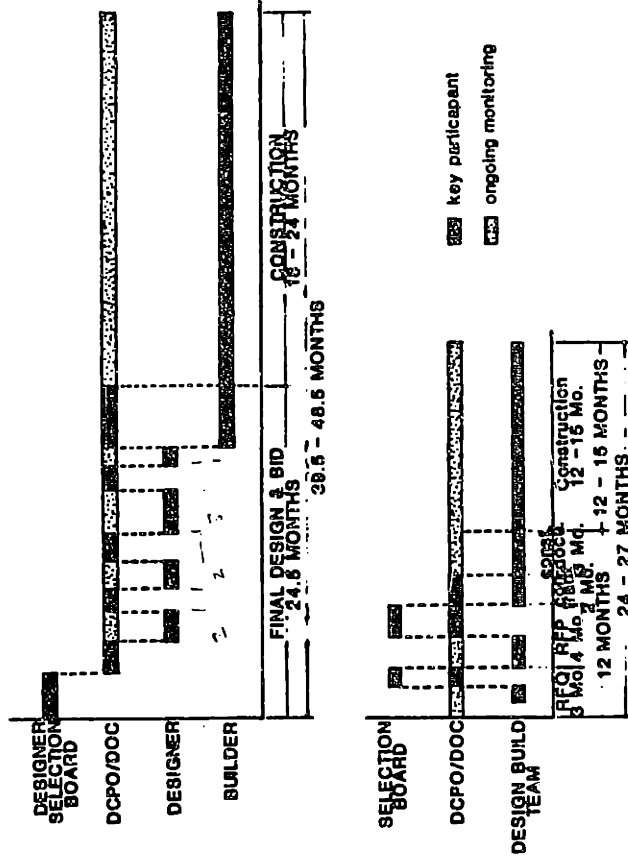
Allowing several design-build teams instead of one architect, the freedom to propose the specific building system and design and construction schedule gives the State more options in choosing the most desirable and cost effective technology. Since teams will propose their own construction schedule and compete in part on their ability to construct the facilities quickly, the construction schedule should be both reasonable and shorter than the conventional schedule.

The use of a special selection board for the qualification of the teams and the selection of proposals, in addition to the normal pre-qualification procedures, provides greater public review of professional expertise than is available under the current process. It concentrates the public decision making in the early conceptual stages of facility development. The DCPO role during construction will be supervisory, to ensure the facility is constructed to meet the performance specifications and contract requirements.

The creation of the special unit devoted only to projects funded in the special message is necessary to make the design-build method work more efficiently. DCPO's project management staff has demonstrated its capacity to expedite projects when court decrees mandate construction schedules. The allocation of resources to allow a similar high level of supervision for special message projects will allow efficiencies such as the concurrent review of drawings and close monitoring of construction progress.

Finally, the design-build method is much more interactive than the conventional process. The process promotes a high level of trust and confidence, based on qualifications, performance, and track record, throughout the process, between the designer and the contractor and between the state and the design-build team. The process also depends on a high level of communication between the various project participants. It provides for clearly stated performance benchmarks and procedural requirements, ensuring that the public interest will be protected.

DESIGN-BUILD PROCESSING VS. CONVENTIONAL*



* The conventional schedule shown does not assume special unit and priorities which could substantially shorten the time shown.

B. DETAILED PROCEDURES

1. PARTICIPANTS

- a. DCPO PROJECT MANAGEMENT SPECIAL UNIT, under the direction of the DCPO Director of Project Management, will provide necessary staff services related to the development of procedures, preparation of documents and monitoring of design and construction progress. The special unit will be responsible for internal processing and project management for all special message correctional facility construction, including the three facilities designated for design-build and the three facilities designated for conventional design and construction.

The special unit will also provide staff services for the design-build selection board, including the verification of information provided by design-build teams in their qualification and proposal submission and the array of information for evaluation by the selection board. The selection board will determine the specific evaluation procedures it will use in qualifying finalists and in ranking final proposals. Special unit staff may advise the board as requested, but it will not vote on any board decisions.

The specific responsibilities of the special unit include the preparation of the Request for Proposals package, the verification of submission materials, the array of submission information for the benefit of the selection board, preparation of contract documents, review of design construction documents, and monitoring of construction.

A project manager will report to the DCPO Director of Project Management and will direct the special unit staff. The special unit will be staffed by highly qualified personnel with expertise in the fields necessary to accomplish the responsibilities mentioned above.

1. Project manager will have overall management and decision making authority for the project. Major responsibilities include management of qualification and proposal phases, review and approval of contract documents, and decision making during the construction phase.

(See sample job description in Appendix.)

2. Project and field engineers will work under the project manager to assist him or her where necessary and to monitor the construction of the three facilities.

3. Pre-Construction proposal group will produce and coordinate all components of the pre-construction phase of the projects. Responsibilities include compiling all applicable codes and standards, producing the performance and prescriptive specifications, the RFP, and the contract, assisting the selection board in the evaluation of the Request for Qualifications and Request for Proposals submissions, and negotiating the contract for the State. The proposal group will include a researcher, a writer, and special consultants as necessary to prepare contract and special documents.

4. Corrections representative from the DOC will provide corrections expertise and serve as the liaison to the Department of Corrections (the client agency). Responsibilities include providing expertise in corrections related issues such as security, prison architecture, and prison operations and management.

- b. DEPARTMENT OF CORRECTIONS, the client agency, and DCPO will execute a Memorandum of Understanding describing formal review and approval of documents at key phases of the process, including review of the Request for Proposals package and review of design documents.

- c. SELECTION BOARD will evaluate all qualification and proposal submissions, select up to six design-build teams to participate in the final proposal and rank the top three final proposals. It will evaluate submissions based on the Evaluation Criteria contained in the appendix of this report, but it will determine its own method of ranking qualification and proposal components. The board will consist of five members, from both the public and private sectors, appointed by the Governor. They will be chosen based on expertise in the area of:

- * Public sector facilities management
- * Construction management
- * Design-build projects
- * Public facilities architecture
- * Corrections facilities construction and management
- * Public sector development

The Commonwealth will provide an honorarium for the selection board members, and it will cover expenses. The members will be expected to meet for six working days over a three to four week period. The Board will attend an orientation at the beginning of the selection process. This will include visits to the project facilities, review of the special process framework, and review of prepared study documents for the three facilities.

d. **DESIGN-BUILD TEAM** will design and build the three facilities chosen for the alternative method. The teams may be either design build firms or a builder in a joint venture relationship with an architect with whom they have previously worked. Besides the architect, the design component will include subconsultants including mechanical, electrical, and structural engineers.

Both the design component and build component of the team must meet normal DCPD qualifications. The Designer Selection Board will be asked to qualify the design component, and the build component must complete the normal DCPD contractor qualification process. The State will negotiate and execute a single contract for the design and construction of the three designated facilities.

2. PROCESS

a. **DOCUMENT PREPARATION** will be done within DCPD by the special unit.

* The RFP is critical to the success of this design-build process. Much of the foundation for the preparation of the RFP has been done by DCPD. Members of the special unit proposal group will be chosen for their experience in the preparation of an RFP including experience with performance specifications and specification writing.

* Responsibilities of the special unit include:

- compile all applicable codes and standards
- complete the performance and hardware specifications
- develop a format for uniform evaluation
- assist the selection board to develop a final evaluation criteria
- compile and edit all the elements of the RFP.

b. **TEAM QUALIFICATION PROCESS** will begin with the advertisement of the RFQ at the beginning of the design-build process.

1. Request for qualification process

- DCPD will invite bidders to submit qualifications. Advertisement will be through the Central Register, newspapers, and trade journals. The advertisement period will last one month.
- Interested architects and builders will begin to form teams. Design-build firms will concentrate on pre-qualification.

- Bidders will have 30 days after the advertisement period to respond to the RFQ.

2. The Selection Process

- Special unit will review responses, verify information, and array information emphasizing:

DSB designer clearance

Base qualifications

Qualifications to be evaluated by the selection board

- Qualification packages and summaries will be forwarded to the selection board which will choose no more than six for participation in the final RFP process.

- Announcement of qualified bidders.

c. **FINAL TEAM SELECTION** process will begin when DCPD distributes the RFP package to the pre-qualified finalists at a pre-proposal conference. The conference will be scheduled as soon as the selection board makes its decision, about three months after the first RFQ advertisement.

* The Proposal Production Process

- There will be a pre-proposal conference for all qualified teams. The briefing will include:

Distribution of the RFP

Scheduling of site visits

Funding allocation for preparation of proposals.

- Bidders will have two months to prepare the proposal.

- Work sessions will be scheduled at the second and sixth week points in the proposal production period. The public meetings will be used to answer any questions bidders might have about the projects. Questions after the sixth week will be answered in writing and all finalists will be copied, so that no team will gain an unfair information advantage.

* The Selection Process

- Special unit will review the proposals, verify information, and arrange proposals for clear uniform review by the selection board.

- The selection board will meet for at least two working days over two weeks to evaluate the proposals.

DESIGN-BUILD SCHEDULE

- Board will rank three top bidders for selection by DCPO Deputy Commissioner. Bidders will be required to hold price for four months.
- The selection board will reserve the right to reject all proposals and advise the Deputy Commissioner to use conventional design and construction procedures if it finds that the proposals do not represent time or cost savings, based on certified building studies, or if it believes the quality of the proposed facilities is measurably lower than that of conventionally designed and constructed buildings.
- The Deputy Commissioner will select winning team. The selected team will be the first choice of the selection board unless the Deputy Commissioner provides a written statement providing the reasons why he determined to select the second ranked team or the third ranked team instead of the first ranked, or first and second ranked teams.

d. CONTRACT PREPARATION AND DESIGN under the direction of DCPO counsel, the special unit project manager will negotiate a contract with the selected design-build team. The contract will authorize the design-build team to proceed to prepare preliminary and final design documents. The special unit staff will monitor the preparation of design documents on an ongoing basis, approving elements as prepared in accordance with the project performance specifications and the proposal. Approval by the Commissioner of the Department of Corrections will follow the Memorandum of Understanding agreed to by the DOC and DCPO. Once final construction documents are prepared and approved, DCPO will authorize the design-build team to proceed to construction.

e. CONSTRUCTION. During construction, the special unit project and field engineers will provide continuous monitoring of the construction progress. The project manager will determine percentage of work completed, for the purpose of payment authorization, and make other field decisions with respect to construction methods and materials, consistent with the proposal, performance specifications, and contract.

	REQ	REP	CONTRACT PREP.	CONST. OCCUP.	Completion/Occupancy
SELECTION BOARD	A	B	C		
DCPO/DOC SPECIAL UNIT	D	E	F	G	H
DESIGN BUILD TEAM	J	K	L	M	N
	1.3 MO.	4 MO.	2 MO.	3 MO.	12 - 18 MO.
RFQ Advertisement	J F M A M J J				
Bidders Conference					
Team Selection					
Contract Signing					
Ground Breaking					
					Jan 3 - Jan 12 86

TOTAL TIME: 24 - 27 MONTHS

SELECTION BOARD - Governor appoints selection board

B - Evaluates and qualifies up to six teams

C - Evaluates and ranks the top three teams

DCPO/DOC SPECIAL UNIT

D - Advertise RFQ and hires special unit

E - Prepares RFP and assists selection board

F - Assists selection board

G - Negotiate contract

H - Ongoing Review

I - Ongoing Monitoring

DESIGN BUILD TEAM

J - Form teams

K - Prepare qualifications submissions

L - Prepare proposal

M - Negotiate contract

N - Preliminary design

O - Final design

P - Construction

IV. DESIGN-BUILD AND PUBLIC PROTECTION

- Q. How does the Commonwealth know that the selection of the design-build team will be fair and impartial?
- A. The selection process incorporates three important elements which assure fairness and protection of the public interest: the use of clearly stated and uniform evaluation criteria in both the RFQ and RFP phases, the use of an independent selection board as the decision maker, and team member pre-qualification through DCPO and the DSB.
- Participating teams and the design-build proposals will be subjected to close scrutiny according to the evaluation criteria. The criteria will provide a method of ranking each of the elements required for team qualification and final proposal. The criteria and ranking system will be distributed in the RFQ and RFP packages, assuring that each participant has full knowledge of the decision-making process. The use of a uniform standard to evaluate teams and proposals ensures an impartial and fair decision-making process.

Prior to participation in the competition, each design-build team submitting a proposal will be dually pre-qualified. Since a design-build team by its nature includes both a contractor and a designer, DCPO has determined to conduct its standard contractor pre-qualification analysis of the contractor component of the team. The Designer Selection Board will be asked to review the designer component of the team to assure that it is qualified to undertake the project design.

An independent selection board will meet and make all selection decisions. The board will include knowledgeable professionals selected for their experience with public capital construction and corrections facility development. The Governor will appoint the board. The professional special unit staff will do background research on teams and proposals, to assist the board in its deliberations, but staff will not be permitted to vote. In the qualifications phase, the selection board will identify up to six teams most qualified to participate in the final competition. After evaluating the final proposals, the selection board will rank the top three design-build finalists. The Deputy Commissions will then proceed to negotiate a contract with the design-build finalists in the order of their ranking.

- Q. How does the Commonwealth know that the final facility will meet its specifications?
- A. There are a number of features incorporated in the proposal and construction document phases which assure that the Commonwealth gets a facility which meets its specifications.

First, in the proposal phase, DCPO will have completed and certified studies for each project prior to the proposal competition. The study specifies the architectural program, outline specifications, and a cost

estimate. Based on the study program, the DCPO special unit will prepare performance specifications for each facility. The detailed architectural program and performance specifications will be essential components of the Request for Proposals. While DCPO always completes a program before proceeding into the design stage of a project, it is particularly important to complete a detailed program for a design-build project, since the criteria required in the program will dictate the performance specifications. The program will be DCPO's single most important tool in comparing design-build proposals and in ensuring that the design and construction meet a high level of professionalism and quality.

In the proposal competition, each finalist will prepare schematic designs for each facility and describe the proposed building system. To assure that proposals are well thought out, with sufficient detail, DCPO will provide each participant with a cash award to cover part of the cost of proposal preparation.

An additional safeguard incorporated in the contract phase is designed to provide the State with a final right to approve or to partially or totally reject the pre-construction documents in the following way: It is required that within 120 days after the award, the design-build contractor must submit design drawings and specifications completed to a point where the State can reappraise and reaffirm the contractual understanding among the parties. Minor differences will be clarified by both parties.

In the unlikely event that the final documents do not meet the requirements of the performance specifications or the original proposal, the State can terminate its contract with the first ranked design-builder for a fixed sum designated in the contract and begin negotiations with the second ranked team.

Finally, the special unit staff will monitor construction closely to ensure that the facility as built meets the contract requirements.

- Q. How does the Commonwealth know that the dollar value for the selected proposal is appropriate?
- A. The selection board can evaluate the appropriateness of the lump sum price of the proposals by comparison with each other and with the cost estimate included in the certified facility feasibility study.
- Feasibility studies including a cost estimate for conventional construction will be completed for each facility prior to the proposal competition. The study cost estimate becomes a benchmark against which to compare the proposal bid cost. Given six proposals, the selection board will thus have seven cost estimates, one for conventional construction, and one for each proposed building system. This process gives the selection board a substantial basis for the evaluation of proposed costs for each facility. The capacity for cost comparison and the previously described controls over product quality assure that the dollar bid of the final proposal will be appropriate.

APPENDIX A

ALTERNATIVE METHODS OF DESIGN AND CONSTRUCTION OF
CORRECTIONAL FACILITIES

Through the Office of Project Management and the Office of Programming, the Deputy Commissioner has investigated various alternative methods of prison facility development. Researchers defined the alternatives in terms of design alternatives, building production procedures, construction management, building technology, public management of the development process, and public protection. The investigation involved three kinds of analysis: an examination of specific building projects developed by both public and private sector owners using conventional and alternative development methods, interviews and working sessions with experienced public and private owner/developers of buildings, and working sessions with State corrections facilities planners and project managers.

The analysis focused on specific issues. First the relationship between the owner, designer, builder, and developer of a building project was reviewed. The next set of issues reviewed related to building production, cost, time, and quality control. Third was the State's management of the development process. Finally, there was a special evaluation of the issue of public protection and the maintenance of the integrity of the public process.

A. Examples and sources of information.

In investigating the question of alternative prison facility development, DCPO considered the following:

1. The experience of private development and construction firms, based on meetings with principals in
Beacon Companies, commercial and residential developers and builders.
John I. Carlson, Jr. - consultant, founder of The Carlson Group, a design build firm.
Corcoran, Mullins and Jennison, a residential developer.
Joseph Corcoran, a residential developer.
Winn Development Company, a residential developer.
2. Public projects undertaken conventionally or using alternative development methods.
Expansion of the Worcester County Jail, under conventional DCPO procedures with accelerated design and public processing.
Shared Savings, energy conservation in public buildings.
Turn-key public housing, including Fidelis Way in Boston and Jefferson Park in Cambridge.

APPENDICES

Typical public building construction, including a computer based analysis of conventional DCPD procedures.

Worcester Centrum, a turnkey, design/build, fast track project built for the Worcester Civic Center Commission.

3. The experience of state facility planners and managers

Executive Office of Human Services and the Department of Corrections-site visits to facilities proposed for alternative methods of development, meetings with facility superintendents, and working sessions with the EONS planners, the DOC Director of Facility Planning and Management, and the DOC facilities architect.

DCPO Project Management - working sessions with the Director of Project Management, and with project managers and project engineers responsible for prison construction.

4. Special working sessions with Peter Forbes, architect and former member of the Ward Commission, to ensure that the proposed procedures protect the public interest and conform to the intent of Chapter 579.

5. Interviews with architects, corrections facilities planners, and builders of prisons in other states.

8. Alternative contractual relationships between owners, designers, builders, and lenders.

Following is a brief description and evaluation of alternative contractual arrangements.

CONVENTIONAL

Under the current procedures, the Commonwealth, as owner of the facility, creates an independent relationship between itself, the building architect, and the building contractor. The Commonwealth acts as its own developer, and the general contractor provides construction management. The Commonwealth provides its own construction and permanent financing by issuing bonds.

Evaluation: (See detail in Section II). Time inefficiencies inherent in the conventional process could be reduced through a consolidation of the selection and contract document process. The DCPD project managers have demonstrated potential time savings through improved management techniques.

DESIGN-BUILD

Under this system, the Commonwealth would have one contract with an architect/contractor team, or a design-build firm, which would provide design, construction, and construction management services. The State would act as its own developer and provide construction and permanent financing.

Evaluation: (See detail in Section III). This kind of contractual relationship between the Commonwealth and the facility designer/builder can be designed to allow consolidation of the public selection process and to promote production efficiencies through the coordination of the design and construction elements.

TURN-KEY

Under a turn-key system, the State would have one contract with a team which would act as developer, provide design and construction services, and provide construction financing. The State would provide permanent financing and own the facility upon completion.

Evaluation: This process replaces the public development role with a private developer role, thus reducing State control. It also makes the private developer responsible for construction financing, potentially increasing costs through the higher cost of private borrowing. There are no substantial procedural efficiencies.

LEASE-PURCHASE Under this system, the State would commit to lease a facility upon its completion to specification, and it would agree to purchase the facility at some future date. The State role would be equivalent to that under a turn-key arrangement, except that the developer would be able to depreciate the facility during the term of the lease.

Evaluation: This system has the same characteristics as the turn-key, but the developer provides permanent financing for a period of time and can take advantage of the tax benefits of depreciation. Potentially, cost savings could be passed on to the State. Private ownership of a prison expansion facility on State land, however, would have legally and politically complex ramifications.

C. Production Procedures.

1. CONVENTIONAL The Commonwealth currently specifies the products and the building systems through detailed architectural documents. Construction by the low bidder follows.

Evaluation: The separation of the contractor from the architect prevents the State from taking advantage of certain production efficiencies. High quality information about the applicability of new technologies and products may rest with the contractors. Unless these tested technologies are also known to a particular architect, the State loses the benefit of the contractor's knowledge and experience.

2. FAST TRACK Under this system, the State would specify a building program, design concept, and performance standards. The designer would prepare the designs for building components in phases, and construction on each phase would proceed before the complete design documents are prepared.

Evaluation: Experience indicates that the fast track process is a very difficult one to control, that change orders can substantially alter the project cost. Multiple independent contractors on the same site often confuse schedules and responsibilities. There may, however, be substantial time savings in a well managed fast track process.

APPENDIX G
CONTRACT PROVISIONS

3. CONSTRUCTION Under this system, an agent for the Commonwealth would manage the construction and the subcontractors for the State, with supervision by DCPO project managers.

Evaluation: A construction management component can be included as part of the design-build team. Experience suggests that it may be inefficient to hire an outside firm to oversee developer managed or design-build team managed projects.

D. Building Fabrication.

In various parts of the country, prisons are constructed through conventional on-site, pre-fabricated, or largely off-site modular methods. The expertise on fabrication methods rests with the product manufacturers, contractors, and corrections architects. In order to take advantage of the technical knowledge available within the construction industry, the Commonwealth should allow knowledgeable professionals to propose appropriate building systems for evaluation relative to State correctional facilities standards.

E. Inmate Labor.

Analysis indicates that the use of inmate labor is not likely to contribute to reduced construction time, and it is only feasible for small sub-components at the end of the building process, for example, painting or landscaping.

1. DCPO will contract with either a builder in joint venture relationship with an architect with which he has previously worked, or a design-build firm. The State will also scrutinize the formal relationship between the designer and the builder in the qualification phase.
2. The design-build team will provide a performance and payment bond, construction insurance, and errors and omissions liability insurance in forms acceptable to DCPO.
3. The construction schedule will reflect the schedule indicated by the design-build team in its proposal. Failure to perform will result in the assessment of liquidated damages.
4. The contractor will be required to pay prevailing wage rates and follow an equal opportunity/affirmative action program, and ten percent MBE and five percent WBE participation will be required.
5. The contract scope of service will include the design-build team's plans and specifications. Proceeding into the construction phase of the contract will be contingent on the completion and approval of the construction documents. The basis of DCPO's approval will be the conformance of the final drawings and specifications to the performance specifications, applicable codes and standards, and the proposal submission by the team.
6. The price for the services will be the lump-sum cost stated in the team's proposal. Percentage payments will be made upon completion of construction documents, and at agreed upon points during construction. Payments will include a retainage payable after final construction is accepted or use and occupancy is taken.
7. Change orders will be processed based on the normal DCPO procedures.
8. DCPO will provide as built drawings of the existing facilities, as necessary.
9. The builder will provide a post-construction warranty of at least one year.
10. The contract will specify procedures for monitoring performance.

APPENDIX H

SAMPLE JOB DESCRIPTION

PROJECT MANAGER

CORRECTIONAL FACILITIES SPECIAL UNIT

ORGANIZATIONAL LEVEL: Program Manager VI

SUPERVISOR: Director of Project Management

SUPERVISORY RESPONSIBILITIES:

1. Direct supervision of all special unit staff including project and field engineers, proposal group, designated clerical or other employees, and technical consultants.
2. Functional supervision of DPC designated special unit corrections staff.

DUTIES AND RESPONSIBILITIES:

Direction of all aspects of design and construction of Special Message correctional facilities, including prison renovation, expansions, and new facilities. Specific duties include:

1. Development and implementation of policies and procedures for the selection of a design-build team for the design and construction of facilities designated for alternative methods of facility design and construction.

- a. Review of all qualification packages submitted by design-build teams and array of information for evaluation by the selection board.

- b. Preparation of Request for Proposals package.

- c. Review of all proposals submitted by design-build teams and array of information for evaluation by the selection board.

- d. Staff support needed for selection board.

2. Implementation of policies and procedures for the design and construction of facilities designated for development under conventional construction methods.

- a. Preparation of scope of services for facility designers for submission to the Designer Selection Board.

- b. Preparation of Specifications and bid documents for final construction.

3. Supervision of preparation of design and construction documents, including coordination of required reviews, and document approvals.

4. Review and approval, in conjunction with DCPO counsel, of contract documents.

5. Monitoring and review of construction progress, approval of products and methods consistent with requirements of contract documents, and approval of contractor/builder payments based on progress and performance.

6. Coordination of facility designer and construction with Department of Corrections Director of Facility Development and Maintenance.

7. Preparation of project budget analysis, facility costs analysis, and other financial evaluations and reports.

QUALIFICATIONS AND EXPERIENCE:

1. General management qualifications including those required for all Program Manager VI positions.

2. Technical qualification including:

- a. Knowledge of principles, practices, and techniques of institutional facility design,

- b. Knowledge of principles, practices, and techniques of institutional facility construction.

3. Experience including:

- a. Management of construction of institutional or equivalent facilities (\$10 million project value),

- b. Five years experience in direct supervision or management of building development operation, with staff and employee responsibilities,

- c. Experience with prison construction preferable.

APPENDIX D

**EXCERPTS FROM
REQUEST FOR PROPOSAL FOR DESIGN AND CONSTRUCTION
OF THREE CORRECTIONAL FACILITIES**

This document describes requirements and procedures for the submission to the Division of Capital Planning and Operations (DCPO) of proposals for the design and construction of correctional facilities at three sites in the Commonwealth. Four design-build teams (DBTs), selected on a competitive basis by the Design-Build Selection Board (DBSB), will receive the document. Each project will be an expansion of an existing Department of Correction facility; two involve renovation to existing buildings which are currently in use.

DCPO will use design-build procedures for the three projects. This will be the first time DCPO has used the design-build approach to construction; the procedures were authorized by the legislature for the three projects in January of 1986.

Overall Project Goals

Design-build was proposed by DCPO and approved by the legislature and the Governor to achieve early completion of critically needed facilities to accommodate the growing prison population. Efficient project scheduling is therefore a priority. In addition, DCPO will adhere to its established standards for all public buildings, emphasizing good design and high quality cost effective construction, to ensure that facilities developed under design-build meet the state's long-term needs for attractive, durable, easily maintained facilities.

Because this approach is a major innovation in public building procedures, there is significant interest in its success. DCPO expects that participating DBTs will create proposals that recognize both the short- and long-term goals of the Commonwealth, and that the team that wins this contract award and DCPO will work cooperatively to achieve a smooth sequence of design and construction and facilities which meet the state's long-term goals. DCPO anticipates a successful project based in large part on the reputation, past performance, and management structure of the four teams selected to participate in the proposal competition.

In making its case to the legislature for authorization of design-build, DCPO argued that "the procedure achieves pre-construction time efficiency through consolidation of the design and contractor selection and document preparation processes. Design-build should also achieve construction cost and time efficiency by allowing the incorporation of innovative design and production methods, to be proposed by the design-build teams, and through improved coordination between the designer and the builder and between the team and the Commonwealth." (*Alternative Method of Design and Construction for Correctional Facilities*, DCPO: Publication # 14243-27-100-11-85-C.R. 1985, p.4).

The critical question for DCPO in establishing a framework for the implementation of design-build has been how to create an environment which allows for innovation within the context of a highly structured public building process. DCPO anticipates the most significant areas of innovation will be in the sequence of decision making. Under the

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systems to permit DCPO to compare the proposal to its standards. Teams must also document the performance qualities for proposed modifications.

Analysis Standards

In general, DCPO will conduct a technical review of proposals by measuring key elements against a specific standard. Evaluation elements and relevant standards are described in Section One, Chapter II-D & E.

State Requirements

In addition to the quality standards, the state has certain non-negotiable requirements. These include:

- o architectural program (state law requires that final building program be within 10% of the gross square feet specified in the study program, see Section Two, Chapter II.)
- o contract provisions (Section Three contains a two-phase Contract and general conditions, which includes basic provisions common to all state design and construction contracts and which reflects the procedures described in Section 1, Chapter IV. DBTs should assume all provisions of this Contract will apply unless a team identifies in its proposal specific provisions it wishes to negotiate.)
- o schedule
- o cost (state will not accept a proposal without a lump sum price)

Chapter II of this section of the RFP describes the state role in the proposal process and the participants in DCPO and DOC. Chapter III contains the requirements for proposal submissions. Preparation submission, evaluation, and selection of proposals will occur between August 15, 1986, when this document is distributed, and January 2, 1987, when DCPO announces the award. Teams will have approximately three months to prepare and submit proposal documents. Evaluation by DCPO and DOC staff and final selection by the Design-Build Selection Board will take about two months.

Submission Requirements - Summary

DCPO has designed a two-stage submission process. The first submission, due on November 3, 1986, will include presentation boards, drawings, facility specifications, project management plans, a schedule of design and construction document submissions, work plan, and percentage of price breakdown for building systems. This submission should not include the total lump sum price, which is due at DCPO on

existing system, DCPO and its architects specify the building program, design, materials, fabrication methods, the contents and schedule of submission of all documents, and the management and scheduling of construction. DCPO staff oversees design and construction to ensure that its procedures and requirements are strictly enforced. Since 1981, DCPO has demonstrated its capacity to produce high quality, well-designed public buildings using this conventional method for design and construction. Under design-build, DCPO will specify the building program and the quality standards of construction for the three facilities, but it expects the DBT to propose the specific design, materials, fabrication methods, schedule of submission of documents, and the management and scheduling of construction. DCPO staff will first review and approve (or request modification of) the final team's proposed building and procedural system, and it will then supervise the design and construction to ensure that the approved procedures and requirements are met. Although the DBTs are encouraged to develop an optimum design and construction process which meets the needs of the team, adaptability to DCPO - Office of Project Management's existing process is important.

Quality Standards

For this process to be successful, it is important that DCPO communicate clearly to the competing teams its expectations and requirements with respect to both the final building product and interim design and construction decision making. DCPO will describe its expectations by using examples, drawn from DCPO's experience with successful building projects. With respect to design and construction decision making, Chapter IV, Post-Award Procedures, describes the processing, document submission, review and approval, and construction supervision and management system that DCPO would find appropriate. Using that example as a framework, DBTs should propose submission, approval, scheduling, and management systems which, based on their experience and operating procedures, will achieve efficiency in implementation and will be compatible with DCPO's current system and its need for effective project control. With respect to the design and specification of each facility, DCPO has approved an architectural program for each, and its consultants have proposed a schematic design and building specification which meets both DCPO's and the DOC's construction and operating standards. The Technical Requirements in Section II, Chapter III provide a detailed description of the particular requirements for each facility if it were designed and constructed as proposed in the consultant study. DBTs should regard the facility-specific technical requirements as a standard of quality. Each team should then propose a design and building system which it believes will produce an equivalent or superior facility to that described. If the Technical Requirements specify a proprietary system or equipment, the DBT must provide that specified item.

DBTs may choose to respond directly to DCPO's model procedures and building requirements without modification. In proposing modifications, teams must clearly describe the proposed procedures and building

December 1. The separation of price from facility and management proposal elements will allow both the technical review staff and the DBSB to evaluate the degree to which proposals comply with DCPO standards and overall state objectives and to request the revision of proposals, if appropriate, prior to the establishment of a final fixed contract price. In this way, DCPO can assemble a group of proposals, all of which substantially comply with state objectives. At this point, DCPO will consider the relative prices of each competitive proposal.

DBTs should note that the final award will be on the basis of building quality, project management, and cost effectiveness of proposals.

Review and Selection - Summary

During the technical review, the DCPO review team will match each proposal with the minimum requirements of this RFP. If a proposal fails to meet certain requirements, DCPO may return the proposal to the DBT for clarification or revision. Incomplete or substantially non-responsive proposals may be rejected without revision. Teams whose proposals comply substantially with the requirements of the RFP will be compensated \$25,000 for the preparation of the proposal. This is not expected to cover all or even most of the cost of developing the proposal, but is intended as an honorarium in recognition of a team's commitment to submit a thorough proposal. DCPO intends to complete the technical review by December 1, at which time price proposals are due from DBTs.

The proposal review teams will then analyze each proposal in detail to determine how each proposal element relates to DCPO and DOC standards. Standards for analysis are listed Section One, Chapter II-D. The proposal review team will summarize the findings of its technical analysis for the DBSB.

The proposal review team will then forward the proposals, the staff technical analysis, and lump sum price to the Design-Build Selection Board. Upon completion of its evaluation, the DBSB will rank proposals based on the application of selection criteria listed in Section One, Chapter II-E, emphasis will be placed on the design and performance of the proposed facilities and the quality of the proposed management strategy, particularly the project schedule. It is expected that by January 2, 1987, the Deputy Commissioner of DCPO will announce the recipient of the Contract award.

Communications

All correspondence and documents should include reference to:

Project Number:

Massachusetts State Project No. P86-3,
Design-Build for Three Correctional Facilities

Address for Submissions:

Initial proposals and price proposals are due by 5:00 p.m. on the specified deadline date to:

DCPO
One Ashburton Place, Room 1519 (Bid Room)
Boston, MA 02108

Design-Build Team Contact Person

At the first workshop, DBTs should provide DCPO with the name, address, and phone number of the team contact person. DCPO will address all communications during the proposal phase to that person.

DCPO Contact Person:

Thomas Nally, Coordinator
DCPO - Corrections Special Unit
One Ashburton Place - 15th Floor
Boston, MA 02108
(617) 727-4068

DBTs should address all communications to Mr. Nally.

Alphonso Binda (Deputy Director of DCPO - Project Management) will have final authority for clarification and resolution of all DBTs questions and concerns.

DCPO Proposers' Reference Room:

In the proposers' reference room is a collection of additional studies, drawings, and policy, regulatory, and technical documents pertaining to the three facilities. These materials are available for review and duplication by teams as they wish. The specific contents of the room are listed at the end of this section and in the reference room. Additional materials will be added as they are located or developed throughout the proposal period. The materials in the reference room are provided in an effort to give proposers every possible assistance in putting together a good submission. As such, the materials are for information only and are not binding parts of the RFP.

The reference room is behind the reception area on the 15th floor of One Ashburton Place, DCPO's main offices. Proposers may check in with the receptionist and may have access to the space and materials at any time during DCPO office hours. Up to ten items may be checked out for not more than three hours for copying at the team's expense.

There are no copying facilities available in the reference room or at DCPO; however, both a copy shop and architectural reproduction company with walk-in service are available less than five minutes' walk from DCPO. Should any team fail to return materials in good condition or within the time limit, they will lose further access to reference resources. Failure to return materials will result in disqualification of the team for unfair competition.

Available Documents:

Building Studies:

- o *M.C.I. Concord - Vitetta Group*
- o *Bay State Correctional Center - KJA Architects, DiMarsini & Wolfe*
- o *South Middlesex Pre-Release Center - KJA Architects*

DCPO Annual Report

Commonwealth of Massachusetts Instruction to Designers and Standard Specifications - Form 9

Other:

Contract documents, new water system, MCI Concord

DOC 103108, Policy on Facility Access (see page 14, SMPRC, for list)

DOC 103700, Guidelines

DPH 105 CMR 450, Health, etc.

DOC, 'Classification in Massachusetts,' reference and training manual.

Proposal Schedule

Date	Activity
August 15, 1986	Distribution of RFP
August 19 & August 20, 1986	Workshop I and facility tours
September 3, 1986	Workshop II
September 17, 1986	Workshop III
November 3, 1986	Deadline for proposal submission, excluding price
December 1, 1986	Price proposals due
January 2, 1987	Announcement of selected team
January 30, 1987	Award of Contract

B. Participants

Glossary of Acronyms

AA - Alcoholics Anonymous
 ABB - Architectural Barriers Board
 ACA - American Correctional Center
 ACI - American Concrete Institute
 A/E - Architect/Engineer
 AIA - American Institute of Architects
 AISC - American Institute of Steel Construction
 ANSI - American National Standards Institute
 APA - American Plywood Association
 ASTM - American Society of Testing Materials
 AWI - Architectural Woodwork Institute
 AWS - American Welding Society
 BSCC - Bay State Correctional Center
 BIA - Brick Institute of America
 CFM - Cubic Feet per Minute
 CMU - Concrete Masonry Unit
 CPM - Critical Path Model/Method (schedule)
 CSI - Construction Specification Institute
 CY - Cubic Yards
 DBSB - Design-Build Selection Board
 DBT - Design-Build Teams
 DCPO - Division of Capital Planning & Operations
 DOC - Department of Correction
 DPH - Department of Public Health
 EEO - Equal Employment Opportunity
 FACP - Fire Alarm Control Panel
 FC - Foot Candles
 GWB - Gypsum Wall Board
 HID - High Intensity Discharge
 HVAC - Heating, Ventilation, & Air Conditioning
 IG - Inspector General
 KV - Kilovolt
 KVA - Kilovolt-Amp
 KW - Kilowatt
 MCI - Massachusetts Correctional Institute
 MGL - Massachusetts General Law
 NA - Not Available
 NEC - National Electrical Code
 NEMA - National Electrical Manufacturers Association
 NFPA - National Fire Protection Association
 NIC - Not Included in Contract
 NILMA - Northeastern Lumber Manufacturers Association
 NSF - Net Square Feet
 NTE - Not to Exceed
 NTP - Notice to Proceed
 OSHA - Occupational Safety & Health Agency
 PC - Personal Computer
 PERT - Program Evaluation & Review Technique (schedule)
 RDC - Reception/Diagnostic/Classification (center)
 RFP - Request For Proposal
 SMPRC - South Middlesex Pre-Release Center

Division of Capital Planning and Operations

DCPO has established a Corrections Special Unit to accelerate the implementation of design and construction of all correctional facilities authorized by recent legislation. Qualified staff from each functional office have been assigned to the special unit, and DCPO has hired new employees with particular experience in planning and supervising the construction of correctional facilities. Special unit staff retains a direct connection to the functional offices. General responsibilities within DCPO relative to this project will be as follows:

Office

Responsibility

Special Unit Administration Coordination of administrative functions of all special unit components

Special Unit Coordinator: Thomas Nailly

Project Management

- o Management of building final design and construction, including post-award document review and approval
- o Participation in preparation of facility technical requirements and proposal technical review

Deputy Director, Special Unit: Alphonso Binda

Programming

- o Management of building feasibility studies and certification of architectural program
- o Preparation of RFQ and RFP, coordinating the participation of other DCPO offices and the DOC
- o Coordination of proposal technical review

Deputy Director, Special Unit: David Burson

Facilities Management

- o Facility maintenance and repair
- o Review of proposed facility operation and maintenance performance as part of technical review

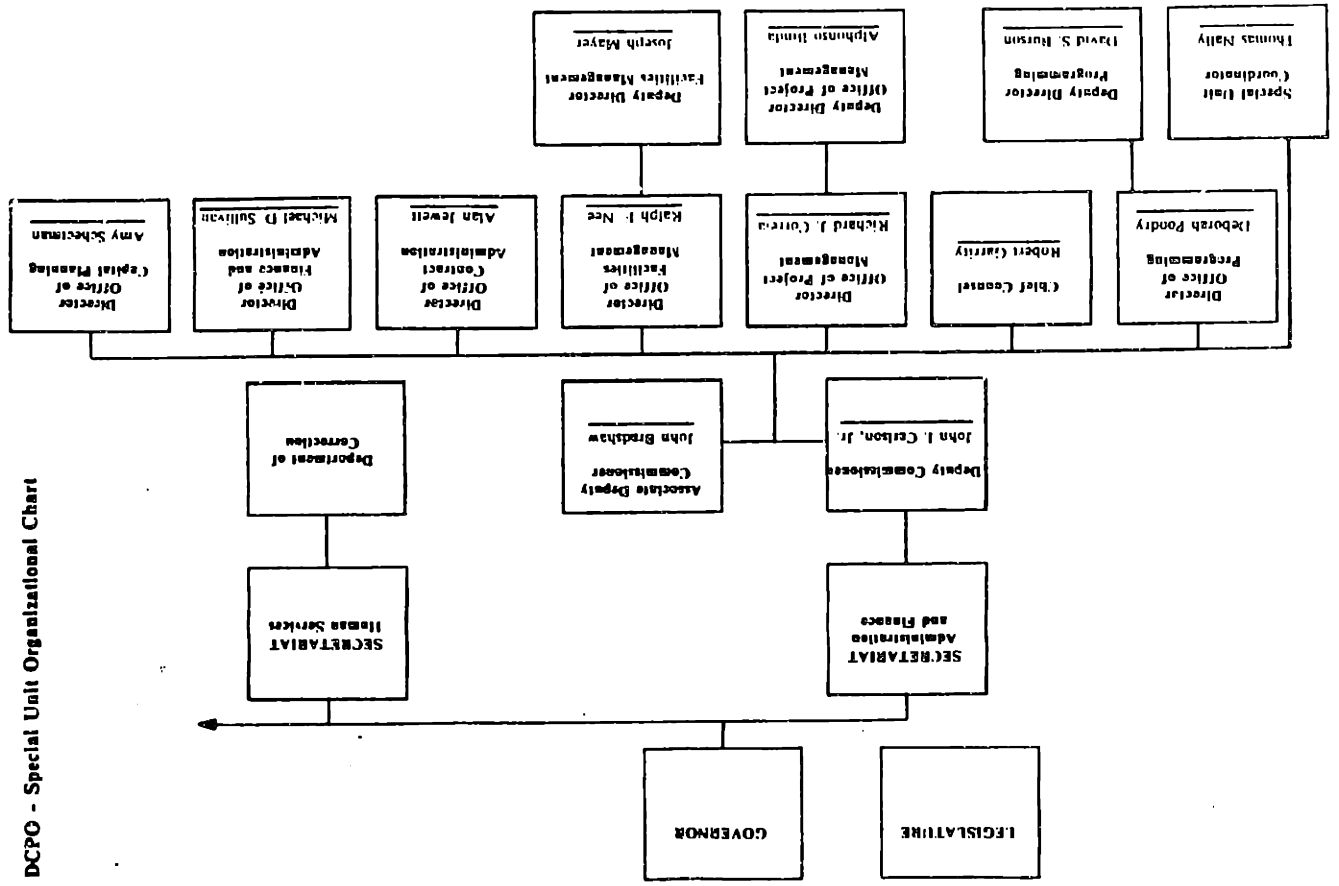
Deputy Director, Special Unit: James Mayer

CPO - Prime Responsibility Chart

Design-Build Phases	DCPO Office
RFP Preparation	<u>Programming</u>
Qualification Statements Review	<u>DBSB</u> <u>Programming</u> DOC Special Unit Administration
RFP Preparation	<u>Programming</u> Project Management
Proposal Review	<u>DBSB</u> <u>Project Management</u> <u>Programming</u> Facilities Management
Contract Execution	<u>Contract Administration</u> Legal Counsel Project Management
Project Design and Construction	<u>Project Management</u>

* Underline--Prime responsible party

DCPO - Special Unit Organizational Chart



Department of Correction

DOC's Office of Capital Management is responsible for the planning and management of all capital facilities in the correctional system. To assist in the acceleration of the design and construction of recently authorized correctional facilities, the DOC has added staff to its OCM to work with the DCPO Corrections Special Unit. The Office of Capital Management is under the authority of the DOC Associate Commissioner for Operations, who is responsible for policy decisions about building feasibility studies and during the design-build proposal review process.

The Director of the Office of Capital Management will coordinate overall DOC participation in the three design-build projects, assisting DCPO in the preparation of the RFP and the review of proposals, coordinating the timely DOC review of design-build proposal, design, and construction documents, and taking overall responsibility for DOC field decisions.

The Director of the Office of Capital Management has designated individuals for each of the three facilities under this contract, to coordinate the study process with facility superintendents and the OCM, to participate in the proposal technical review, to participate in design review and construction job meetings, and to make field decisions for DOC.

The superintendent of each correctional facility is responsible for facility management and operations. Within its overall policy guidelines, the DOC gives considerable responsibility to its superintendents for planning facility expansions to ensure compatibility with existing operations. Superintendents of the three projects in this contract participated actively in the building feasibility study and have reviewed and approved the technical requirements in this RFP. The superintendents will participate in the proposal technical review, evaluating the operations and security systems of each proposal and providing comments on building systems performance. Security related components of the RFP technical requirements are largely the result of the specification of each facility Superintendent.

DCPO will coordinate all team site visits through the DOC Office of Capital Management and the Superintendent of each facility. Teams must arrange visits through DCPO. Teams must not contact facility Superintendents directly. This procedure is necessary for the maintenance of security at each facility.

The DOC maintains plans for all correctional facilities at its office at MCI Shirley.

Associate Commissioner, Operations: Brian Gendron
Director, Office of Capital Management: Robert Poulriot

Design-Build Selection Board

The DBSB is a newly created Board, appointed by the Governor on June 3, 1986. The DBSB is responsible for the evaluation of all proposals and the ranking of proposals with respect to schedule, quality, and price.

The DBSB members are:

Peter Forbes, FAIA, an architect, is president of Peter Forbes and Associates, Inc. He served as a member of the Special Commission Concerning State and County Buildings that, between 1978 and 1981, investigated corruption in public building procurement in the Commonwealth. The commission's findings led to the creation of DCPO. Mr. Forbes is presently a member of the Commonwealth's Designer Selection Board.

Richard Gourdeau is president of Gourdeau Construction Company, and is responsible for all facets of the corporation's construction and development projects. He has helped expand the firm to its current construction volume of over \$26 million annually. Mr. Gourdeau is responsible for the firm's entry into the Design-Build, Construction Management field, and has negotiated projects in excess of \$50 million for work done under this concept.

Henry Irwig, an architect, is the director of construction services for the Beacon Construction Company, Inc., and is a senior lecturer in construction management at the Massachusetts Institute of Technology. From 1981 to 1985, he was an associate professor of civil engineering at MIT.

Gary Moig, AIA, is a former assistant director of the Federal Bureau of Prisons. He holds a degree in Architectural Engineering, and has worked for the past four years as a facility planning consultant for state and local governments and the federal government. He is a nationally recognized expert in the field of correctional facility design.

Lewis H. Spence, a member of the Boston firm of HBC Associates, is project director for the 16.5-acre \$700 million Fan Pier project, a joint venture of Hyatt Hotels and Carpenter & Co., a Boston development firm. Mr. Spence, an attorney, was appointed by the Suffolk Superior Court to serve as Receiver to direct the Boston Housing Authority during its period in Receivership. He served as chief executive officer of the BHA and assumed all policy formulating responsibility previously carried out by the housing board.

C. Proposal Preparation

DCPO encourages feedback and questions from DBTs during their proposal preparation. To ensure a fair and open forum for this interchange, DCPO will:

1. conduct open workshops during the initial proposal phase;
2. respond to all questions in writing;
3. permit all teams reasonable access to each facility to verify and clarify existing conditions; and
4. distribute addenda as necessary.

Proposal preparation will begin with the distribution of the Request for Proposals package. To ensure that each team receives accurate and equal information about the projects and the proposal process, DCPO has established the following procedures. First, DCPO encourages proposers to raise all questions at workshop sessions. DCPO will respond verbally at these sessions and will provide follow-up documentation and clarification in writing to all teams. DCPO will respond to questions--other than those raised at the workshops--in writing with copies to all teams. Only written responses represent accurate DCPO/DOC information. Teams should note that assumptions made based on information not verified in writing by DCPO may be inaccurate and may be cause for disqualification during the proposal review.

Workshops

There will be three workshops during the proposal preparation period. The Commonwealth's Corrections Special Unit will conduct a presentation of the three facilities and the RFP at the first workshop on August 19 and 20, after proposers have had a chance to review the RFP. This will be a two-day workshop, including site visits and question and answer periods. A discussion on the contract will be a part of the first workshop. DCPO will conduct subsequent one-day workshops every two weeks. The workshops will provide DBTs with the opportunity to raise questions concerning the facilities and the process. The Corrections Special Unit staff, including persons from the DCPO Offices of Programming and Project Management and the DOC Office of Capital Management, will be at all workshops to answer questions. DCPO encourages proposers to raise all questions at the workshops, since expertise from all the areas will be available. Teams who wish to discuss particular topics in detail should notify Thomas Nally in advance to allow DCPO/DOC staff to prepare material and information.

D. Proposal Evaluation and Selection

Proposal review and selection will occur in four stages. First, a staff proposal review team will examine each submission for compliance with the RFP minimum requirements. At this stage DCPO and DOC review staff may require DBTs to submit additional information to clarify or revise the proposals. Next, DCPO will accept submission of lump sum prices from all teams submitting compliant proposals. DCPO will not consider proposals that do not offer a lump sum total price. Third, the Design-Build Selection Board will evaluate proposals based on the selection criteria outlined in the following section, and it will then rank the proposals. Finally, the Deputy Commissioner of DCPO will make the final award.

The proposal review team will include Special Unit staff from the DCPO Offices of Project Management, Facilities Management and Programming, the DOC Office of Capital Management and consultant specialists in prison design and construction. DCPO will begin the technical review by examining each proposal to ensure that it is complete and meets the minimum requirements of this RFP. If any proposal fails to meet the minimum standards, DCPO may disqualify the non-complying proposal at that time. However, DCPO also reserves the right to return the proposal to the design-build team and request additional information or revisions. This will only be done for minor technical revision or for clarification. Proposals which do not comply substantially with DCPO requirements on the first submission will be rejected. At the completion of the compliance review on December 1, 1986, DCPO will accept the submission of lump sum prices. Members of the review group will then complete a detailed analysis of each proposal.

Standard of Analysis

ELEMENT

Design

- o Study schematic
- o DCPO experience with other correctional facilities

STANDARD

Building Technology

- o RFP Technical Requirements
- o DCPO construction experience
- o DOC operating experience

Building Performance and Life Cycle Cost

- o DCPO facility maintenance experience
- o DOC operating experience

Submission/Review Schedule

- o Section One, Chapter IV - Post-Award Procedures

ELEMENT

STANDARD

- Construction Schedule
 - o RFP Schedule
 - o DCPO construction experience
- Project Management/Control
 - o Section One, Chapter IV - Post-Award Procedures
- Building Systems Percentage Price
 - o Study cost estimating
 - o DCPO construction experience

As part of the DCPO technical review process, qualified engineers and corrections and maintenance experts will perform a net present value life cycle cost analysis for each proposal. This analysis will consider uniformed guard staffing costs, energy costs, maintenance costs, and major replacement and repair costs.

Once the technical analysis is complete, the review team will forward proposals and findings of the technical analysis to the DBSB. The DBSB will then begin its evaluation. The DBSB first will evaluate the compliant proposals without the price. The DBSB will focus on the quality of design, building performance, management plan, and schedule. After this evaluation is complete, the DBSB will consider the cost proposal.

Before opening the cost submissions, the DBSB will: (1) rate each compliant proposal as Outstanding, Superior, Good, or Acceptable; and (2) rank the proposals. A record will be maintained of these preliminary ratings and rankings. The DBSB will then open the cost submissions and rank the proposals again, taking account of the cost submissions. (The ratings, which are to be based solely on non-cost evaluation criteria, are not to be changed.) If the second-round rankings differ in any respect from the first-round rankings, the DBSB will explain in detail its basis for concluding that the incremental quality of each proposal is worth the incremental cost of that proposal. The DBSB may require interviews with the DBTs prior to the final evaluation and ranking.

The preliminary rankings, the ratings, and the second-round rankings, together with the DBSB's explanations and all underlying documentation, will be submitted to the Deputy Commissioner, who will make the final proposal selection and contract award. The Deputy Commissioner may request additional material or explanations from the DBSB. The Deputy Commissioner shall make the final selection of a DBT in writing, explaining in detail the reasons for the selection. If the selected DBT did not submit the lowest-cost proposal and receive the highest ranking based on the non-cost evaluation criteria, the Deputy Commissioner shall explain why the team's rating on the non-cost evaluation criteria justifies its proposal cost.

The proposal costs will be compared with conventional construction cost of equivalent work, as indicated by the certified studies for the projects. The Deputy Commissioner reserves the right to reject any proposals which exceed the cost of conventional construction based on this

comparison. Further, the Deputy Commissioner reserves the right to reject any or all proposals when deemed in the best interests of the Commonwealth.

The Deputy Commissioner of DCPO will make the final award. The ranking of proposals will provide DCPO with the option of awarding the contract to an alternate team if for some unforeseen reason DCPO and the winning team fail to execute a contract, or the winning team cannot perform under the contract. To allow for that eventuality, all teams must guarantee their price for 120 days. DCPO estimates there will be two months between the submission of the price proposal and the Notice to Proceed with design.

E. Selection Criteria

Evaluation Parameters

The Design-Build Selection Board will evaluate, rate, and rank all proposals which comply with the requirements of this RFP. Proposals which meet these minimum requirements necessarily meet the schedule and facility cost parameters established by DCPO. Nevertheless, it is expected that proposals will have significant differences in both cost of projects and time of completion for the three facilities. The DBSB also anticipates that there will be significant differences across proposals in the areas of design quality, building performance, and project management strategy.

The DBSB therefore has established selection criteria within the following broad evaluation categories:

Design Quality
Building Performance
Project Management Capabilities
Schedule Implementation and Achievement
Cost

The first four proposal elements are of equal importance and the DBSB and DCPO must be convinced that all are achievable for a proposal to be viable. Differences between proposals' ratings on these elements will be weighed against differences in proposals' costs (as explained above in section D).

There are differing priorities, however, for each of the three projects. Therefore, the DBSB will be weighing the key differences in the proposals, i.e. how the five goals are achieved (or oversatisfied).

What follow are groups of criteria which must be achieved in the judgment of the DBSB and DCPO, along with the prioritization of certain elements for each of the three projects.

Selection Criteria

The DBSB will consider the following specific criteria in its evaluation of each compliant proposal.

1. Design Quality

a. Program

- o degree match to DCPO-certified program requirements, including functional relationships.
- o layout efficiency; distribution of space for functions performed; appropriateness of the hierarchy and adjacency of spaces for the sequence of activities.

b. Architectural Quality

- o orientation: clarity of functions; ease of movement in and around the facility, of understanding its parts and its connections to surrounding destinations.
 - o normalized environment: degree to which the design creates as normal an environment as possible for inmates and staff including a residential scale.
 - o flexibility: degree of physical and organizational change possible; modification of facility layout, as other factors change.
 - o site utilization: appropriateness of overall planning, integration of building and site elements, compatibility of grounds and buildings with surroundings, ease of vehicular and pedestrian circulation; solar orientation and landscaping.
 - o exterior image: aesthetics, the appearance of the facility grounds and exterior envelope; compatibility of style and treatment of new construction with existing architecture.
 - o interior image: visual quality of interior environment for staff and inmates.
- #### 2. Building Performance
- o security and safety for both inmates and staff: impact of building and site arrangement on operations of the total facility; ease and efficiency of staffing; perimeter security where appropriate; interior control points and ease of casual supervision; ease and safety of circulation patterns; and quality of security construction and hardware.
 - o physical comfort: level of potential inmate, guard, staff satisfaction with environment, temperature, ventilation, lighting, levels of sound, and quality of finish materials.
 - o economy: degree to which facility can be managed cost-effectively.
 - o maintenance: degree to which space configurations, materials, personnel, and procedures allow for the facility's efficient cleaning, repair, and operation.
 - o energy conservation: consumption levels of energy sources per space, time, and person unit; performance coefficients of facility's service systems; effectiveness of measures taken to conserve generated energy.

- o life-cycle facility costs: including initial total and system costs, staffing costs, maintenance and system replacement costs, and utility costs.

All of the specific Design Quality and Building Performance criteria are important to DCPO, but each facility demands different priorities. The following are the priorities for each of the facilities (in their order of importance):

MCI Concord

- 1) security and safety
- 2) normalized environment
- 3) interior image
- 4) degree match to DCPO-certified program
- 5) orientation
- 6) site utilization
- 7) layout efficiency

Bay State Correctional Center

- 1) normalized environment
- 2) interior image
- 3) security and safety
- 4) degree match to DCPO-certified program
- 5) orientation
- 6) layout efficiency
- 7) exterior image

South Middlesex Pre-Release Center

- 1) normalized environment
- 2) interior image
- 3) degree match to DCPO-certified program
- 4) orientation
- 5) layout efficiency
- 6) security and safety
- 7) exterior image

3. Project Management Capabilities

All of the following criteria are important to DCPO. The first four are higher priorities than the others.

- o Ability of the design-build team to interact effectively with DCPO Project Management and the DOC.
- o Scheduling: assignment of experienced personnel to tasks, use of appropriate systems and logic, level of integration with design and construction operations, clarity and frequency of reports issued internally and to DCPO.

- o Staffing: assignment of personnel with experience appropriate to their function in the project, dedication of project staff to each of the three facilities, re-use of teams of individuals who have successfully worked together in the past, commitment of principals' time to project.
- o Interaction of design and build components of the team at key decision points during project progress.
- o Organization: clarity of internal reporting relationships for the entire duration of the project, use of appropriate mechanisms for coordination, and for reporting to and working with the owner.
- o Document Preparation Capacity: plan for design and working document production and submission; extent of detail of proposed submissions during design and construction to assure DCPO of the quality of construction.
- o Quality Control: assignment of experienced and qualified personnel, independence of personnel from responsibility for production operations, clarity of quality control plan, use of appropriate systems, clarity and frequency of reports issued internally and to the owner.
- o Cost Estimating and Control: ongoing assignment of experienced personnel through design and construction, use of systems which provide rapid access to historical and current data, frequency and regularity of reports on overall project costs, clarity of reports, especially with regard to projected costs for entire project.

4. Schedule Implementation and Achievement

With respect to time of completion, DCPO has outside limits for each facility which must be achieved (page 41). Although all proposals must meet DCPO completion deadlines, the DBSB will examine in detail the plan for meeting those deadlines, proposed time-saving strategies and the capacity of the team to meet or better the time schedules proposed.

Because earlier completion of projects other than the outside limits is among the Commonwealth's highest goals, a BOND'S PENALTY CLAUSE is included in the contract (page).

- o Overall design-build schedule and earliest completion dates for each facility.

- o time-saving strategy or approach used to meet proposed schedule.
- o strategy for achieving bonus
- o capacity to implement schedule based on project management plan.

Early completion is important for all of the facilities. DOC does have priorities based on the demands and needs for the proposed facilities. They are (in their order of need):

- 1) MCI Concord
- 2) Bay State Correctional Center
- 3) South Middlesex Pre-Release Center
5. Cost for All Three Facilities

All proposals must be within project budgets (page 41).

It is not the intention to ask the proposers to design and bid up to the limit of the funds available. The extent to which a proposal is below the project cost limits will be one evaluation factor to be weighed by the DBSB and the Deputy Commissioner.

F. Documentation of the Process

After the announcement of the selected team, teams who were not selected will have an opportunity for debriefing by members of the DBSB as well as Special Unit staff. During the debriefing, DBSB members will describe the relative strengths and weaknesses of each team's proposal for the purpose of informing that team about the viability of its approach for future work.

The DBSB will make public a report of its findings and a summary of the process by which the Board arrived at its findings within the selection procedures described in this RFP. The report will substantiate the decisions of the Board for the public record. For the preliminary proposal rankings based on the evaluation criteria other than cost as well as the final proposal rankings reflecting the trade offs between cost and the other evaluation criteria, the DBSB report will explain the choices of the first, second, and third ranked proposals as well as the demonstrated strengths of the proposals underlying those rankings. The Deputy Commissioner reserves the right to return the report to the DBSB for addition of further detail if he determines that the report does not constitute an adequate public record of the selection process.

DCPO will also prepare a summary report of its analysis of the proposals for the public record. In addition, the DBSB may prepare other summary tables and matrices which will accompany the DCPO staff analysis of proposals placed in the project file.

In the event that the proposal selected by the Deputy Commissioner is not the first-ranked proposal based on the evaluation criteria other than cost as well as the lowest-cost proposal, the Deputy Commissioner will justify his final selection in writing.

DCPO reserves the right to keep the presentation boards submitted by the teams for up to six months after selection of the final team. DCPO may organize a public display of the board submissions after the final selection.

G. Contract Execution

After the announcement of the winning design-build proposal, the designated DBT and DCPO will finalize the design-build contract and sign the first phase, design contract. After the completion of design-build documents, DCPO and DBT will sign the second phase construction contract. DCPO's design-build standard contract requirements are contained in Section Three. Proposal-specific contract provisions governing the schedule of document submissions, work schedule, progress payments, and similar items will be finalized by DCPO and the DBT after the award announcement. The approved document submission, approval and construction schedules will become the basis for a construction bonus incentive. The bonus incentive is described in the contract, Article XIV. DCPO will also assess liquidated damages for failure to complete construction within the time specified in the contract. DCPO expects that the final design-build contract will be executed within four weeks of the award.

A. General

Proposal documents should be submitted in two packages. The first submission, due on Monday, November 3, 1986, is to contain the components: summary documents and presentation boards, detailed drawings and specifications, questionnaire, management plan and schedule, and percentage of prices broken down by building systems. The second submission, the guaranteed lump sum price is due at DCPO on Monday, December 1, 1986.

This section identifies DCPO's minimum requirements for proposal documents. Teams are encouraged to include any other descriptive material to adequately describe the proposed project to the DCPO technical review team and the Design-Build Selection Board.

Teams are alerted to the fact that DCPO expects the winning team to complete development documents within eight weeks of contract execution. Proposal documents should be developed sufficiently to anticipate this schedule.

To facilitate smooth contract finalization, teams should review the DCPO contract carefully and should include in their proposals project-specific contract provisions. Teams should also indicate which DCPO standard requirements may require modification to be consistent with team management practices.

The following chart summarizes individual submission requirements and their use by the review team and the DBSB.

CHART - SUBMISSION REQUIREMENTS

PROPOSAL ELEMENT	DESCRIPTION	USE
PROPOSAL SUMMARY	<p>Proposal Summary Report</p> <p>Presentation Boards</p>	<p>To introduce all members of review team and DBSB to proposal.</p> <p>DBSB: To highlight important features of each proposal and team approach.</p> <p>PUBLIC: For public presentation after contract award.</p>
FACILITY SPECIFIC PROPOSAL DETAIL	<p>Drawings</p> <p>Outline Specifications & Product Data</p> <p>Building Performance Plan</p>	<p>REVIEW TEAM: As the basis for detailed proposal analysis including life cycle cost of alternative proposal.</p> <p>DOC for security & operations</p> <p>DBSB: As the basis for application of building design and performance selection criteria.</p> <p>DCPO PROJECT MGT: As the basis for review of subsequent submission by selected team after contract award.</p>
REVIEW MATRIX	Questionnaire	<p>REVIEW TEAM: Uniform format for review team to compare characteristics of each team's proposal for each facility, including data for building performance evaluation and building system percentage costs.</p>
MANAGEMENT STRATEGY	Project Organisation	<p>REVIEW TEAM: To provide data for analysis of project management capacity and match to DCPO's requirements.</p> <p>DBSB: The basis for the application of project management selection criteria.</p> <p>DCPO PROJECT MGT: As the basis for planning project supervision.</p> <p>DCPO ATTORNEY: As the basis of contract schedule & submission provisions.</p>
PRICE PROPOSAL	<p>Percentage Price by System</p> <p>Lump Sum Price</p>	<p>REVIEW TEAM: As data for comparison of alternative building systems in technical analysis.</p> <p>DBSB: As a measure of the cost effectiveness of each proposal.</p> <p>DCPO PROJECT MGT: As the basis for review of subsequent submission of schedule of values by selected team after contract award.</p> <p>Submitted by December 1, 1986</p> <p>To provide frame work for project supervision as a basis for contract price.</p>

B. Summary Documents And Presentation Boards

1. Proposal Summary Report

The proposal and overall management plan summary report should be a written statement summarizing the contents of the proposal. This written summary should include:

- a. A statement of the designer's approach to the building and site design, to long-term maintainability, and to building quality, including a summary of the major features of each project site;
- b. A summary of the square footage and functional program contained in the drawings, compared to the square footage requirements in the program;
(Teams should justify any deviations and explain any innovative interpretations.)
- c. A statement of the team's approach to security through hardware, design, and staffing;
- d. A description of the team's overall management structure.

2. Presentation Boards

Proposers are required to submit a set of presentation boards for the overall project and for each of the facilities. The Design-Build Selection Board will use the boards in its evaluation of the proposals. DCPO may also use these boards for public presentation of the results of this competition. All boards must be 30 by 42 inches. Boards must contain the following information:

- a. Name of the DBT
- b. Project identification:
P86-3, Commonwealth of Massachusetts Design-Build for Three Correctional Facilities,
Division of Capital Planning and Operations
- c. Facility-specific labels

The boards are intended as a clear and comprehensive summary of the overall scheme and its distinguishing highlights. They are not intended to replace the more detailed drawings identified in the following sections.

DBTs are allowed to submit a maximum of 12 boards for the entire project.

C. Detailed Submission Documents

1. Proposal Drawing Requirements

At a minimum, proposers are required to submit the following drawings. Proposers are encouraged to submit any additional drawings that may better describe the proposed building.

a. Format

- 1) The outside dimensions of drawings shall be 30 by 42 inches.
- 2) If there are five or more sheets in a set, the top sheet shall be a title sheet containing a complete index with sheet numbers and title of each drawing. The names of the designer and each of the consultants shall appear on the title sheet. The seal of Massachusetts registration and signature shall appear directly below each name. The standard title and signature box shall appear on the title sheet.
- 3) If there are four or fewer sheets in a set, the top sheet shall contain the index adjacent to the right border above the title box.
- 4) The title box in each drawing shall include the designer's or consultant's Massachusetts registration seal and signature. A facsimile signature stamp will not be accepted.
- 5) Drawings should be submitted as blackline prints and shall be clear and legible. Drawings should contain sufficient information to enable DCPO to understand the design of the building and how it will perform.
- 6) Scale of floor plans should be 1/8 inch to foot. A north arrow and graphic scale should appear on all drawings.
- 7) The system of numbering and sequence of drawings for projects shall be as follows:

Title Page	
Site	L-1, L-2, L-3, etc.
Architectural	A-1, A-2, A-3, etc.
Structural	S-1, S-2, S-3, etc.
Plumbing	P-1, P-2, P-3, etc.
Fire Protection/Sprinklers	FP-1, FP-2, FP-3, etc.
Heating and Ventilating/AC	H-1, H-2, H-3, etc.
Electrical	E-1, E-2, E-3, etc.

b. Design Drawings

Drawings shall show that the proposed building and site plan are functional and conform to all necessary codes and standards.

- 1) Site and Utility Drawings (scale: 1" = 40')
 - o Site plan showing roof plan, roads, parking areas, site drainage, landscaping, lighting, and other site improvements.
 - o Plot plan showing existing and proposed contours and location of the proposed building or buildings, including benchmarks. Building locations shall be referenced to the main survey baseline. (Note: Commonwealth to provide site survey at 1" = 40')
 - o All utilities existing and proposed within contract limit lines, indicating location, elevation, and size. Highlight utility modifications.

2) Architectural Drawings (scale: 1/8" = 1', or as noted)

- o Demolition Plan (schematic)
- o Floor plans for each floor, indicating use of each room
- o Plans should be in sufficient detail to identify penetration, circulation, code compliance, and major materials.
- o Provide 1/2" = 1' drawings of a typical cell or bedroom showing plan, wall elevations, furnishing and fixture locations, finish schedules, and highlighting security measures. Provide 1/2" = 1' wall floor and roof sections.
- o Provide two overlay drawings to the architectural floor plans.
 - a) Physical security system: include definition of secure perimeter (MCI Concord only), control zones within the buildings, secured fire zones, location and supervision provided by security hardware, visual security sightlines for security control, circulation zones within the facility, etc. (Describe extensively for M.C.I. Concord.) Narrative accompaniment may be useful.
 - b) Security staffing plan: indicate on the floor plans staffing requirements, by shift, to operate each facility. (Refer to the building studies for operating characteristics of each facility and to page 148 for additional information on operations at M.C.I.

Concord.)

- o Major building elevations
- o Building sections to show room heights and building relationships
- o Appropriate wall sections showing floor, roof and wall construction (3/4" = 1').
- o Typical roof and waterproofing details, at 1-1/2" = 1'
- o Typical door and window details, at 1-1/2" = 1'
- o Perspectives, axonometrics, and sketches

3) Structural Drawings

Structural plans and details to show type and character of structural systems and foundations.

4) Mechanical, Electrical, and Plumbing Drawings

Floor plans should show the following systems and detail. Separate drawings showing certain systems may be provided for clarity. Provide a legend for each.

- o Plumbing: floor plans showing location of all plumbing fixtures and special features, including fixture schedules. Include a schematic layout for typical module or toilet/shower room showing cleanouts. Identify piping systems, show typical details.
- o Mechanical: the mechanical system shall be shown in sufficient detail to show source of heat, location and type of major equipment, and method and location of heating, ventilating and air conditioning distribution and controls within the building. Drawings should include a schematic layout of mechanical rooms and spaces. Show typical details and schedules.
- o Electrical: all service connections and electrical equipment (panels, transformers, and switch gear) shall be located on the drawings. Show lighting, switching, and outlets for typical inmate room and dayroom. Lighting shall be indicated as to location and intensities in foot candles for each space, room, or typical space or room. All service for special purposes shall be located and indicated. Show schedule and typical details. Show layout and schematic diagrams for security systems, telephone, master TV antenna, and intercom/paging system.

- o Fire protection: all sprinklers and other fire protection systems should be shown on building plans. Show typical details.

2. Technical Specifications and Product Data

DBTs should provide technical specifications consisting of a comprehensive description of the scope of the project and the materials proposed for use in the work for each facility. Teams should use the Technical Requirements provided in Section Two, Chapter III, as a guide. For those systems or building components described in the Technical Requirements which the proposal includes as specified, the preliminary specification can reference the Technical Requirements. For components or systems the DBT is proposing as an alternate to the system or component specified, the technical specification should contain a level of detail equivalent to that provided in the Technical Requirements.

The primary concern is materials. General and execution sections for each division may be covered in summary form. The general scope and outline of work to be done shall be set up in sections following the standard CSI format.

3. Maintenance Plan and Schedule

a. Facility Concept Summary

The designer shall prepare a Maintenance Concept Summary Report which shall describe all major building systems, how systems are related, basic operating requirements for each system and safety and/or emergency requirements associated with each system. The summary shall be presented in booklet form with a uniform scheme of lettering, titling, graphics, and organization. The Facility Maintenance Concept Report shall contain the following:

- 1) Identification of Preventive Maintenance (PM) Units - a breakdown of the PM Units evident at this design stage, an indication of considerations which will be important in the completion of the design from a maintenance viewpoint and the types of technical documentation which will be provided for each PM Unit (schematics, flow diagrams, parts list, operating instructions, etc.).
- 2) Design Considerations - a discussion of the factors considered in the selection of facility systems as they relate to maintenance. This should include compatibility with existing systems and/or components, access to systems for maintenance, maintainability of recommended systems, energy cost, expected useful life, and maintenance requirements.

- 3) Maintenance Requirements - a discussion of the factors considered in the selection of facility systems as they relate to ongoing maintenance and operation of the facility. This should include estimates of the trades and skill levels required to maintain the recommended systems, the estimated levels of effort for maintenance, special tools or test equipment needed, operational impact to facility operations of maintenance requirements and estimated annual cost for maintenance.

b. Equipment Schedule

Provide a schedule of all equipment broken down according to the DCPO Preventative Maintenance (PM) unit classification identified in the following list. This schedule shall be as complete as possible. It will be used by the proposal evaluation team as a basis for estimating maintenance and replacement costs. This schedule should include the following information for each piece of equipment (PM unit).

- o Description of type of unit
- o Manufacturer and model number, if known
- o Number of equipment units
- o Size/capacity of unit
- o Special features and accessories
- o Location(s)

c. Energy Use

Provide an estimate of the energy use and costs for the first year of operation of each facility, based on the operating cost assumptions below. Assume a 5000 degree day heating season based on 68 degrees Fahrenheit inside temperature.

The following table gives unit cost for the three different facilities. Complete the Energy Costs/Year table according to those base unit costs.

ASSUMPTIONS	MCI	CONCORD	BSCC	SMPRC
ELECTRICITY	0.15/kwh		0.15/kwh	0.10/kwh
STEAM	8.00/mlbs(*)		N/A	8.00/mlbs
OIL	N/A		0.85/ga	N/A
GAS	N/A		N/A	6.50/mmbtu

(*) Includes allowance for transmission losses.

Estimate first full year energy costs using the following format. Provide conceptual backup calculations for the information provided.

FIRST YEAR ENERGY COSTS PER YEAR

FACILITY _____
DESIGN-BUILD TEAM _____

FIRST YEAR ENERGY COSTS PER YEAR _____
DESIGN-BUILD TEAM _____

	SPACE HEATING	DRW	AC VENT	EQUIP	LIGHT	TOTAL	UNIT COST	TOTAL
ELECTRICITY (KWH)								
OIL (GAL)								
STEAM (MLB)								
GAS (MMBTU)								
TOTAL								

D. Questionnaire

To allow the DBSB and the technical review team to compare the important features of competing proposals, DCPO requests that teams complete the following questionnaire for each facility. Teams should provide the requested information in both printed and machine readable form. Attached to the back cover of the RFP is a floppy diskette which has been formatted to be compatible with all IBM AT (low density drive), XT, and PC type computers. On the floppy diskette is a file named "QUESTION" containing the questionnaire. Teams should input information on the floppy disk.

The software LOTUS 1-2-3 must be used for inputting data. Instructions for inputting information are contained on the diskette.

Answer the following questions for each facility:

QUESTION

Design Characteristics (Note: numeric entries)

1. Gross square feet of building (AIA Form D101)

New construction
Renovation (0 entry for Concord)
Total

2. Net square feet of building (AIA Form D101)

New construction
Renovation (0 entry for Concord)
Total

3. Net sf divided by gross sf to two decimal places

New construction
Renovation (0 entry for Concord)
Total

4. Footprint size of new construction

Residential component
Program component (future Phase II for Concord)

5. Number of housing cells

New
Renovation (0 entry for Concord)
Total

6. Gross square feet divided by number of cells
7. Number of cells in each typical housing cluster
8. Number of typical housing clusters
9. Number of cells in smallest housing cluster
10. Number of small housing clusters
11. Total net square feet of dayroom space
12. Square footage of day space divided by number of cells
13. Ceiling height of day space - new construction from finished floor to finished ceiling
14. Percentage of total roof area that is pitched (new construction)
15. Design Sound Transmission Coefficient (STC) rating of walls (new construction)
 - Between cells
 - Between clusters
 - Between clusters and corridors
16. Percentage total deviation from DCPO program (net square feet)
 - Building Technology
(Note: descriptive entries)
 1. Structural system - new construction
 2. Material of exterior surface - new construction
 3. Exterior envelope system - walls/new
Manufacturer reference
 4. Roofing system - new
 5. Interior partition system -
 - Between cells
 - Between clusters
 - Between clusters and corridors
 6. Control room envelope system (Concord only)

7. Ceiling system -

Housing cells
Dayrooms
Corridors

8. Flooring material finish -

Housing cells
Dayrooms
Corridors
Administrative

9. Security glazing system

10. Detention window - type, manufacturer reference

11. Detention door - type, manufacturer reference

12. Detention hardware - type, primary locking system, manufacturer reference

13. Non-detention windows - type

14. Non-detention doors - type

Building Performance

(Note: numeric and descriptive entries)

1. Custodial staffing to inmate ratios:

- a. Peak
 - with direct supervision
 - with manned control room (Concord only)
- b. Off-peak

2. Equipment:

- a. Heat distribution system - type
- b. Heating source equipment - type
- c. Cooling distribution system - type
 - Equipment - type
 - Equipment - manufacturer reference
- d. Ventilating system - capacity
 - Equipment manufacturer reference

e. Electrical - Primary manufacturer reference

Emergency generator
T.V. surveillance equipment
Duress alarm system
Fire protection

3. Energy Use/Costs:

- a. R Value - exterior walls, roof, windows
- b. Costs per year (from energy cost calculations)

Space heating
DHW
Air conditioning/ventilation
Equipment
Lighting

Time Schedules

(Note: numeric entries)

- 1. Design development submission production time (weeks from award of contract to submission)
- 2. Working document production (weeks from DCPO acceptance of design development final submission)
- 3. Number of phased submissions - working documents
- 4. Total construction time (weeks from ground breaking to completion)
 - New Construction
 - Renovation
- 5. Total design-build time (weeks from contract to completion)
 - New Construction
 - Renovation

Cost
(Note: numeric)

Calculate the percentage of the total price for the following building systems:

- 1. Foundations
- 2. Substructures

E. Management Plan and Schedule

3. Superstructures

4. Exterior Closures

5. Roofing

6. Interior Construction

7. Conveying

8. Mechanical: HVAC

Plumbing

Fire Protection

9. Electrical

10. General Conditions

11. Special

12. Site Work

1. Project Organization

Some of the following information may have been provided in the Statement of Qualifications. Please reiterate and note if the information has changed since that time. Attach resumes of any individuals not identified in the Statement of Qualifications.

a. Project Management Plan

Describe in detail the project management approach, identity, and role of key individuals managing the project, and quality and cost control systems.

1) Overall Strategy

Describe the overall project management system, including identity of major team members and sub-consultants, identifying the team communications and interactions. Provide a description of the design - construction overlap period, demonstrating project continuity during this period.

2) Team composition

The Management Plan should identify and describe in detail the role of the following individuals and the percentage of their time to be spent on this project:

Project Manager - overall project
Project Manager - architectural/engineering
Construction Manager
Project Manager - M.C.I. Concord
(or Superintendent)
Project Manager - Bay State Correctional Center
(or Superintendent)
Project Manager - South Middlesex Pre-Release Center
(or Superintendent)
Corrections Specialist
Project Architect
Structural Engineer
Geo-Technical Engineer
Mechanical Engineer (person in charge)
Electrical Engineer (person in charge)

Include any other key personnel relevant to your organizational decision making and project supervision. Provide the information in a format most suitable to explain your organizational structure and management strategy.

3) Organizational Chart

Provide organizational charts for the DBT and for the management of design and construction for each facility. Show clearly the communication links and lines of authority that exist.

The organizational charts should identify all key participants and decision makers to be included in the project and should identify

- o name of individual
- o title of project
- o professional registration in the discipline of individual's project responsibility (must be registered in Massachusetts)
- o firm association and title in firm

Provide three organizational charts showing responsibilities and hierarchies during:

- o design
- o design - construction overlap
- o construction

4) Project Quality and Cost Control

Describe in detail the project quality and cost control systems, including reference to any computer applications. Include a sample of a typical project control report submitted to DCPO.

The description of the quality control plan should include:

- o organizational chart for quality control personnel, indicating lines of reporting and responsibility
- o job description and quality control responsibilities of each person within the organization
- o standard quality control procedures, reports, and documentation during all phases of design and construction. This section shall include a series of quality verification checklists covering each phase, area of work, subcontractor, trade, etc

2. Project Schedule

a. Overall Schedule

Provide a detailed description of the time sequence of activities after the execution of a contract with DCPO. Include the following for each project:

- 1) Description, sequence, and schedule for production and submission of design development drawings and related documents.
- 2) Treatment of long-lead items.
- 3) Description, sequence, and schedule of working document preparation and submission.
- 4) Project construction schedule, by major building component, including reference to required phasing at Bay State Correctional Center and South Middlesex Pre-Release Center.
- 5) Points of contact with DCPO. (meetings, submissions, etc.)

b. Critical Path Schedule

Provide a detailed critical path schedule for the entire project showing separate design, procurement, and construction activities in sufficient detail to describe construction activities and precedences, especially during the design material procurement and early construction phases of the project. Also include activities for DCPO review. Each activity should include the following information:

- 1) description
 - 2) early start, late start, early finish, late finish
 - 3) activity float, free float
 - 4) responsibility
 - 5) critical resource requirements: labor, equipment, materials, management, and other requirements.
 - 6) Bar chart
- The following are optional items to include in the critical path schedule:
- 7) time-scaled Critical Path Model (CPM)
 - 8) total resource requirement histograms for critical resources, e.g. major equipment, manpower.
 - 9) "PERT" analysis using probabilistic activity durations.

F. Price Proposal

Project Schedule Parameters

The following schedule guidelines are the maximum allowable completion times for the design and construction of each of the facilities. Use and occupancy of the total facility must be achieved by the given deadlines. Teams are encouraged to submit a schedule which completes the project in less than the caps given.

Projects	Months from Award of Contract	Activity
(DCPO caps. Teams should propose project-specific schedules)		
	2 mos.	Construction start (phased approval)
	15 mos.	Completion Concord
	12 mos.	Completion South Middlesex - new construction
	17 mos.	Completion South Middlesex - renovation
	14 mos.	Completion Bay State - new construction
	23 mos.	Completion Bay State - renovation

Bonuses

There is a bonus incentive plan for early completion. Completion of facilities (accepted for use and occupancy) before the completion dates specified in the selected proposal will result in a bonus for the DBT.

MCI Concord
\$3,350/day

Bay State Correctional Center
\$2,000/day

South Middlesex Pre-Release Center
\$1,500/day

A maximum bonus of \$150,000 is available for the entire project.
A detailed description of the bonus incentive plan is in the Contract.

Initial Submission

In the proposal due on November 3, DBTs must submit a schedule outlining the projected percentage cost for the following building systems for each facility:

1. Foundations
2. Substructures
3. Superstructure
4. Exterior closures
5. Roofing
6. Interior construction
7. Conveying
8. Mechanical:
HVAC
Plumbing
Fire Protection
9. Electrical
10. General conditions
11. Special
12. Site work

Lump Sum Price

Each DBT shall submit a lump sum price for the total contract 30 days after the initial proposal submission. This submission should include the following: (see attached Bid Form)

1. Guaranteed lump sum price for the total contract
 2. In order to allow DCPO to compare the costs of alternative systems, teams are asked to provide the following details for each facility:
 - a. Total bid price - design, renovation, new, total
- The Total Bid Price shall be further broken down into:
- (1) Basic Design Fee - Phase I Contract
 - (2) Construction Costs - Phase II Contract
- b. Price per square foot - renovation, new, total
 - c. Price per housing cell
 - d. Phase II Contract cost for the building systems described in the initial submissions above.
3. Statement guaranteeing lump sum price for a period of 120 days.
 4. Completed bid bond and insurance forms are also required in this submission.

5. Price detail for contract purposes for each facility

Design Services - for design phase
for construction supervision

Construction - schedule of values

Budget Limits

The following dollar amounts are the maximum allowable prices for the design and construction of the facilities. The proposed guaranteed lump sum price must not be greater than the figures given. Price proposals which exceed the amounts given will not be considered for selection. Teams are encouraged to propose prices which provide the completed facilities for less than the caps given.

MCL Concord
\$8,220,000

Bay State Correctional Center
\$9,194,000

South Middlesex Pre-Release Center
\$2,441,000

NOTE:

There will be no price adjustments for design errors and omissions.

DCPO will not consider proposals that do not offer a guaranteed lump sum total price.

There will be no change orders authorized for design or construction errors. DCPO will hold the DBT responsible for all such changes.

IV

Post-Award Procedures and Requirements

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The following section provides a framework for the design and construction of facilities under this Contract. DBTs should review this section carefully to understand the way DCPO expects the projects to proceed. The sample Contract, Section Three, reflects these expectations. Teams that propose to modify these procedures to match the implementation requirements of the projects should clearly indicate so in their proposals. Modifications must be compatible with DCPO's current procedures and staff capabilities.

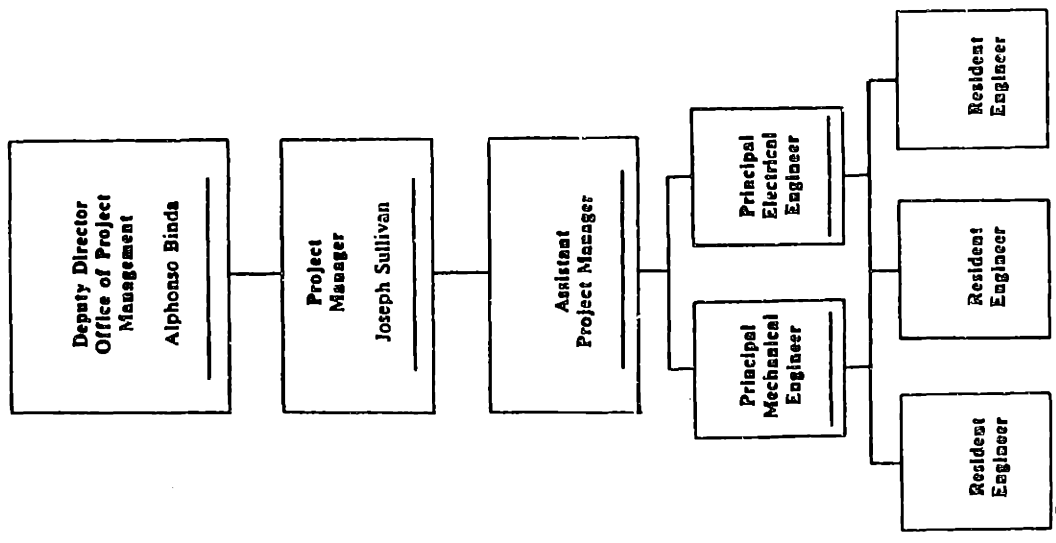
After the Deputy Commissioner of DCPO announces the award, DCPO contract administration, legal counsel, and project management will meet with designated members of the DBT to finalize proposal-specific contract provisions. DCPO expects these provisions will cover:

- o Design Schedule (Article VII)
- o Design-Build Management Plan (Article XII)
- o Price and Payment Provisions (Article XVI)

A. DCPO Project Management

The DCPO Project Management staff will supervise the design and construction of the three facilities. The Project Management staff will meet regularly with the DBT during the entire process. Weekly meetings will be scheduled during the preparation of design documents and bi-weekly meetings will be scheduled during construction.

- The project management team will include the following individuals:
- o The Corrections Special Unit for the Office of Project Management has overall responsibility for all corrections projects.
Deputy Director: Alphonso Binda.
 - o The design-build project manager will have authority on all design and construction submissions, authority to approve certain negotiated change orders, and to direct certain unilateral change orders. He will also approve all progress payments and all other means of contract enforcement.
Design-Build Project Manager: Joseph Sullivan.
 - o An assistant project manager will carry out day-to-day project administration on behalf of the design-build project manager. The assistant project manager will report directly to the project manager. He will be responsible for contract administration, negotiations, and enforcement. He will recommend design acceptance, change order approvals, unilateral change orders, etc. to project manager.
 - o Resident engineers will carry out day-to-day field inspection and administrative duties. They will report directly to the assistant project managers for each facility. During the design phase resident engineers may be stationed at the designer's office to facilitate design review and coordination. The resident engineer will act on behalf of the project manager and engineer in the enforcement of the contract in the field. They will report on daily progress, coordinate field testing, issue non-compliance notices, and recommend change orders.
- DCPO will include members of the DOC Office of Capital Management in the design and construction review meetings. DOC will review working documents to ensure that the submissions are consistent with the proposal documents and approved design documents. The DOC will communicate its comments to DPCO, which will incorporate them in its comments to DBTs.



B. Progress Schedules

Network Analysis System

1. Within 15 days of the initial notice to proceed after contract award the DBT and DCPO shall meet to discuss the critical path network schedule for each project site based on and elaborating the schedule submitted with the design-build proposal.
2. The schedules shall identify all separate activities for design development, working document, shop drawings, fabrication and delivery, and all on-site construction activities. Activities shall be broken down according to area, trade, subcontractor, etc., in sufficient detail to distinguish individual critical activities and to adequately assess and control the project. The sequence and precedence of activities shall be identified. Each activity shall contain the following information:
 - o Preceding and following activity numbers
 - o Activity number and description
 - o Estimated duration in days
 - o Early, late, and actual start dates
 - o Early, late, and actual finish dates
 - o Slack or float time in days
 - o Planned and actual quantities of major manpower, equipment
 - o Other resources, individual or firm responsible for each activity
 - o Monetary value based on schedule of values (see below)
 - o Percent complete
3. The following network schedule documentation for each project site shall be submitted:
 - a. Activity on arrow or activity on node diagram.
 - b. If diagram is not time-scaled, submit a time-scaled bar chart.
 - c. Tabular report listing each activity and associated activity data described in B above.
 - d. Time/cost "S" curves for each project site, based on early/late/actual start, finish, and percent complete for each activity.
 - e. Time/quantity, histograms of planned and actual cumulative major resources.
 - f. Short narrative status report of significant critical activities, delays, etc.

Schedule of Values

1. Within 15 days of NTP the DBT shall submit a schedule of prices based on and elaborating the price proposal breakdown submitted with the design-build proposal.
2. The price breakdown shall be integrated with and related to the schedule activity breakdown in order to calculate accurate values of activities and percentage of completion. "Front end loading" of the schedule of prices will not be accepted. If necessary, the project manager may require the DBT to provide detailed bid estimates to justify the schedule of prices. Prices shall include a proportional allocation of the DBT's overhead and profit.
3. Schedule of prices shall be submitted on the standard form DCPO-51b, identifying labor, material systems, fixtures and equipment, and specialties, noting all trades.

Monthly Submittals

1. Approximately 10 days prior to monthly billing date the DBT shall review project progress at each site with the project manager or assistant project manager. The resident engineer will approve the percent complete for each activity and line item on the schedule of prices. This will become the basis for the monthly billing--see Contract - Payment Provisions.
2. Along with the monthly progress payment application, the DBT shall submit six (6) complete updated copies of the time and price schedule documentation described above.
3. The DBT shall also revise the schedule as necessary to reflect any changes in planned work sequencing, anticipated delays, etc. CPM must be submitted with each payment, updated if necessary.
4. If, in the judgment of the project manager, the project has become delayed to the point where the schedule is unrealistic, he may direct the DBT to revise and resubmit the schedule to indicate a modified plan for completing the project on time.

Quality Control Plan

The DBT set out and maintain a formal organization within the overall project design-build organization responsible for quality control. This organization shall systematically monitor, check, and order corrective actions as necessary to ensure that the required level of quality for all design and construction is maintained throughout the project.

Within 15 days after initial notice to proceed after contract award, the DBT shall submit a comprehensive, overall plan for quality control. This plan shall cover, at a minimum:

1. Organizational chart for quality control personnel, indicating lines of reporting and responsibility.
2. Job description and quality control responsibilities of each person within the organization.
3. Standard quality control procedures, reports, and documentation during all phases of design and construction. This section shall include a series of quality verification checklists covering each phase, area of work, sub-contractor, trade, etc.

Quality Control Submissions

1. Within 15 days after notice to proceed, the DBT shall forward a submittal log based on the document submission plan included in the proposal requirements (see page 40), using the standard DCPO submittal form attached. This shall list all major submittals planned during the course of the project. Submittals involving multiple drawings, project data sheets, etc., should be described in detail listing sections, sub-sections, etc. This submittal log shall be maintained by the DBT during the entire duration of the project in order to track all submittals. In general, all submittals for each of the three project sites shall be handled independently and separately as if for three separate projects.

2. The Project Manager or Resident Engineer may require additional submittals besides those proposed by the contractor. All submittals shall be forwarded to the DCPO project manager at the following address:

DCPO Office of Project Management
1 Ashburton Place, Room 1519
Boston, MA 02108

Attention: Project Manager, Design-Build Special Unit

3. All submittals shall be accompanied by a DCPO design-build submittal form filled out in quadruplicate. Unless otherwise noted, submit six (6) copies of all items, plus any additional copies required by contractor. All drawing submittals larger than 11" x 17" shall

include one transparent mylar reproducible copy. Identify any deviations from RFP or proposal with each submittal.

4. Unless otherwise noted, the Office will review all submittals within 30 days.
5. All submittals shall be thoroughly checked, reviewed, approved, stamped, and signed by the DBT's Mass. registered architect or professional engineer employed by the contractor prior to being forwarded to the Office. The approving architect or engineer shall become the designer of record for the item(s) covered in each submittal and shall assume full professional liability and responsibility for the items as to their conformance with all codes, standards, and requirements set forth in the RFP, proposal, and other design-build documents.
6. Review and acceptance of a submittal by the Office is meant to provide an added measure of quality assurance and public accountability to the project, but in no way shall relieve the contractor and the designer of record from responsibility for compliance with all codes, standards, and requirements set forth in the RFP, proposal, and design-build documents, and from providing a complete and usable facility. Review and acceptance of a submittal by the Office shall in no way imply any responsibility or liability for any errors and omissions of design contained in a submittal.
7. The Office may withdraw acceptance of designs, products or work if such designs, products, or work are found to be unsuitable or defective. The DBT shall correct any such errors or defects promptly and at no cost to the Commonwealth.

C. Design Development

Once DCPO and the DBT execute a contract, DCPO will issue an initial Notice to Proceed (NTP), and the team should begin the preparation of design development documents. DCPO expects that the designer will submit complete design development documents within eight weeks of the NTP.

DCPO Project Management staff will conduct regular weekly meetings with the DBT during the design development phase. The purpose of the meetings will be to monitor and facilitate progress of design work. These meetings will be attended by the project manager, project engineers, other office consultants and DCPO representatives, DOC representatives, and by the DBT's project manager, designers, and any other representatives from the DBT's staff or sub-contractors. Project engineers and/or resident engineers will be available for coordination and ongoing design review. If necessary, DCPO may assign project or resident engineers to the DBT's design office to facilitate and coordinate ongoing design review.

After design development documents are completed, the DBT should submit a complete design development package to DCPO for formal review. All design development documents should be stamped and approved by the team's registered architects and engineers. Documents should also have the Department of Public Safety's stamp "Tentatively Approved." DCPO Project Management will review and accept the design-build package or return the package for revision and resubmission. (See Contract.) The design development documents as approved by DCPO shall be the basis for coordinating working documents.

1. Design development drawings shall expand upon the proposal drawings as follows:

- a. Drawings shall conform to all requirements of the Department of Public Safety and other State agencies having jurisdiction. When submitted to the Office for approval, one set of preliminary drawings shall be stamped "Tentatively Approved" by the Supervisor of Plans, Department of Public Safety, unless the work is of a nature that does not require such approval. Any drawings revised after being stamped by the Supervisor of Plans shall be replaced by prints of the revised drawings similarly stamped. In general, drawings shall be of sufficient detail so as to allow detailed working drawings to be easily coordinated. Special attention shall be given to portions of the design which involve critical long-lead items which must be pre-purchased at an early date and with portions of the design which will be impacted by early phases of construction, such as foundation and under-slab utilities, superstructure, and all imbedded or concealed work.

b. Design development drawings for buildings shall consist of not

less than the following unless otherwise permitted by the Office:

- 1) Site and Utility Drawings
 - o Plot plan showing existing and proposed contours at 2-foot intervals and locations of the proposed building or buildings including bench marks.
 - o All utilities existing and proposed, indicating location, elevation, size, and connections to existing systems.
 - o Roads, parking areas, and other site improvements.
 - o Building locations shall be referenced to the main survey baseline.
- 2) Architectural Drawings
 - o Floor plan layouts for all floors in sufficient detail and dimensions including finish schedules, wall thickness and construction types, column locations, door and window locations, designations and schedules.
 - o Building elevations.
 - o Cross-sections of the building at appropriate points to show room heights, floor and wall construction, and flashing details.
 - o Roof plan and drainage.
- 3) Structural Drawings
 - o Location and dates of test boring holes and results of soil investigation including water levels, allowable soil bearing pressure and bottom grades of footings and slabs. Location and dimensions of footings and grade beams.
 - o Typical foundation details and foundation structure interface details.
 - o Structural drawings to show type and character of structural systems, including sizes of typical members.
- 4) Plumbing Drawings
 - o Floor plans showing location of all plumbing fixtures, special features, and approximate size of all piping systems, principal items of equipment and riser diagrams, general plumbing layout, in sufficient detail to allow coordination of framing around chases, sleeves, etc., with structure and interior construction.

5) Fire Protection/Sprinkler Drawings

- o Floor plans showing location of all sprinkler heads, types, and piping systems, including sizing, alarms and other principal items in sufficient detail to allow coordination with framing and all other mechanical and electrical systems and ceilings.

6) Heating, Ventilating, and Air Conditioning Drawings

- o The heating system shall be shown in sufficient detail to show both source of heat and method and location of heating distribution and controls within the building.
- o Ventilating and air conditioning drawings shall show locations and approximate sizes of piping and duct systems, air handling systems and principal items of equipment such as compressors or cooling towers, including necessary controls and riser diagrams, and general layout in sufficient detail to allow coordination of chases, sleeves, duct spaces, etc., with structure and interior construction.
- o Power plant design shall provide a schematic flow diagram of all piping systems which will note each piece of equipment including all necessary controls, and a floor plan indicating the location of each piece of equipment.
- o Power plant and general exhaust designs shall comply with all requirements of the Air Use Management Bureau of the Department of Public Health, and all applicable building codes and agency regulations.

7) Electrical Drawings

- o All service connections and electrical equipment (panels, transformers and switch gear) shall be located on the drawings.
- o Lighting shall be indicated as to type, location, switching, and intensities in foot candles for each space, room, or typical space or room.
- o All service for special purposes shall be located and indicated.
- o Single line diagram of service entrance, main switch gear and distribution panels showing size of conductors and conduits.
- o Layout of service entrance and distribution feeders in sufficient detail to allow design coordination with structure, interior construction, and HVAC equipment.

- o Electric power and lighting layout for typical cell or bedroom.

- o Single line diagrams and general layout showing location of consoles, panels, fixtures, devices, and main feeders for:

- Fire alarm systems
- Electro-mechanical security door system
- Telephone system
- Master TV antenna system
- Intercom/paging system
- Any other electrical systems

2. Design Development Specifications

- a. Specifications shall consist of a comprehensive description of scope of the project and materials and equipment to be used in sufficient detail to allow preparation of preliminary construction order lists, especially for critical long-lead items. This shall expand upon the specifications submitted with the proposal as necessary.

- b. The following is the minimum checklist of items that should be covered:

- 1) Site work: Clearing; drives, walks, parking areas; fences; excavation; backfill; planting.
- 2) Footings: on earth; rock; piles; caisson, proposed bearing pressures; boring logs; reason for adopting the system proposed.
- 3) Foundation walls: type of concrete; reinforcing; type and extent of waterproofing.
- 4) Footing drains: type; disposal of drainage.
- 5) Exterior walls, superstructure: type; materials; brick type and coursing; back-up material; dampproofing; material and extent; special features.
- 6) Roofs: types; vapor barrier; insulation; flashing; materials.
- 7) Flashings: general types; materials; weights; where each type is to be used.
- 8) Sheet metal: gutters; leaders; other uses; except flashing.
- 9) Windows: general types; materials; section weights; sub-frames; finish; glazing; screens.

public utility; overhead or underground; transformers, type and location; types of conduit and wiring; fire alarm, telephone; public address; emergency lighting and wiring; emergency or other generators; special features, including Master TV, security systems.

- 27) Elevators and dumbwaiters: capacity; speed; travel in feet; landings; operation; controls; platform sizes; machine type and location; car and entrance finishes; signals, electrical data.
- 28) Cabinet and casework: types and materials
- 29) Food service equipment: types and materials.
- 30) Other built-in equipment: types and materials.
- 31) Special features.
- 32) Correctional/security equipment

3. Design Development Site Investigation, Calculations

a. Provide a complete site and soils investigation as required to supplement that given in the RFP as follows: an independent soils and foundation report, including logs of exploration locations, and additional soil borings, testing, and investigation, as required, shall be furnished with the first design submittal by the DBT to whom this Contract is awarded, at no additional cost to DCPO. This report shall be prepared by a registered civil engineer experienced in soil mechanics and shall certify to the adequacy of the soil and foundation aspects of the design, including, but not limited to:

- 1) Earthwork construction
- 2) Cut and fill slopes
- 3) Streets
- 4) Surface and subsurface drainage
- 5) Erosion and siltation prevention (during and after construction)
- 6) Foundation stability
- 7) Settlement or heave
- 8) Soil percolation

b. Provide engineering analysis and/or calculations prepared by professional engineers as required to support the design development drawings and specifications, including, but not limited to:

- 1) Site work analysis: calculations for
 - o Runoff and storm drainage
 - o Earthwork
 - o Pavement design (if required)

- 10) Doors, exterior and interior: types and thicknesses.
- 11) Steps, exterior: including platforms and landings, materials.

12) Stairs, interior: including platforms, landings, walls; materials and finishes.

13) Framing: describe system adopted.

14) Partitions: materials; thicknesses; finishes.

15) Furring, lathing, plastering: materials and location.

16) Insulation, thermal: types; thicknesses and location.

17) Acoustical treatment: types; thicknesses, methods of application and location.

18) Interior finishes: materials for floors, walls, bases, wainscots, trim, ceilings; ceiling heights.

19) Water supply: source; location of main to which connection will be made; type of pipe for service main; load requirements, load factor, and pressures.

20) Sanitary sewers: describe sewage disposal system; pipe and other materials.

21) Storm sewers: describe storm drainage disposal system (Institution or local facility); pipe and other materials.

22) Gas: main owned by whom; material; size; location.

23) Plumbing: enumerate systems such as supplies, rain water, soil, wastes, vents, hot water, cold water, gas, sprinklers identifying pumps, alarms, heads, valves and trim, main source of supply; materials for each, water heaters, pumps, fixture quality, all special features.

24) Fire protection/sprinklers: enumerate main source of supply systems, identifying sprinkler heads, alarms, pumps, and all special features.

25) Heating, ventilating, and air conditioning: type of power plant; type and capacity of boilers and cooling equipment; fuel; grade of oil; type of burners; fuel storage; heaters; feed water pumps and heaters; type of heating medium; supply and return piping; radiation; unit heaters, radiant heating; air conditioning; ventilation and exhaust; tie-ins to electrical; special features.

26) Electric work: service connection, location, institution or

D. Design-Build Working Documents

Once the DBT has submitted design development documents, DCPO will accept the submission of working documents, detailed working drawings, specifications, and calculations, for major phases of construction. The DBT need not wait for design development documents to be accepted to prepare and submit working documents. For example, the DBT could submit working documents for foundation and site work along with the design development submission. DCPO, however, must accept the design development submission prior to acceptance of any working documents. Although it is preferred that these submissions be limited to the fewest possible separate submittals in order to minimize piecemeal reviews and potential coordination errors, partial, phased submission of different portions of the project will be allowed in order to expedite construction. However, it is emphasized that the responsibility for maintaining an integrated and coordinated overall design shall remain with the contractor and his designers.

During the working document phase, DCPO project engineers will continue to meet at least weekly or as necessary with the design-build team to ensure smooth project coordination. Upon submission of documents, DCPO project management will review and accept submissions or reject the documents and request resubmission. Submissions must be stamped by the design-build team's licensed architects and engineers, bear the approval stamp of the Department of Public Safety, the State Examiner of Plumbers and Gas Fitters, and be sufficiently detailed and complete to provide the basis for construction as judged by DCPO's project management staff. Specific requirements for working drawings are covered on the following pages.

Working document submittals made prior to design development acceptance are made at the risk of possible rejection if the previous submittals are rejected. The Office will make reasonable effort to ensure good communication and timely review in order to minimize such problems, but it is incumbent on the DBT and its designers to thoroughly check and coordinate design work, especially for phased design submissions.

Acceptance of working documents will constitute Notice to Proceed with construction for the work covered by the submission, subject to construction submittal requirements.

- 2) Foundation calculations
- 3) Structural calculations
- 4) Plumbing design calculation
 - o Water supply systems
 - o Sprinkler system (method of design)
 - o Waste and soil piping, including building sewer, ejectors, etc.
 - o Roof drainage
- 5) Fire protection/sprinklers: design calculations and method of design
- 6) HVAC design calculations
 - o Heating and cooling loads
 - o Equipment sizing
 - o Duct work sizing
 - o Piping sizing
 - o Equipment sizing
- 7) Electrical system analysis:
 - o Power system
 - o Emergency power system
 - o Lighting calculations
 - o Other systems analysis
 - Security doors
 - Fire alarm
 - Telephone
 - MTVA
 - Paging/intercom
 - Other special electrical systems

Working Drawings

Working drawings shall include drawings as described in Section Three, Contract under Phase 2--Construction Documents, and further described as follows:

- a. Approval Stamps
 - 1) One set of working drawings shall be stamped "APPROVED" by the Supervisor of Plans, Department of Public Safety, for all state projects.
 - 2) One set of working plumbing drawings and specifications shall be stamped approved by the State Examiner of Plumbers and Gas Fitters and shall be bound in the set with the Architectural Drawings approved by the Supervisor of Plans.
 - 3) The same set of working drawings and specifications shall have the approval stamp of all other State or Federal agencies having jurisdiction over certain types of building requirements as directed by DCPO.
 - 4) Any drawings revised after being stamped shall be replaced by prints of the revised drawings similarly stamped.
- b. Information on the appropriate drawings shall be furnished as follows:
 - 1) A scale plus a key plan adjacent to the title box on all drawings showing section details, when the floor plan to which the section details apply is on another sheet. The key plan shall show clearly where each section applies to the related floor plan, and the drawing number of the sheet showing the floor plan.
 - 2) Legends of materials, symbols and abbreviations for each classification of plans.
 - 3) Drawing sheets shall be 30" x 42" formatted and with title blocks and cover sheets as shown in attached samples.
- c. The date to be inserted in the title box of all working drawings shall be the date on which the drawings are approved on the title sheet of the set. The date shall be inserted on the tracings by the Designer immediately after the receipt of the approved drawings.
 - 1) The Designer shall insert progress dates above the title box to identify drawings prior to approval. These shall be erased when the approval date is inserted.
 - 2) The revision box is intended for use in the event of an

- d. approved revision after the final approval date and for "as built" revisions. The Designer shall insert no other dates in this space.
 - d. Color-coded overlay coordination drawings shall be submitted to the Office with working plans and specifications (C-1). These drawings shall show all Mechanical and Electrical disciplines superimposed over the Architectural/Structural plans.
 - e. Site drawings shall show the following:
 - 1) Layout and location of all proposed work including buildings, structures, retaining walls, and other site improvements with details.
 - f. Architectural drawings shall show the following:
 - 1) Detailed demolition plans of existing structures.
 - 2) Floor plans of each floor, with room and corridor dimensions, wall thicknesses, column locations, floor elevations, door and window designations and schedules.
 - 3) Room finish schedules clearly designating types of materials and limits. Abbreviations may be used to indicate the materials.
 - 4) All rooms and corridors shall be numbered in accordance with the following system: numbering of outside rooms shall commence at the upper left-hand corner of the drawing and proceed clockwise. Numbering of interior rooms and corridors shall commence at the left-hand end of the drawings. In projects involving alterations of existing buildings the existing room numbers shall be used. Designers should use DCPO-approved standard numbering system for all documents.
 - 5) Roof plan showing openings, drainage, pitch, expansion joints, and all projections, including equipment.
 - 6) Key plans on all floor plans and section drawings.
 - 7) Reflected ceiling plans.
 - 8) Legend of materials, abbreviations, and symbols.
 - 9) Wall sections indicating dimensions, flashing, anchorage, reinforcing, coursing, and other details showing all conditions.
 - 10) Exterior and interior elevations and cross-sections including floor to ceiling heights. Designate all items of material.
 - 11) Details for roofing, flashing, insulation, windows, doors,

entrances, interior and exterior walls, expansion control of construction joints, waterstops, stairs, handrails, millwork, and built-in equipment.

8. Structural drawings shall show the following:

- 1) Boring plans with dates, water level, and bottom grades of footings and slabs plotted.
- 2) Foundation plan with bottom grades showing layout of all footings, walls, slabs on grade, including reinforcing, grade beams, and columns; include design soil bearing pressures and live loads for each area.
- 3) Floor and roof plans of structural systems, including framing, grades of finished floors and depressed areas, with locations and dimensions for all openings. Also indicate design floor loads.
- 4) Complete foundation wall elevation and sections, with reinforcing, indicating location, dimensions, and grades for all footings, steps, and wall openings.
- 5) Complete details and sections with dimensions for all construction including expansion and construction joints, reinforcing and other embedded items.
- 6) Schedules (with dimensions) for all lintels, beams, joists, and columns.
- 7) Unless detailed on the drawings, the following information shall appear in the general notes, Sheet S-1: Class and 28-day strength of concrete for each portion. Structural steel and concrete reinforcing design stresses for each type of structural member. Concrete cover for each type of structural member. Shrinkage and temperature steel requirements. Reinforcing laps for main reinforcing and temperature steel. Bendpoint, cut off, and hook locations for all members. Minimum beam and lintel bearing. Reinforcing steel fabrication shall be in accordance with most recent ACI "Manual of Standard Practice for Detailing Reinforced Concrete." Structural steel fabrication shall be in accordance with the AISC "Manual of Steel Construction."
- 8) Roof structural systems shall be designed to provide for a minimum of 1/4 inch per foot pitch to roof drains.

h. Plumbing drawings shall show the following:

- 1) All work to be done by the plumbing sub-contractor, which includes all water, gas, sanitary and storm wastes, and accessories thereof, whether the pipe lines are metallic or non-metallic. Foundation drain lines are the work of the DBT

and are not to be shown on the plumbing drawings. Site utilities shall be shown on site drawings.

- 2) Plumbing drawings other than site work shall not be combined on the same sheets with the heating and ventilating, electrical, sprinklers, or other drawings except with the prior approval of the DCPO project manager.
- 3) Every plumbing fixture shall be trapped and every trap shall be vented. Floor drains are fixtures. Show grease traps for kitchen waste.
- 4) Water and gas supply sources, storm, and sanitary discharge mains.
- 5) All piping shall be carefully sized and all sizes shall be shown on plans and riser diagrams. Indicate all directions of flow and pitch on piping.
- 6) All accessories, valves, fixtures including all drinking fountains, and all necessary access panels, identified as to type and size.
- 7) Plumbing legend and/or graphical symbols shall be shown on first sheet of the plumbing drawings and shall be in accordance with the American Standards Association (ASA).
- 8) Plumbing riser diagram for structures two or more stories in height above ground level.
- 9) Domestic water-booster pumps, boiler feed water, meter location, hose bibs.
- 10) Hot water storage tanks, mixers, piping, material, hanger details.
- 11) Backflow preventor in accordance with requirements of State Plumbing Code and Department of Public Health and DEQE.
- 12) Cleanouts in accordance with the Mass. State Plumbing Code.
- 13) Fire protection systems. (This can be a separate division and a separate sub-contract.)
Sprinkler work shall be shown on a separate drawing.

j. Heating, ventilating, and air conditioning drawings shall show the following:

- 1) All work to be done by the heating, ventilating, and air-conditioning sub-contractor. Site utilities shall be shown on site drawings.
- 2) Heating, ventilating, and air conditioning drawings other than

site work shall not be combined on the same sheets with plumbing, electrical, or other drawings.

- 3) All piping and ductwork systems shall be located and sized.
- 4) Riser diagrams of piping and duct systems with sizes noted thereon. All systems shall be sized at all reductions and branches.
- 5) Indicate all directions of flow and pitch on piping, and direction of flow, volumes, and velocities for duct systems.
- 6) All large items of equipment shall have sufficient servicing and/or replacement space indicated on drawings.
- 7) All equipment accessories, valves, and fixtures, with all necessary access panels identified as to type and size. Access panels, where required for access to valves and dampers, etc., are to be shown on drawings.
- 8) Cooling system pumps, chillers, cooling towers, air handling units, ductwork system and dampers, fan details, temperature control system, air and hydronic balancing, and schedules.
- 9) Cooling tower design, if applicable, shall be completely delineated on the drawings showing site location, elevations, and floor plan of equipment layout and typical flow diagram as related to the total HVAC system.
- 10) Utility tunnels, if required. Designer is to note the need for adequate ventilation and lighting.
- 11) All fire dampers on drawings as required by code. Show access panels to be required. Location of fire dampers to be in accordance with NFPA Code 90A, latest edition.

j. Electrical drawings shall show the following:

- 1) All work to be done by the electrical sub-contractor. Site utilities shall be shown on site drawings.
- 2) Electrical drawings other than site work shall not be combined on the same sheets with plumbing, heating, and ventilating, or other drawings.
- 3) General arrangement: Outline layout of each floor (unless shown on architectural drawings in the same set); typical sections through the structure, floor heights and elevations, and type of construction, including concrete pads.
- 4) Interior lighting system: Type of wiring; light fixture schedule; location of all fixtures, receptacle and switch outlets; types, locations, and mounting heights of all fixtures; sizes and types of all lamps; conduits; all other essential

special detail; riser diagrams. Show details and indicate method of supporting electrical fixtures and conduits. Designer to specify that all electric lighting fixtures be supported from the building structure, independent of ducts, pipes, ceilings, and their supporting structure.

- 5) Power system: Locations, types, and method of control for all motors, heaters and appliances; type, size, and location of all controllers, starters, thermostats, and other control devices; branch circuit and control wiring; sizes, types, and locations of all panels; sizes of feeder conductors and conduits; all other essential special detail; riser diagrams. Show details and indicate method of supporting electrical conduit.
- 6) Signal systems: Locations and types of all outlets and equipment; service connections; wiring diagrams; all other essential detail.
- 7) Services: Location and details of all services, whether overhead or underground; feeder sizes; plans and elevations of switchgear and transformers; metering arrangements; service switchboard showing arrangement; wiring and ground fault diagram; bus duct.
- 8) Generator and sub-stations: Location, size, method of connecting and protecting of all generators, transformers, exciters, motor generators, switch gear, and associated equipment; current characteristics and equipment capacities: Indicate connections by means of one line and wiring diagrams; schedule all major items of equipment and all instruments.
- 9) Underground work: Manhole sizes and locations: number size and location of ducts; locations, sizes and types of cables; method of cable support and fireproofing; duct line profile, one line diagram of connections. Cast in place or one piece manholes are to be used.
- 10) Pole line work: Location, length, treatment, and class of poles; guying, crossarms; insulators, circuiting; transformers; protective and switching devices; lightning arresters; special structures; diagrams, current characteristics; grounding.
- 11) Site lighting: Location, size, and types of transformers, luminaries, poles, light standards, cables, ducts, and manholes; details of control equipment; connection diagram.
- 12) Emergency system details including transfer switch, type of fuel.

- 13) One line diagram showing service, transformers, switch-boards, generators, distribution panels, branch circuit panels, feeders, and major equipment. Indicate load in KVA amperes, and available short circuit amperes at each transformer; switchboard, distribution panelboard, branch circuit panelboard, and at major pieces of equipment.

- 14) Riser diagrams shall be provided for all systems.

Working Specifications

Working specifications shall fully describe all general, product, and execution information for all work in the project. In general, the working specifications shall follow the CSI format described below, and shall expand and elaborate but remain consistent with specifications given in the RFP, proposal, and design development documents. In order to save time, and with the permission of the DCPO project manager, the DBT may provide a single manufacturer of the product intended to be used in lieu of a prescriptive type specification where appropriate. The specifications shall thoroughly describe all materials, installation, and any other requirements for each portion of work. However, the DBT will not be required to write the exhaustive specifications associated with conventionally bid public projects.

Specifications shall be provided in the form and arrangement specified by DCPO. The working specification format shall contain the following elements, grouping general categories of related information:

Part 1 - General	Part 2 - Products	Part 3 - Execution
Description	Materials	Inspection
Quality Assurance	Mixes	Preparation
Submittals	Fabrication and Manufacture	Installation/ Application
Product Delivery, Storage and Handling		Performance
Job Conditions		Field Quality Control
Alternatives		Adjust and Clean Schedules
Guarantee		

E. Construction Phase

During construction, DCPO project management staff will continue to meet regularly with the DBT, at least weekly, but more often if required. The project engineer will be responsible for coordination between the DCPO main and field offices and with the main office of the Department of Correction. The resident engineer will provide on-site field inspection and will coordinate with DOC personnel at each site.

The DBT will provide shop drawings, project data, and samples in a DCPO-approved format as required by the working documents and/or as requested by the project manager. The contractor/construction group will prepare submittals, coordinating with sub-contractors and suppliers as necessary. Shop drawings should be approved by the architect or engineer of record. The DCPO project manager will review and accept or reject submittals for revision and resubmission. DBTs must maintain and update a submittal log and coordinate and revise as necessary all shop drawings, product data, and sample submittal requirements with working drawings and specifications. Acceptance constitutes a Notice to Proceed with fabrication, shipping, and installation.

Testing and field quality control will be done according to the standards outlined in the Technical Requirements, Division 1D.

DBTs should note that all facilities will remain fully operational during construction. Teams should plan and phase construction, planning in particular for special security requirements at MCI Concord, minimum disruption of facilities in general, the completion and occupancy of new facilities in general, and the completion and occupancy of new construction at SMPRC and BSCC prior to the start of renovation.

Note: Builders should allow 30 days from the acceptance of new work at BSCC and SMPRC to allow existing portions to be vacated for renovation.

Shop Drawings

- Present in a clear and thorough manner. Title each drawing with Project and Contract name and number; identify each element of drawings by reference to sheet number and detail schedule, or room number of Contract Documents.
- Identify field dimensions; show relation to adjacent or critical features of work or products.
- Minimum Sheet Size: 8-1/2 x 11 inches.

Product Data

- a. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls, component parts; finishes; dimensions; and required clearances.
- b. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- c. Provide manufacturer's preparation, assembly, and installation instructions.

Samples

- a. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures, and patterns, and architect's recommendation for owner selection.
- b. Submit samples to illustrate functional characteristics of products, including parts and attachments.
- c. Approved samples which may be used in the work are indicated in the Specification section.
- d. Label each sample with identification required for transmittal letter.
- e. Provide field samples of finishes at the project, at location acceptable to DCPO, as required by individual Specifications Section. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

Design-Build Team Review

- a. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
- b. Coordinate submittals with requirements of work and of Contract Documents.
- c. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Contract Documents. Notify DCPO in writing at time of submittal of any deviations from requirements of Contract Documents.

d. All submittals shall be reviewed, approved, signed, and stamped by the DBTs Mass. registered architect or professional engineer prior to submittal to DCPO.

e. Do not fabricate products or begin work that requires submittals until return of submittal with designer and DCPO acceptance.

Office Review and Acceptance

The Office shall review all submittals as promptly as possible. DBTs should allow up to seven days for Office reviews. Upon review, the Office shall return the submittal as "accepted," "accepted as noted," or "rejected: revise and resubmit." Acceptance shall constitute Notice to Proceed with fabrication, shipping, and installation subject to other quality control requirements which may apply.

Acceptance of a submittal does not relieve the DBT or its designers of full responsibility or liability.

Resubmission Requirements

a. Make any corrections or changes in the submittals required by the Office and resubmit until approved.

b. Shop Drawings and Product Data:

- 1) Revise initial drawings or data, and resubmit as specified for the initial submittal.
- 2) Indicate any changes which have been made other than those requested by the Office.
- c. Samples: Submit new samples as required for initial submittal.

Distribution

a. Distribute reproductions of Shop Drawings and copies of Product Data which carry the Architect/Engineer's stamp of approval and DCPO acceptance to:

- 1) Job site file
- 2) Record Documents file
- 3) Other affected contractors
- 4) Subcontractors
- 5) Material suppliers

b. Distribute samples which carry the Architect/Engineer's stamp of approval as directed by DCPO.

Maintenance of Documents and Samples

a. The DBT shall obtain from DCPO copies of the Contract Documents for the team and for each sub-contractor for Record Mark-Ups.

b. In addition to requirements in the General Conditions, maintain at the site for DCPO one record copy of:

- 1) Contract Drawings
- 2) Specifications
- 3) Addenda
- 4) Change Orders and other modifications to the Contract
- 5) Reviewed shop drawings, product data, and samples
- 6) Field test records
- 7) Inspection certificates
- 8) Manufacturer's certificates

c. Store Record Documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.

d. Label and file Record Documents and samples in accordance with Section number listings in the Technical Requirements section. Label each document "PROJECT RECORD" in neat, large, printed letters.

e. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.

f. It is imperative that "as-built" documents be maintained up to date throughout construction and not just at the end of the job. Failure to maintain "as-builts" may be grounds for withholding progress payments.

Recording

a. Record information on a set of blue line opaque drawings, and in a copy of the Specifications.

b. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.

c. Record information concurrently with construction progress. Information will be checked at weekly meetings. Do not conceal any work until required information is recorded.

d. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:

- 1) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2) Measured locations of external and internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.

3) Field changes of dimension and detail.

4) Changes made by modifications.

5) Details not on original Contract Drawings.

6) References to related shop drawings and modifications.

7) Valve numbers for all systems

8) Record drawings shall be of reproducible type

e. Specifications: Legibly mark each item to record actual construction, including:

1) Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.

2) Changes made by addenda and modifications.

f. Other Documents: Maintain manufacturer's certifications and inspection certifications, and those required by individual Specifications Sections.

Submittals

a. At the completion of the Contract, each listed sub-contractor shall submit to the DBT a complete set of record drawings showing all "as-built" corrections and value numbers. After checking the above drawings, the DBT shall certify that they are complete and correct and shall submit the record drawings to the Office.

b. Transmit with cover letter in duplicate, listing:

- 1) Date
- 2) Project title and number.
- 3) DBT's name, address, and telephone number.
- 4) Number and title of each Record Document.
- 5) Signature of Contractor or authorized representative.
- 6) Signature of Mass. register A/E.

F. Project and Quality Control

Project Control

During document preparation and during construction, the design-build team shall develop, maintain, and provide to DCPO a detailed critical path schedule defining:

- o detailed activities, broken down by area of work, trades, etc., and showing duration, responsibility, and resource requirements;
- o precedence relationship between activities; and
- o planned and actual starts of activities.

During design and construction, the schedule shall be updated monthly, more frequently if necessary for certain critical areas. The schedule shall be revised as necessary to reflect changes in precedence or new activities, or to catch up in case of delay.

In the proposal, DBTs will provide a proposed price schedule. During design-build document preparation, the team will develop a schedule of prices to correlate with the time schedule and work breakdown structure. The schedule of prices will be the basis of progress payments, excessive front loading will not be acceptable. Within 14 days of contract execution, the DBT should also generate and provide to DCPO a time/cost "S curve" for early, late, and actual activity starts and completion.

Quality Control

After award of contract, the DBT shall refine the detailed quality control plan submitted with the proposal, further identifying quality submissions, quality testing, field inspection, which apply to conventional DCPO projects will also apply.

Quality will be controlled by the DBT and assured by DCPO. Quality will not be compromised for the expeditious completion of the projects.

Relationship to Review Process and Administration

The DBT has primary review responsibility to ensure compliance with all codes, standards, and requirements of the RFP and proposal. The DBT shall have its licensed professional A/E review, approve, sign, and stamp all submissions. The designer of record is the A/E who stamps the documents and has full legal, ethical, and professional responsibility and liability. The DBT has full responsibility and liability for all construction errors and omissions. DCPO will not accept change orders.

Sections.

c. Manual for Equipment and Systems

- 1) Each item of equipment and each system: Include description of unit or system and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - 2) Panelboard circuit directories: Provide electrical service characteristics, controls, and communications.
 - 3) Include as-installed color-coded wiring diagrams.
 - 4) Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down and emergency instructions. Include summer, winter, and any special operating instructions.
 - 5) Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 6) Provide servicing and lubrication schedule, and list of lubricants required.
 - 7) Include manufacturer's printed operation and maintenance instructions.
 - 8) Include sequence of operation by controls manufacturer.
 - 9) Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - 10) Provide as-installed control diagrams by controls manufacturer.
 - 11) Provide DBT's coordination drawings, with installed color-coded piping diagrams.
 - 12) Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - 13) Additional Requirements: As specified in individual Specifications Sections.
- #### d. Instruction of Owner Personnel
- 1) Before final inspection, instruct DOC's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.

- 2) Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
 - 3) Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.
- e. Submittals
- 1) Submit three (3) copies of draft of operations and maintenance manuals twenty (20) days prior to completion of work at each facility.
 - 2) Submit five (5) copies of completed volumes in final form ten (10) days prior to final inspection of work at each facility.
 - 3) Amend this final volume as necessary during subsequent phases.

Warranties, Bonds, and Guarantees

a. Form of Submittals

- 1) Bind in commercial quality 8-1/2 x 11-inch three-ring hard back side binders, with cleanable plastic covers.
- 2) Label cover of each binder with typed or printed title "WARRANTIES AND BONDS," with title of Project; name; address and telephone numbers of DBT; and name of responsible principal.
- 3) Table of Contents: Neatly typed, in the sequence of the Table of Contents of the project manual, with each item identified with the number and title of the Specification Section in which specified, and the name of the product or work item.
- 4) Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List sub-contractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

b. Preparation of Submittal

- 1) Obtain warranties and bonds, executed in duplicate by responsible sub-contractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work. Except for items put into use with DCPO's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.

2) Verify that documents are in proper form, contain full information, and are notarized.

3) Co-execute submittals when required.

4) Retain warranties and bonds until time specified for submittal.

c. Time of Submittals

Submit warranties and bonds as a part of the Operation and Maintenance Data as scheduled in Section 1P.

Record Drawings

a. Record drawings on reproducible mylar shall be submitted for review prior to final approval of the project.

R F P
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II

Design and Program Data

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Introduction

This project has been developed in response to the long-standing need of the Commonwealth's Department of Correction for a secure reception classification center. To be located on the grounds of MCI Concord, this facility will provide space and programs for reception, classification and assignment decision making for inmates newly admitted to the system and for others in need of security reclassification.

The selected site is slightly larger than two acres and is immediately east of the facility chapel. This site satisfies size and terrain criteria as well as lending itself to the smooth operation of the new facility vis-a-vis the requirements of the existing operation.

The program for the completed facility includes medium/maximum security housing for 240 residents (Phase I) plus all necessary spaces to administer classification and reception activities (Phase II, future construction which is not part of this project). The facility is to be "semi-autonomous," in that utilities, kitchen, laundry and chapel will be shared with the host facility.

Because of funding limits, the project is divided into two Phases for implementation: Phase I will provide only for housing and dayroom space - approximately 37,500 gross square feet of space. Upon completion of Phase I and prior to construction of Phase II, the occupants of the Center will utilize the existing facility for classification services, medical services, visiting, recreation and chapel.

Phase II will consist of approximately 37,500 gross square feet of program, administrative and support space for classification and reception-related activities.

The first phase provides housing for 240 inmates with basic sanitary and dayroom amenities as well as attendant security space requirements. It is acknowledged that Phase I strives for maximum efficiency in the provisions of standard-compliant housing units only. This design-build RFP covers only Phase I.

Phase II will complement the project by providing all necessary administrative, programmatic and support space for the efficient and effective delivery of reception/classification activities.

Project History and Background

A reception/classification center is an essential component of an effective correctional system. The primary function of a center is to assess the needs of incoming inmates for programmatic and security requirements and to issue recommendations for placement in the system based on a thorough individualized assessment process. In addition, such a facility is needed for the placement of inmates who must be reassessed for a change in custodial status.

The reception/classification center provides the setting for the diagnostic and decision-making phase of processing. During this phase, an inmate's mental, physical, and psychological condition is assessed and considered together with his dangerousness and tendency to attempt escape. The Center must provide these services within a secure perimeter since the residents' custodial requirements are largely unknown. The facility must therefore make possible the segregation of the individuals from each other (through individual cells and manageably-sized housing units) as well as from the longer-term facility residents, about whom custodial requirements and interaction capabilities are known. Clearly, the effectiveness of the entire system is directly related to the validity and accuracy of placement decisions made concerning each inmate.

Because of the overcrowding and density of populations in the Commonwealth's correctional facilities, the need for a secure reception classification center of sufficient size to accommodate the system's incoming inmates has long been felt and identified as a high priority. With the availability of funds to initiate Phase I of this project, the Commonwealth has realized both a long-standing need and an essential system component.

Existing Conditions

The site is basically flat and level, with the exception of some partially exposed stone foundations from a previous building. There are also known to be some sub-surface utility runs within the area, and investigations have been undertaken to determine the locations and extents of these runs and the previous foundations. The same investigations also produced a soils investigation report, which will be used by the civil/structural engineer of the selected DBT in proposed foundations design.

As part of the study, Vitetta Group contracted with the Massachusetts engineering firm of Cleverdon, Varney and Pike, Inc. to do a preliminary study of the existing facility systems to determine if these systems could support the additional services required by the new Center. Their report appears on the following pages. The conclusion, as stated in the report, is that modifications to the existing systems will be necessary before new construction is undertaken.

A new water distribution system is currently planned to be on line early in 1987 and the drawings for that contract are available for review by each DBT in the proposers' reference room.

It must be understood that soils investigations and utilities reports contained or noted in this study are preliminary. The selected DBT should therefore undertake more comprehensive investigations in these areas before proceeding with final design.

It should be understood that utility lines, abandoned granite foundations and an abandoned boiler room are known to exist and that it is the DBT's responsibility to identify and locate these conditions to the degree practicable for the development of a design proposal. Please refer to other sections of the RFP relating to unanticipated site conditions.

Utilities Description

MCI Concord is made up of a group of buildings heated from a central boiler plant. The facility has its own waste water treatment plant, and generates a portion of its own electricity with steam turbine generators. The boiler plant consists of three high pressure (350 psi), dual fuel boilers and three steam turbine generators. At this time, only one of the steam turbine generators is in operating condition.

The boiler plant runs at approximately 50% capacity during the winter. This includes the running of one steam turbine. The boiler load will increase if, as part of the future upgrading of the facility, additional generator capacity is added.

The waste water treatment plant is operating at approximately 25% above its design capacity. Under these conditions, it still meets the State

requirements for BOD count, but it is unable to meet the State requirements for solids. The peak capacity of the plant is being overloaded for a period of approximately 3-1/2 hours a day, Monday through Friday, when laundry is being done.

The buildings are heated with 15 psi steam that is distributed from a pressure-reducing station in the boiler room. Electricity is supplied at 4,160 volts from the main switchboard in the boiler plant. Both systems are distributed underground through a system accessible by manholes.

The water system for the entire site is under redesign at this time. The existing deteriorating 6-inch lines are proposed to be replaced with new 8-inch lines. The water has a high quantity of grit in it. Part of this is from the deteriorating pipes, and part of it is from the town water system.

Gas is used as an interruptible fuel source for the boilers and for cooking in the main kitchen. The other fuel for the boilers is No. 6 fuel oil.

Utilities Study

The following utilities serve MCI Concord:

Water: The facility obtains water from the Town of Concord at four meter locations. A total of 21,791,484 gallons of water have been used in a recent six-month period.

The metered water services supply the prison as well as State residences alongside the prison. These services are also believed to supply the farm, but this has not been confirmed.

Assuming an average inmate population of 725, the average daily consumption of water per inmate is 167 gallons. In the 1981-82 ASPE Datebook, it is estimated that a flow of 79 to 159 gallons per inmate per day is typical, and the average is about 119 gallons per day. The employees of the institution are estimated to consume 5 to 16 gallons per day, and the average is 11 gallons per day.

The waste water from the facility is treated at an on-site (tertiary) treatment facility. This facility is rated at an average flow of 162,000 gallons per day, but is now operating at an average flow of 200,000 gallons per day. It has a peak flow rating of 262 gallons per minute, but is actually operating at approximately 350 gallons per minute during a peak load that lasts approximately 3-1/2 hours (due to laundry). The plant treats the waste from the prison as well as from the residences and the farm.

The peak flow rates at the treatment plant occur when the laundry is in a washing cycle. The afternoon and evening meals can be noted on the flow charts (in the treatment plant) but they do not overload the system.

At this time, the design of a new water main system is underway. This system will replace all the exterior water piping within the walls with 8-inch pipe. The majority of the existing piping is 6-inch. This renovation, however, does not propose to replace any of the piping within the buildings. As a result of a survey and renovation of the building water systems, it is estimated that the system's life expectancy will be 20-plus years. The treatment plant, with its overloaded operation, will be a maintenance problem in a short time, and its life expectancy is less than five years unless the capacity of the plant is increased.

Gas: Natural gas is used for cooking in the main kitchen and for running the high-pressure steam boilers. The kitchen used 3,500 CCF for a recent six-month period. The boilers were run on gas for the period of July 1985 to November 1985 and consumed 663,500 CCF.

The kitchen gas load is approximately 0.023 CCF of gas per inmate day, and the boiler gas load is approximately 6.1 CCF of gas per inmate day. The gas distribution system seems to be in good working condition and is estimated to have a life expectancy of 20-plus years.

No. 6 Oil: The boilers are dual fuel and run on both natural gas and No. 6 fuel oil. 275,275 gallons of No. 6 fuel were purchased in a recent six-month period.

The boiler load is approximately 2.1 gallons per inmate per day.

There are three high-pressure steam boilers rated at 30,000 pounds per hour and running at 235 pounds pressure. The high pressure is used to supply the steam turbines that generate the electricity. The heating system in the prison is supplied with 15-pound steam through a reducing station in the boiler plant. Approximately 75% of the condensate is returned to the boilers. The heating distribution system consists of an underground piping system. The actual terminal heating is accomplished by radiators, convectors and fan-coil units.

The boiler system and the distribution system seem to be in good working order. With normal maintenance, it is estimated that the life of the system is 20-plus years.

Electricity: Electricity is purchased from Concord Municipal Light, as well as generated in the power plant. A total of 1,241,878 KWH was purchased from the Town of Concord during a seven-month period.

The purchased electricity is approximately 8.16 KW per inmate day.

There are three 600-KW steam turbine generators in the boiler plant. They are rated at 4,160 volts output. At the time of this report, only one of the three generators was in operation. Another generator is out for service, and the third generator is inoperable.

The operating generator is running in parallel with the Town of Concord municipal electrical service. The municipal service is rated to

supply a maximum load of 550 KW. The load in the facility fluctuates from a low of 350 KW to a high of 900 KW. The difference between the 550-KW municipal supply and the actual demand load is supplied from the steam turbine generator.

There is a load-shedding scheme that will drop out loads, such as the furniture shop (185 KW) in the event of municipal power failure or steam turbine failure. There is a 300-KW stand-by generator outside the boiler plant to provide power to the boiler plant in the case of a cold start condition.

The distribution system in the facility is at 4,160 volts through an underground ductbank and manhole system. There are transformer banks for each building. Some of the transformers have been tested and found to contain PCBs.

The electrical distribution system is in fair condition. The underground distribution system has an estimated life of five to ten years. The single turbine generator that is now running continuously and could fail at any time. Without at least one other unit in operating condition so that preventive maintenance can be accomplished on this unit, the failure of any component on the system will shut down the turbine.

MCI Concord - Phase I

The utilities required to support a 40,000 square foot building at MCI Concord are not presently available without modifications to the existing physical plant. It is assumed that the building would not increase the total population at the facility. The electrical capacity in the power plant is already at maximum capacity. The waste water treatment facility is overloaded for 3-1/2 hours a day. The new water distribution system should be in place by the time this building requires service and should be adequate to supply the additional load. The existing boiler capacity is adequate to support the new load that is estimated at 750 MBH.

The two areas that require modification are the electric generating plant and the waste water treatment plant.

A new 600-KW steam turbine generator shall be installed on the existing turbine foundation to supply the additional load. It must be compatible with the existing facility devices and equipment. This could double the generating capacity available. To protect the incoming service from the utility company, a load shedding scheme have to be incorporated in the new building and the existing system of load shedding will have to be modified.

The installation of three waste water holding tanks will reduce the peaks that now overload the plant and will extend the capacity of the existing plant. The installation of approximately 75,000 gallons of sewage storage tanks shall be included as part of this contract.

The holding tank system shall consist of three (3) 25,000 gallon septic tanks manifolded together. There shall be a pumping system to draw a suction from these tanks rated at the design capacity of the plant to transfer the waste water to the treatment plant. There shall also be trash screens to remove solid items from the system.

Operating Guidelines

The Department of Correction has designated the walled medium security facility MCI Concord as the reception/diagnostic/classification (RDC) center for the state correctional system. The design capacity of the facility is 274 beds (rated capacity of 255), but it currently houses over 700 inmates. The facility houses 87 inmates assigned to serve part of their sentences at MCI Concord; the balance are transient. The present facility serves both groups, integrating them with respect to their use of the available support and program space. The goal of the DOC is to create a semi-autonomous RDC center within the existing institution, separating classification inmates from the regular population. Through its overall capacity expansion program, the DOC also intends to reduce the occupancy of the facility to match the rated capacity.

Because of budget constraints, the expansion program will occur in two phases. Phase I will add 240 new permanent beds, day space, and related attendant security space. Phase II will add administrative, programmatic, and support space serving all of the reception, diagnostic, and classification functions necessary for the operation of Phase I and Phase II as a semi-autonomous unit within the institution. Prior to the completion of Phase II, the administrative, programmatic, and support functions will occur in existing buildings now used for those functions. This design-build contract is for Phase I only.

Although the host institution is classified as medium security, the RDC Center will operate as a high-medium/maximum security unit, corresponding to a level 5 in the Federal Bureau of Prisons system.

Inmates

Currently, MCI Concord classifies 33 new male commitments per week plus about 30 returns from lower custody, parole violators, returns from escape, and transfers from the counties or from out of state. The inmates remain in classification for four to six weeks. The following chart shows the classifications during 1985:

CATEGORY	PER YEAR	PER MONTH	PER WEEK
New Men (MCI Walpole)	1600 (1000)	135	33
Returns from Lower Custody	850	71	16
Parole Violators	420	35	8
Returns from Escape	210	18	4
County & Out of State	80	7	2
TOTAL	3160	266	63

Connections to the Host Institution - Phase I

Phase I will provide only housing and dayroom space. Before Phase II is completed, therefore, the Center will require programmatic and non-programmatic support from the host institution, as detailed below.

Orientation: Each week at regularly scheduled times, institutional orientation is conducted for all appropriate inmates admitted to the institution during the preceding one to two weeks. The Orientation Coordinator, in conjunction with the appropriate division heads, schedules staff members with expertise in service/procedural areas to make presentations during the orientation session.

Classification Service: These professional assessment and diagnostic activities will need to occur, as presently, in MCI Concord spaces such as Building B.

Upon arriving at the facility, all inmates are assigned a case worker. The case worker is responsible for preparing and presenting the case to the classification committee. The classification committee then hears the case and assesses the needs of the inmate. The time frame is roughly 14 to 28 days for an inmate to be classified.

Food Service: Upon completion of the housing units (Phase I) inmates will eat in the housing unit dayrooms at fixed tables. The food will be prepared in the D Building kitchen, as currently, and brought to the housing unit in carts.

Health Services: Until Phase II is complete, inmates will be required to use current MCI Concord health facilities, located in Building C. All medical services are provided by Goldberg Associates, which is under contract for four hours per day, five days a week, on call weekends and nights. Available staff are: two dentists, Monday through Friday; physician assistants/correction medical assistants on two shifts and on call the third shift; an X-Ray technician, Tuesday and Friday; a psychologist/psychiatric social worker or psychiatrist, Monday through Friday; a diet technician, once a month; and an optometrist on Tuesdays.

Library: The institution has a large, modern, well-equipped general and law library. Schedules are posted in the housing units and library services are available to all inmates regardless of their security or classification status. A professionally trained librarian supervises both the general and law libraries.

Recreation: Until the completion of Phase II, it will be necessary to accompany and supervise Center inmates in the existing facility recreation area, as schedules and staff permit. RDC inmates should be isolated visually from other inmates and visitors. Recreation functions are located in and behind Building H.

The institution offers touch football, league basketball, league field hockey, league softball, volleyball, paddleball, handball, bocci, horseshoes, soccer, and weightlifting. Movies are shown weekly to all

inmates. Bingo, board-games, cribbage, etc. are scheduled regularly.

Visiting: As with recreation, visiting will occur in current areas (e.g., Building B) until Phase II is complete. Visits are highly monitored by staff. Visitors are screened via a weapons detector pass-through, shakedown, and occasional cavity searches.

Visiting hours are as follows:

(A-L)

Saturday
9:00 a.m. - 11:00 a.m.
1:00 p.m. - 3:30 p.m.

Sunday
9:00 p.m. - 11:00 p.m.
6:30 p.m. - 9:00 p.m.

Tuesday & Thursday
1:00 p.m. - 3:30 p.m.

Wednesday & Friday
1:00 p.m. - 3:30 p.m.
6:30 p.m. - 9:00 p.m.

Holidays
9:00 a.m. - 11:00 a.m.
1:00 p.m. - 3:30 p.m.

(M-Z)

Saturday
9:00 a.m. - 11:00 a.m.
6:30 p.m. - 9:00 p.m.

Sunday
9:00 a.m. - 11:00 a.m.
1:00 p.m. - 3:30 p.m.

Tuesday & Thursday
1:00 p.m. - 3:30 p.m.
6:30 p.m. - 9:00 p.m.

Wednesday & Friday
1:00 p.m. - 3:30 p.m.

Holidays
9:00 a.m. - 11:00 a.m.
6:30 p.m. - 9:00 p.m.

Chapel: The chapel is located in Building K. Protestant Chaplaincy Programs include Sunday and Wednesday Chapel services with Bible studies, group discussions, and pastoral counseling offered every weekday. Catholic mass is held on Saturday evenings at 5:30 p.m. and counseling is available from the Catholic Chaplain during the week. A Jewish Chaplain visits with Jewish inmates regularly. Muslim religious services are held twice weekly in the chapel.

Security/Surveillance

The Center will operate according to the direct supervision model. There will be guard surveillance during the day, and guards will be on duty within the inmate day areas as well as in control stations separate from inmates. The daytime ratio of direct supervision officers to inmates will be 1:50. Guards will escort inmates outside the housing area. During off-peak hours and counts, the ratio of direct supervision officers to inmates will be 1:100. Staff checks will occur every 30 minutes, except more frequently with violent, mentally disturbed, suicidal, and bizarre-acting groups.

There will be electronic surveillance of hallways and perimeter doors.

Order is maintained through the incentive of the classification decision, the threat of a lock-in, and disciplinary segregation. Prisoners will have a negative perception of being housed in this high security space.

Staffing Levels

The May 1986 Study Report prepared by Vitetta Group presents a staffing plan and annual cost for the preferred alternative plan for the complete RDC center.

Design Guidelines

The DBT shall provide the design and construction services for the Phase I housing portion of a two-phased project within an existing high-medium security level facility at MCI Concord. Phase I should meet all current codes and standards for full ACA accreditation, be designed for seismic risk according to its locale, and composed of an appropriate type of construction for a 75-year public facility.

The DBT should refer to the RFP Section entitled Architectural Program for a complete listing of the areas and functions being requested. It should be understood that the design presented has been reviewed and accepted by DOC as a reasonable and efficient representation of their space requirements.

The Technical Requirements of the RFP describe how the Architectural Program could be built, and the level of quality expected by DCPO. The requirements listed will provide the standard of durability and the value against which alternate products and systems should be evaluated. Each DBT, however, has the option of presenting a different approach or construction system (for example, modular inmate rooms) that meets all the durability and quality requirements of the RFP and provides the Commonwealth with a wider margin of efficiency in construction, operations, aesthetics or cost.

It should be clearly understood that the solution and design proposal offered will be monitored by DCPO throughout the design and construction process. Although the cost of required testing, inspection and review will be borne by DCPO, the cost of redesign to meet the stated proposal criteria will be the responsibility of the DBT.

Post-construction evaluation studies will be conducted by DCPO to verify performance and it is imperative that the DBT Quality Control Plan be sensitive and effective in anticipating, monitoring and confirming that the proposed design has in fact been provided.

1. The DBT design solution should recognize and incorporate an understanding of the existing facility with respect to but not limited to the following:

- a. inmate circulation patterns to dining and other program areas
- b. visitor routes from the existing visiting area
- c. existing and planned Phase II improvements
- d. access of vehicles and personnel to and from the site
- e. nature and frequency of all vehicular deliveries, removals and service visits, especially to and from existing kitchen area.

Design Considerations

Operations

- o The facility should be designed according to a modified direct supervision model for high-medium security level facilities. Provide an enclosed counter type officer station for each housing unit.
- o The inmates of Phase I will be fed from the existing kitchen.
- o Medical needs of the inmates will be attended outside of Phase I.
- o Fire safety and exitways shall be provided during construction.
- o This medium security RDC operates with a single controlled point of access. Phase I inmates, however, will enter through the existing vehicular Sallyport and it is essential that the new control stations interconnect electronically with this location and the existing central control station for the site.

Future Design

- o The food service area in Phase II will have a re-heat kitchen for the inmate population of the RDC. Gas should not be used as a fuel source in either Phase I or Phase II.

Site and Building Envelope Design

- o Landscaping should consist of site grading, loaming and seeding only.
- o Limits of Construction: The DBT should provide a continuous opaque fence of 1/2" plywood 8'-0" high as construction fencing on the Contract Limit Lines (CLL). The plywood can be applied to the existing fence if the fence's location is consistent with the proposed design, with DCPO's approval. The plywood shall be removed at the end of the job and the existing fence restored to its original condition. Should DCPO require additional fencing to completely enclose the construction site, the fencing will be 12' high minimum, and solid to the height requested to prevent vision and the passage of contraband. If additional vehicular and pedestrian gates are required, they shall be installed with permanent locking devices. The location of this fence and new openings should be clearly indicated to DCPO prior to construction. The existing fence will remain after construction.
- o Pitched roof systems are preferred. All flat roof areas should have a slope of not less than 1/4" to the foot.
- o The height of the top of any window accessible to inmates, including housing units and excluding clerestory windows, should not exceed the height of the exterior perimeter security wall, which has a design height of 22 feet.

- o The completed Phase I design should include a chainlink enclosure. The existing fence on the site will be accepted to serve this purpose if it is restored to its original condition after construction and has the required vehicular and pedestrian gates located to serve the proposed design.
- o An exterior site lighting system is required to provide a minimum of 1.05 foot-candles of even illumination with a lamp color and distribution pattern that matches the existing system. All faces of exterior walls and walkways to other buildings require illumination.
- o The new fenestration and exterior materials should be compatible with the existing facility and contain openings no larger than 4-1/2".

Handicapped

- o A minimum of 2% of the inmate rooms should be handicapped/wheelchair accessible as should all areas accessible by the public and staff or as otherwise required by code. These inmate rooms should be equally distributed throughout the housing units.

Housing Units

- o There should be a separate control station location for each housing unit configured to permit a direct supervision officer-to-inmate ratio of not to exceed (NTE) 1:50 during the daytime operation and either a direct or indirect supervision officer location providing an officer-to-inmate ratio of NTE 1:100 during off-peak hours of operation and during counts.
- o Direct control and separate control stations should have a clear unobstructed frontal (90 degrees to the plane of the wall) view to all inmate room doors for 80% of the rooms and a clear, unobstructed obtuse (greater than 90 degrees) view to the remainder of the inmate room.
- o One housing module should be subdivided into smaller populations with an officer-to-inmate ratio NTE 1:25.
- o Elevation changes in day space floors should not create blind spots of sufficient size to prevent the high degree of inmate visibility required.

Type of Construction

- o Each housing unit and day space should be acoustically isolated from corridors and other housing units.
- o All inmate rooms shall have reinforced masonry partitions. The security level of corridor, day space, and housing unit walls can vary according to the fire rating, vision panel and security requirements and acoustic separation requested.

- o All exterior walls shall be insulated cavity wall construction with both wythes of masonry units or precast concrete.

Interiors

- o Ceiling heights in all inmate rooms should be a minimum of 8' - 0" and otherwise consistent with ACA and Massachusetts standards. All other spaces should vary in height according to the size, population and configuration of the rooms proposed.
- o All interior walls enclosing functional spaces, including corridors, offices, classrooms and day spaces, should have an average of 5% of their area composed of security-glazed vision panels in security frames positioned appropriately for view by standing individuals. This requirement is in addition to the security glazing requirements of control stations, exterior windows, and door vision panels.
- o Glazed areas should also be as generous as possible in each housing unit. Security glazed day space windows should be included in the proposed design solution. Each day space should have an inaccessible secure skylight or clerestory window to permit the infiltration of natural light, unless there is sufficient light entering from the day space windows. Sound-absorbing material should be used on a minimum of 80% of the day space ceiling area or equivalent surface area.

Fixed Furnishings

- o Fixed day space tables with fixed seating should be a variety of sizes to permit use by all inmates in groups of two, four, and six.

Utilities

- o Telephone locations should be coordinated through DCPO. Conduit with wires pulled will be required. All conduit should be run back to the central telephone room located in the basement of "A" Building on site. Conduit should be run into day spaces to accommodate the possibility of incorporating three payphones in the future.
- o No natural gas should be used as a fuel source for heating.
- o The new system should be tied into the existing steam system on site.
- o The new intercom and paging system should be interconnected with the existing site system.
- o A new fire alarm system is required and shall be integrated into the existing system for the remainder of the facility. The new building should be sprinklered.

Architectural Program

Codes and Standards

For detailed code applications refer to the technical requirements section on page 355. Special applications to MCI Concord include:

American Correctional Association, Standards for Adult Correctional Institutions

National Fire Protection Association Life Safety 101

U.S. Department of Justice, Fire Safety in Correctional Facilities

The architectural space program was established during meetings with representatives of DCPO, DOC, and MCI Concord staff, who conveyed to the study designers their proposed requirements. These included, among other criteria, the numbers and sizes of rooms and their locations with respect to the rest of the facility, as well as the finish materials preferred.

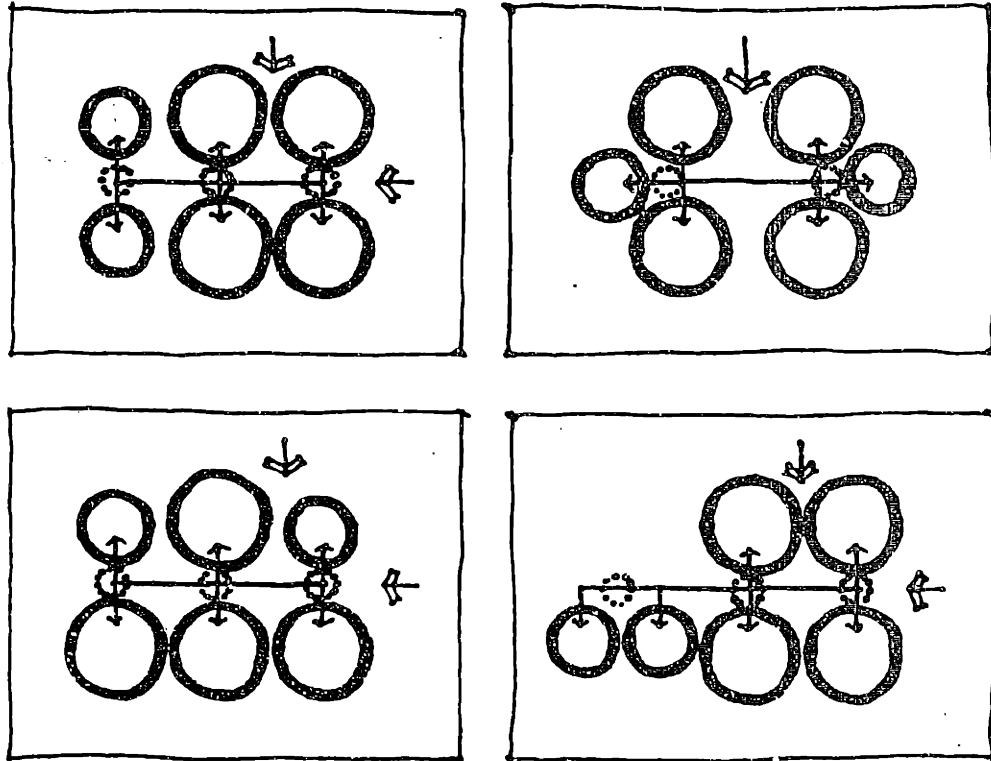
The triangular form of the Phase I housing units, as proposed in this study, is one that is currently favored by a large number of correctional personnel because it not only fulfills the personal needs of the inmates, but also provides a secure and easily administered environment.

The Phase II program building, because of the requirement that it interact to an extent with the existing facility, will be located as closely as possible to those existing buildings which will provide the support services required (kitchen, chapel, visitors' entrance, etc.).

The existing facility buildings are a mix of architectural styles, but are basically brick-faced, and the building in the study is conceived as a brick bearing-wall structure. Roofs are for the most part pitched, a form that is preferred by DCPO, and as well as being visually more acceptable than flat roofs, also permit the concealment of mechanical and other equipment.

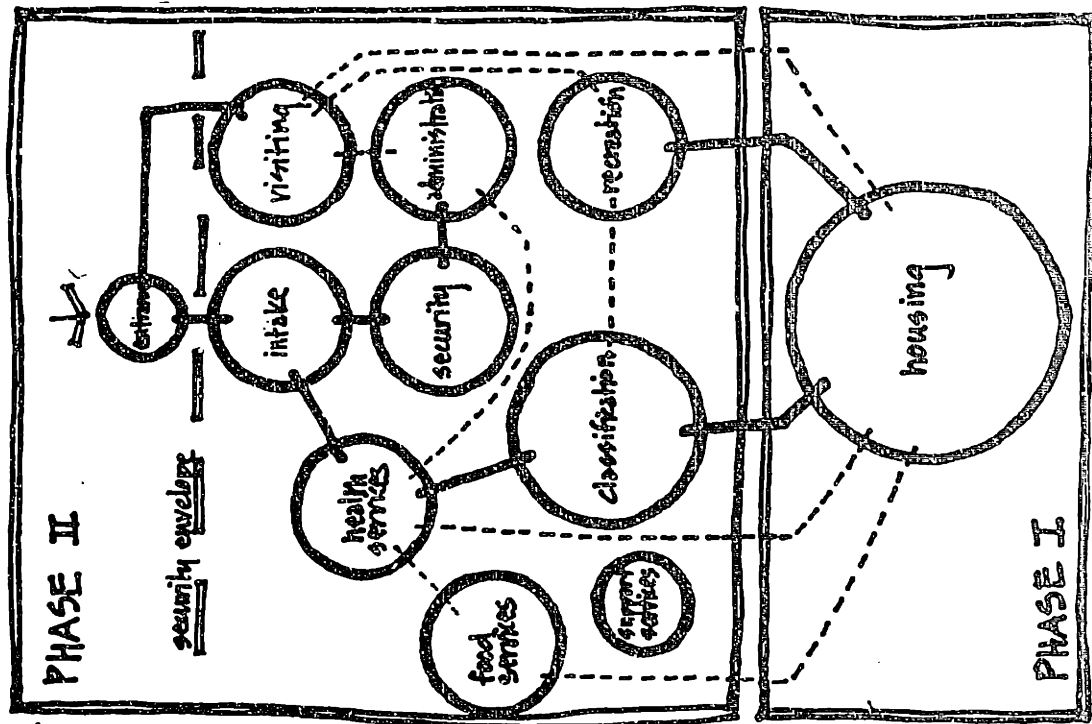
The height of the building, particularly the housing unit elements, should be kept to a minimum that it might be as unobtrusive as possible when viewed from outside the main facility, and so that the inmates not be able to see over the existing security walls from their cells.

POSSIBLE HOUSING UNIT CONFIGURATIONS



- 46 bed housing module
- 24 bed housing module
- remote station
- ↑ possible entrances

PHASE I & PHASE II - FUNCTIONAL RELATIONSHIP DIAGRAM



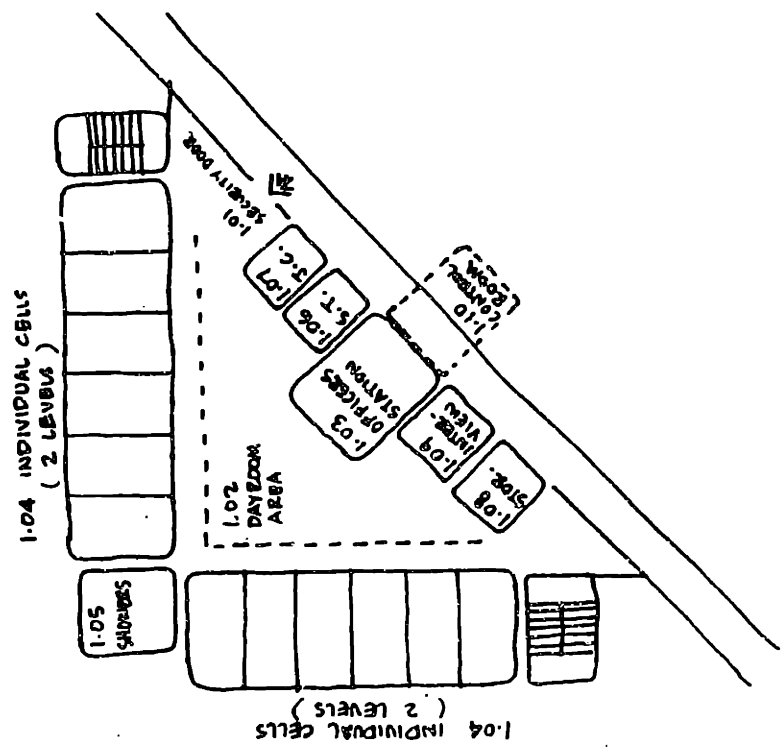
SUMMARY OF COMPONENT - PHASE I

	NSF	CONVERSION	GSF
01. Housing - 48-bed unit (4 @ 5520 nsf)	22088	1.33	29440
01. Housing - 24-bed unit (2 @ 2910 nsf)	5820	1.33	7740
02. Control Room (3 @ 150 nsf)	450	1.20	540
	<u>28350</u>	(1.33)	<u>37720</u>

COMPONENT/SPACE NSF

	48 Bed Unit NSF	24 Bed Unit NSF
1. HOUSING		
1.01 Security door	10	10
1.02 Dayroom area	1680	840
1.03 Officers' station	120	120
1.04 Individual cells (48)	3360	1680
1.05 Showers	160	80
1.06 Staff toilet	40	40
1.07 Janitor's closet	30	30
1.08 Storage room	60	40
1.09 Interview room	60	60
	<u>5520</u>	<u>2910</u>

**COMPONENT 1: HOUSING
FUNCTIONAL RELATIONSHIP DIAGRAM**



COMPONENT: 1.00 HOUSING

SPACE DESCRIPTION: 1.01 SECURITY DOOR

FUNCTION: Provides secure, controlled access to and from the housing unit.

TOTAL AREA: 10 nsf (total 60 nsf)

AREA COMPUTATION: Area to allow housing officer to watch ingress or egress of inmates.

TIME OF USE: Day, evening, night.

SPECIAL FEATURES: Access for the physically handicapped.

ORIENTATION: Adjacent to Dayroom Area, between the housing unit and general circulation corridor in housing area, under visual observation from Control Room.

EQUIPMENT: Sliding security door operated from Control Room.

SECURITY: Door and frame to be detention hollow metal with security glazing. Housing Unit officer observes inside. Control Room officer observes outside and controls door operation.

FINISH MATERIALS: Secure construction.

COMMUNICATION: Intercom to Control Room and Officers' Station.

UTILITIES REQUIRED: Electricity.

COMPONENT: 1.00 HOUSING;
SPACE DESCRIPTION: 1.02 DAYROOM AREA

FUNCTION: Provides an area for small group activities and individual passive recreation activities for each group of cells. Also provides indoor recreation/exercise space in a relatively controlled setting.

TOTAL AREA: 1680 or 840 nsf (100:1 8400)

AREA COMPUTATION: Minimum area requirement of 35 nsf/inmate established by ACA Standards. May be subdivided and associated with each group of cells. Circulation space will generally be contiguous to this area, but is not to be calculated as part of the Dayroom net area. (48 x 35 = 1680 nsf) or (24 x 35 = 840 nsf)

TIME OF USE: Day, evening.

SPECIAL FEATURES: Access to cell utilities to be through secure metal key-locked steel doors.

ORIENTATION: Activities that occur in this area will be under visual supervision by the housing officer. Location should be adjacent to and in front of cells. Natural light must be introduced into this space. Adjacent to Officers' Station, Showers, Staff Toilet, Janitors' Closet, Storage Room and Interview Room.

EQUIPMENT: Fixed security-grade tables with two, four, or six fixed seats each for each group of cells, sufficient to seat inmates from that area.

SECURITY: Direct supervision by housing officer. Maximum security construction envelope to be provided at the 24-bed and 48-bed housing unit level. Unlocking of cell doors to be controlled from the Control Room nearby, outside the housing unit, via radio or intercom request by the housing unit officer.

FINISH MATERIALS: Easily maintained finishes - vinyl composition tile and painted concrete block or concrete walls and ceilings.

COMMUNICATION: Clock, public address system, public telephone (to be key controlled by housing officer) for collect calls only, audio monitoring system for each group of cells as required by code.

UTILITIES REQUIRED: Heat, ventilation, electric (110), floor drain, fire alarm, smoke detection, sprinklers

COMPONENT: SPACE DESCRIPTION:	1.00 HOUSING 1.03 OFFICERS' STATION	1.00 HOUSING 1.04 INDIVIDUAL CELLS (240)
FUNCTION:	Provides an area for housing unit officer to work and to maintain files and information concerning operation of the unit. Also provides a location for local fire alarm panel and annunciator that will minimize tampering.	Provides single occupancy cells for individuals in maximum security general confinement while awaiting classification. This area will provide the basic personal living space for inmates and will be used for relaxing, studying, writing, sleeping and personal hygiene.
TOTAL AREA:	120 nsf (total 720 nsf)	3360 nsf for 48-cell group or 1680 nsf for 24-cell group (total 16,800 nsf)
AREA COMPUTATION:	Occasional work area for officer, other staff, plus some file storage. (10' x 12' = 120 nsf)	Minimum cell size of 70 nsf is required by Massachusetts Department of Correction Standards. (48 x 70 = 3360 nsf) or (24 x 70 = 1680 nsf). Note: DPH will accept 70 nsf cell size as meeting code.
TIME OF USE:	Day, evening, night	Day, evening, night.
SPECIAL FEATURES:	Should be in clear view of and generally open to the Dayroom Area. The officer will generally be out moving around the unit, but this space will provide an "office" to work in. Provide vision panel to permit observation and acoustic privacy.	Access for the physically handicapped for at least one cell per 48. The configuration of the cells should maximize the ease of maintaining awareness of activities in the unit by the housing officer.
ORIENTATION:	Located off the Dayroom Area, in close proximity to the Security Vestibule.	Each group of cells should open onto the Dayroom Area, which will also serve as the means of access to the cells. Cells are to be single-occupancy, maximum security "outside" cells with natural light and ventilation, within a maximum security envelope at the 48-bed housing unit level. The total capacity of the housing unit should be subdivided into two levels around the Dayroom Area.
EQUIPMENT:	Desk Three chairs file cabinet tackboard.	Stainless steel security water closet and lavatory, stainless steel mirror and shelf, fixed bunk, fixed desk and chair, fixed wardrobe, overhead vandal-resistant light fixture. All equipment to be suicide-preventive, with security fastenings. Vandal-proof sprinkler head.
SECURITY:	Privacy lock on door, lockable file drawer, visual supervision from the Dayroom Area.	
FINISH MATERIALS:	Pleasant work environment, durable finishes seamless - vinyl composition tile floor, painted walls and ceiling.	
COMMUNICATION:	Audio paging to cell and dayroom areas, telephone and intercom to Control Room. Panic button.	
UTILITIES REQUIRED:	Heat, ventilation, electric (110), air conditioning.	

SECURITY:

Maximum security construction with masonry cell fronts, electrically-controlled locks on steel security door with view port and 4" horizontal slot for food pass, security windows with 4" maximum opening dimension with operable vent.

FINISH MATERIALS:

Sealed concrete floor, painted concrete block or concrete walls.

COMMUNICATION:

Audio monitoring from Control Room for each group of cells as required by code and audio reception.

UTILITIES REQUIRED:

Plumbing waste vent.
Cold water, hot water, heat, tamper-proof extract ventilation, electric (110), fire alarm and smoke detection as per code, master antenna system. Input air will be supplied from Dayroom.
Sprinklers.

Phase I: New construction

Phase II: Renovation of existing facilities.

Phase II shall not commence until 30 days after acceptance of Phase I.

2. Work during Phase II shall be planned and coordinated so as to minimize disturbance to ongoing operation of the facility. In particular, a minimum amount of space in the existing building shall be vacated at any given time during Phase II. Requirements listed in IBI.05A2 shall also apply.
 3. Food preparation and dining areas shall be operational at all times during the entire project.
 4. Utilities shall not be interrupted for more than six hours at any one time and utilities shall be relocated temporarily or permanently as required to maintain continuous service during the entire project.
 5. Requirements described in IBI.05.A.6 and 7 shall apply to SMPRC also.
- B. Construction Fence**
- No fence will be required. However, barricades shall be provided to delineate construction areas.
- C. Site Access (Same as IBI.05D)**
- D. DBT's Yard (Same as IBI.05E)**

as the investigation.

3. Checking of critical dimensions, openings, and access.

4. Verification as far as possible of location, sizes, and conditions of existing utilities.

5. Investigation of use and loading of existing utilities by qualified engineers to determine that proposed utility services to new facilities under this contract will not overload existing utilities.

B. The DBT is not expected to make additional sub-surface site exploration prior to proposal.

C. The winning DBT is expected to make additional investigation of existing conditions during the design development phase of the project as necessary to develop full working documents, including but not limited to complete site and soils investigation and engineering analysis described in III C 3.

D. In general, site conditions will be judged by DCPO as "differing" for the purposes of changes in work covered by contract Article XV only if they differ from what could have been reasonably observed, inferred, or ascertained from the required DBT's investigations described above, even if they vary from information given in this RFP.

IC1.04 Existing Structures to be Renovated

A. This sub-section pertains to demolition and renovation work at BSCC and SMPRC.

B. The DBT shall base his proposal on the information given in the guidelines and requirements for each facility plus the optional additional investigation as in IC1.03.

C. For space planning purposes, total square footages of existing functional areas shown in the plan's existing facilities can be assumed correct.

D. Concealed conditions will only be considered differing if it can be shown that reasonable effort was made to ascertain or infer them prior to the proposal.

IC1.05 SITE UTILITIES

A. The DBT shall base his proposal on the utilities described in the design and program data for each facility and shall make allowance in his proposal for relocation of utilities as necessary to accommodate new construction.

SECTION IC - DIFFERING SITE CONDITIONS

IC1.01 REQUIREMENTS INCLUDED

A. DBT's responsibility for investigating and verifying existing conditions.

B. Existing structures to be renovated

C. Site utilities

D. Sub-surface geological conditions

E. Hazardous materials

IC1.02 RELATED REQUIREMENTS

A. Section IB - Special Requirements for Construction and Phasing at Three Prison Sites

B. Section ID - General Quality Control, Submittal and Testing Requirements

C. Contract Article XX - changes in work

D. Section Two, II A, B, C - Design and Program Data for MCI Concord, BSCC, and SMPRC

E. Section One, II C - Proposal Preparation

IC1.03 DBT'S RESPONSIBILITY FOR INVESTIGATION AND VERIFICATION OF EXISTING CONDITIONS

A. Documentation of existing conditions at the three facilities given in Section Two, II A, B, C represents the best information available to DCPO. The DBT is expected to conduct reasonable additional investigation and verification of existing conditions prior to proposal submission ensure that proposals adequately take into account all existing conditions affecting the new work. (See Section One, Chapter II for proposal site investigation procedures.) Such pre-proposal investigation may include:

1. Thorough inspection of site and existing facilities by qualified architects, engineers, and construction experts.

2. Reasonable exploratory investigation of concealed portions of existing facilities, including limited selective removal of finishes to expose structural, mechanical, electrical, waterproofing, and other conditions. The DBT shall repair all finishes or elements which are damaged in the course of investigation on the same day

disposal of the excavated material, overhead, superintendent, profit, and all related costs as prescribed under Article XX of the contract.

b. Measurement and payment of rock excavation will be made for:

(1) Foundations within the limits of the concrete lines as defined by the working plans or duly authorized modifications thereto, plus 18 inches outside the vertical concrete lines.

(2) Pipes to a depth of 6 inches below the bottom of the bell and for a width equal to the inside diameter of the pipe or conduit plus 18 inches on each side.

(3) Any unforeseen rock excavation encountered and required to be removed for the construction of work defined on the plans and required under this contract, shall be paid for by measuring said excavation in its original position to the limit of the clearly defined vertical construction lines and the depth required by the new construction.

(4) Where in the opinion of DCPO blasting will not be allowed, the rock removal shall be paid for under Article XX of the Contract. The method of removal shall have prior written approval of the office before proceeding.

c. Blasting operations, if permitted, shall conform to the regulations of the Massachusetts Department of Public Safety concerning storage, handling, and use of explosives as set forth in D.P.S. Form FPR-12, latest edition.

4. Definitions

a. The work "rock", whenever used as the name of excavated material, shall mean sound bedrock, ledge, boulders, concrete, and masonry structures or portions thereof, required to be removed from the excavation. The surface of sound bedrock shall be taken below the level of any rock disintegrated or fractured to such an extent, to be removable by hand tools, power equipment, or other mechanical means.

b. The word "trench" shall mean excavations having vertical sides whose depths exceed their width, such as drain, sewer, water, and gas pipes, electric and steam conduits, and foundations.

c. Compaction shall mean the tamping and rolling of all fill and backfill placed in uniform horizontal layers not exceeding six inches in thickness. Water shall be added in such amounts as necessary to obtain required compaction to a density of not less than 95% as determined by ASTM Designation D-698, Method C.

B. Active utilities which are not indicated at all or vary significantly from locations described in the design and program data and are not reasonably observable, and which require relocation to accommodate new construction, will be considered differing site conditions.

1C1.06 SUBSURFACE GEOLOGICAL CONDITIONS

A. The DBT shall base its proposal on reasonable interpretation by a geotechnical professional of the soil data furnished in this RFP.

B. Subsurface conditions which could not be reasonably anticipated by the soils data provided in the RFP shall be subject to Article XX and compensated as follows:

1. Additional excavation

a. For the first 4 feet below bottom grade, \$6.50 per cubic yard, measured in place between payment lines, eighteen inches outside the vertical concrete lines, or for a width equal to the inside diameter of pipe or conduit, plus eighteen inches on each side, as defined by the working plans or duly authorized modifications thereto.

b. For the second 4 feet below bottom grade, \$10.00 per cubic yard measured in place between payment lines, eighteen inches outside the vertical concrete lines, or for a width equal to the inside diameter of pipe or conduit plus eighteen inches on each side, as defined by the working plans or duly authorized modifications thereto.

c. For depths of more than 8 feet below bottom grade, compensation will be made in accordance with Article XX of the contract.

d. The payment under paragraphs a, b, and c above shall cover all costs relating to such extra excavation, including sheeting, shoring, pumping, disposal of surplus or unsuitable material, filling, backfilling, compacting, overhead, superintendent, profit, and all related costs as prescribed under Article XX of the contract.

2. Rock Excavation

a. Excavation of rock in excess of one cubic yard will be paid for in addition to the lump sum contract price at the rate of \$25.00 per cubic yard in open cut, and \$40.00 per cubic yard in trenches, both measured in place anywhere within the contract limits as defined on the plans or any duly authorized modifications thereto, except in areas where blasting is not allowed, in which cases payment shall be in accordance with Article XX. The payment shall cover all costs relating to such ledge excavation, including blasting, removal and satisfactory

d. Gravel Borrow shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials, uniformly graded and containing no stone having any dimension greater than four (4) inches. Gradation will be determined in accordance with ASTM Designation D-422.

C. The MCI Concord site is known to contain extensive rubble and large granite and concrete boulders, which should be anticipated. Such material at MCI Concord will not be considered a differing site condition unless extraordinary.

1C1.07 HAZARDOUS MATERIALS

A. Any asbestos, toxic waste, petroleum products, or other hazardous material encountered shall be reported at once to the resident engineer.

B. If hazardous material is found, the project manager will direct the contractor how to treat it. Such work shall be treated as a differing site condition and subject to contract Article XX. For bidding purposes the DBT may assume that no hazardous waste will be encountered.

DIVISION 3 - CONCRETE

3.01 GENERAL

A. It should be understood that the system and materials specified relate to the design in the project program manual and that, if the DBT proposes a different system of materials, that the quality and durability level specified herein provides the standard against which the quality and durability of the proposed design will be evaluated.

B. Concrete: ACI Standard Specifications for Structural Concrete for Buildings (ACI 301-72 latest edition) and referenced as part of this Section.

3.02 PRODUCT/SYSTEM REQUIREMENTS:

A. Foundation: Strip and spread footings resting on virgin soil or compacted structural fill 4'-0" below finish grade. 3500 psi concrete. Footings shall be designed in accordance with the bearing pressure presented in the soils report. It is the DBT's responsibility to verify design bearing pressure factors.

B. Under-Slab Fill: Porous fill or crushed stone 6" deep; 8 mil polyethylene vapor barrier, continuous perimeter insulation 2" styrofoam board 2'-0" vertically.

C. Slab on Grade: 5" deep-mesh reinforced 3000 psi concrete slab.

D. Foundation Walls: 3500 psi reinforced concrete walls with shelves to receive masonry finish where exposed above grade.

E. Deck Concrete: 4" lightweight concrete topping on steel deck.

F. Floor Finishes: Screeded and floated generally, steel trowelled where resilient finish floor occurs.

G. MCI Concord (preferred system):

a. Cell areas and administration areas shall be 6" precast prestressed concrete plank with 2" concrete topping, bearing on 8" reinforced masonry walls. Long span roof areas, such as dayrooms, shall be precast prestressed concrete tees. (See Electrical Section 16 for conduit runs.)

b. Elevated Floors: 6" hollow-core precast prestressed plank with 2" composite topping. Plank to be 5000 psi concrete. Topping 4000 psi concrete reinforced with wire mesh.

c. Columns: Concrete with mild steel reinforcement.

d. Beams: Concrete with mild steel reinforcement.

protective chemicals to provide a fire hazard classification of a flame spread not over 25 in accordance with UL label "FRS-Exterior," with treatment in accordance with AWPFA Standards C-27 and C-20.

F. Exterior rough lumber shall be pressure treated conforming to AWPB Standards LP-2, 3 or 4 for above ground. Treated wood shall bear the AWPB quality mark. Treat cut wood in accordance with the AWPFA Standard M-4.

6.04 CONSTRUCTION SAMPLES, TESTS AND SUBMISSIONS

- A. The DBT must comply with submission requirements of DCPO, as directed.
- B. Samples, and certificates of compliance with the above standards will be required for those products noted.
- C. Provide shop drawings.

e. Longspan Roof Construction: Concrete double or single tees. Prestressed with steel strands.

3.03 CONSTRUCTION SAMPLES, TEST AND SUBMISSIONS

A. It is required that the following tests required by ACI 301.-72 (latest revised edition) be performed as specified in that document. All test reports shall be forwarded to DCPO for review.

1. ASTM D75 Sampling Aggregates
2. ASTM C40 Organic Impurities
3. ASTM C143 Slump Test
4. ASTM C39 Compressive Strength of Concret Cylinders

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

7.01 GENERAL

- A. This work includes foundation wall damp-proofing roofing, insulation, flashing and sealants.
- B. It should be understood that the materials referenced herein relate to the design in the Architectural program study. If the DBT proposes a different design approach, the durability and aesthetic quality of the referenced system provides the standard against which the proposed design will be evaluated.

7.02 PRODUCT/SYSTEM REQUIREMENTS

- A. Foundation Wall Damp-proofing: Trowel grade mastic damp-proofing to outside faces of foundation walls. Flintkote Co. roof coating damp-proofing over Flintkote asphalt primer or J & P Petroleum Products, Inc. Tex-Mastic No. 712 over Tex-Mastic No. 716 primer or Karnak 83 fibrated brush damp-proofing over Karnak 108 primer are acceptable standards.
- B. Metal Roofing (MCI Concord): Standing Seam Galvanized Steel Roof with "Kynar" finish. The metal roofing shall be "Snap Seam" Roofing as manufactured by AEP/SPAN, Harrisburg, PA. Provide all fittings, closures, anchors, and accessories.
 1. Zinc-Coated Steel: Provide commercial quality steel sheet with 0.20% copper, ASTM A-525, G90 hot-dip galvanized, mill phosphatized; 0.0239" thick (24-gauge) with fluoropolymer finish coating of 70% Kynar "500" coating.
- C. Shingle roofing (BSCC and SMPRC): Cement base shingles conforming to Fed. Spec. SS-S-291d and ASTM C 222, installed to achieve UL Class A rating. Manufactured by Supradur Corporation or IBP Corporation. The color and texture should match the existing roofing as closely as possible.
- D. Built-Up Roofing: 4-ply built-up roof with glass felts, Class A rated, coal-tar bitumen roofing covered with slag embedded in the top mopping. Koppers Specification No. 320-4 by Koppers Co., Inc.
 1. Glass felts: Koppers Glass Felt, ASTM D2178 Type IV.
 2. Cap sheet: Koppers Glass Felt with aluminum coating.
 3. Coal-tar bitumen: ASTM D-450 Type III.
 4. Aggregates: Clean, hard, dry slag conforming to applicable requirements of ASTM D-1863. Moisture not to exceed 2% by weight.

E. A single-ply ballasted roof system similar to Carlisle System B would be acceptable subject to DCPO approval.

F. Building Insulation: Rigid roof insulation shall be perlite and foam sandwich; rigid wall insulation shall be extruded polystyrene foam panel. Batt insulation shall be kraft-faced fiberglass. "U" values for wall and roof assemblies shall be as specified in Section 15-B.

G. Sealants: Control Joints in precast and masonry relief joints shall be sealed with polyurethane or polysulfide sealant separated by a backer rod, maximum 1/2". Metal door and window frames shall be sealed to masonry or concrete with polyurethane rubber sealant on both the interior and outer perimeter. Silicone sealants at sanitary areas.

H. Skylights: Install continuous glazed skylights of structural aluminum members with security glazing and fittings. Insulated glass shall have laminated inner light and tempered outer light with 1/2" air space.

I. Wall Flashing and Counterflashing AISI No. 2D dead soft stainless steel 3-way key locked.

J. All gutters, vent caps, rain leaders shall match profiles of the existing construction. All anchors, hangers, fasteners and accessories shall be compatible with metal flashings and rain drainage products as recommended by metal manufacturer and SMACNA.

7.04 EXECUTION

- A. The work must conform to recognized standards of the industry, including:
 1. Metal Roofing: recommendations and specifics contained in "Architectural Sheet Metal Manual" by SMACNA.
 2. Shingle Roofing:
 - a. Shingles shall bear Underwriter's Laboratories Class A fire hazard and wind resistance classifications.
 3. Built-up Roofing:
 - a. BUR shall bear an Underwriter's Laboratories Class A fire hazard classification.
 - b. Roofing and insulation assemblies shall be installed to meet Factory Mutual system requirements for Class I I-60.
 4. Insulation: All insulating materials shall comply with the applicable reference standards of ASTM and be compatible with the adjacent damp-proofing and waterproofing materials in order to qualify the assemblies for the warranties offered.

3. Signs shall be lettered in accordance with room tiles and locations approved by DCPO. Assume each sign to require 12 characters, except that inmate rooms shall be identified with numbers (assume 3 each) only.
4. Signs with letters and numbers will be a minimum of 1 1/2" high. Signs with only numbers shall be a minimum of 3" high.

10D.03 EXECUTION

- A. The work must conform to requirements of DCPO and to recognized standards of the industry.
 1. Install signs level and plumb.
 - a. Wall-Mounted Units: Attach panel signs to wall surfaces using silicone adhesive recommended by sign manufacturer to permanently attach sign units to irregular, porous or vinyl-covered surfaces.
 - b. Bracket-Mounted Units: Use manufacturer's standard brackets, fittings and hardware for mounting signs which project at right angles from walls and ceilings. Attach brackets and fittings securely to ceiling or walls with concealed or security fasteners and anchoring devices, as required.

10D.04 CONSTRUCTION SAMPLES, TESTS AND SUBMISSIONS

- A. Submit samples to DCPO for approval of each sign form and material showing finishes, colors, and design of each sign component including graphics.
- B. Shop Drawings: Submit a schedule of to be painted and full size drawings of painted numerals and letters, showing their size, style, spacing and color. Submit a schedule of signs to be fabricated, showing size, style and color of graphics.
- C. Product Data: Submit manufacturer's technical data and installation instructions for each type of sign required.

7.05 CONSTRUCTION SAMPLES, TESTS AND SUBMISSIONS

A. Metal Roofing

1. Submit metal manufacturer's and fabricator's specifications, installation instructions and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements. Provide warranty.
 2. A mock-up that is identical to project requirements will be required. The mock-up shall have typical seams, edge construction and selected finish color.
- B. Shingle Roofing**
1. Submit copies of manufacturer's data describing each material and include proposed manufacturer's specifications and fire and wind test report data to substantiate UL Class A.
 2. Submit samples of roof assembly components, gutters, flashing, etc. for review, prior to installation.
 3. The DBT shall furnish to DCPO executed copies of the roofing manufacturer's Guarantee, providing that they will bear the cost of maintaining the roofing watertight for a period of (20) twenty years minimum from Date of Completion. The Guarantee shall apply to leaks caused by deterioration due to ordinary wear and tear by the elements or improper workmanship.

C. Built-up and Membrane Roofing

1. Submit copies of manufacturer's data describing each material of the system and include proposed manufacturer's specifications and fire test report data to substantiate UL Class A.
2. Submit samples of roof assembly components and roof aggregate for review, prior to installation.
3. Submit specifications for roofing and damp-proofing materials and assemblies proposed. Include warranties to be provided.
4. The DBT shall furnish to DCPO executed copies of the roofing manufacturer's Guarantee providing, without limiting penal sum, that they will bear the full cost of maintaining the roofing and associated base flashings watertight for a period of ten (10) years from Date of Completion. The Guarantee shall apply to leaks caused by deterioration due to ordinary wear and tear by the elements, improper workmanship, or slippage or splitting not caused by movement of underlying elements.

D. Submit samples of all thermal and moisture protection materials for

DIVISION 11 - EQUIPMENT

SECTION 11A - SECURITY CONSTRUCTION EQUIPMENT (MCI CONCORD):

11A.01 GENERAL

A. The work of this Section involves portions of the security equipment and assemblies required, including sliding door units, consoles, and related items.

B. The scope of work includes:

1. Electromechanically operated sliding door system shall be provided at all inmate rooms and shall be complete with doors, operator systems with local emergency release cabinets, locking devices, mechanism housings and remote control consoles. System work shall include all electrical devices and wiring therefor. Doors shall be provided with vision ports, and food pass doors with locks.
2. Individual electromechanically operated sliding door units shall be provided at all salloports and other controlled entrances and cross-corridor locations and shall be complete with doors, operating systems, locking devices, mechanism housings and control switch units. System work shall include all electrical devices and wiring therefor.
3. Metal identification numbers at sliding door assemblies at Inmate and Holding Rooms.
4. Operating instructions, maintenance manuals, spare components and special tools.
5. All anchors, inserts, field welding and fasteners to firmly secure all work.

11A.02 PRODUCT/SYSTEM REQUIREMENTS

A. Hardware and Products

1. Items specified in this Section have been selected for the purpose of establishing a quality and design standard acceptable to DCPPO. Security equipment items specified have been selected from the catalogs of Folger Adams Co. Products of other manufacturers having at least ten years' experience producing prison-type key locks and hardware on a regular basis may be substituted, providing they are equal in quality and design to the items specified. All integrated security equipment and hardware shall be the products of a single manufacturer.

2. Prison Locks

- a. Series 52MS (Folger-Adam) or equal electric locks shall be furnished with functions as specified for Holding Room locations. Locks shall be motor operated, 129 Volt AC, and shall be provided with two-position toggle switches with indication lamps for locked and unlocked status. Locks shall be jamb mounted and controlled from a control console that shall accommodate all switches and status indication lamps for the holding rooms group. Locks shall be capable of manual key operation by prison type (paracentric) key from one side.
3. Deadlock for Emergency Release Cabinet Doors: Malleable iron and steel case, bronze bolt and working parts; Folger Adam Co.'s No. 10 Series.
4. Lock Cylinders and Keys
 - a. Lock cylinders for all locks shall be produced in the factory of the lock supplier to protect the integrity of the key combinations and systems.
 - b. Cylinders for prison locks to be manufactured of polished alloy bronze shall have both hardness and tensile strength equal to mild steel. Cylinder to extend 1/2" beyond case and to be grooved to match and guide similar grooves in key. Prison locks to have "spring temper" hard brass tumblers to be actuated by flat phospher bronze springs.
 - c. Cylinders shall be of field proven construction and shall be of identical design to those supplied by the manufacturer for other projects of a similar nature and which have been in use for a period of not less than five (5) years.
 - d. Prison locks shall be furnished with keys not less than 4-1/2" in length. Blade to be 7/8" wide by 5/32" thick. Key to have overlapping paracentric grooves to match similar grooves in lock cylinder. Handle to be of oval shape about 2-1/4" by 1-3/8" in size and separated from the key blade by 1/2" by 1/2" shank to provide clearance for officer's hand. Entire key to be made of polished alloy bronze having tensile strength of not less than 90,000 pounds and a hardness on the Brinell scale of 150. Stamp each key with numbers of letters as directed by DCPPO.
5. Tools and Fastenings
 - a. Furnish five of each special driver required to install the hardware for this project. Drivers shall be turned over to DCPPO upon completion of the project.
 - b. Provide machine screws for hardware to be secured to metal;

framing and stiffening members of all doors. Insulation material shall be an inorganic and noncombustible product, to be submitted for approval.

f. Furnish and install one Folger-Adam flush pull No. 4 on each face of each sliding door.

8. Door Suspension for all Sliding Doors

a. Doors shall operate on overhead hangers and bottom guide. Door rollers shall be machined from solid, cold-rolled steel bar and shall not be less than 3-3/4" in diameter. Rollers shall turn on permanently lubricated ball bearings. The roller track shall be of cold-rolled steel bar stock not less than 1/2" wide. The use of formed metal track will not be allowed. Hanger guides shall be of 1/4" thick steel plate.

b. The door hanger assembly shall be so engaged to the track that it cannot be lifted off or forced out of alignment.

9. Painting

a. All items and work equipment herein specified, (except parts of the work to be plated and aluminum, bronze, brass, or stainless steel finish hardware) shall be painted one coat of high quality red oxide primer before shipment from factory.

b. All interior unexposed surfaces of cover panels and covering boxes shall be painted one shop coat of aluminum paint before shipment from factory. All door rollers and other door operating and locking device housing must be electro zinc plated in conformity with Federal Specification QQZ 325, Type 2, Class 2 requirements. These unexposed parts shall not be painted in the field.

B. Sliding Door Units

1. Electromechanically Operated Sliding Inmate Room Door Systems

a. Furnish and install complete operating and locking device systems and enclosures for sliding inmate room doors. These systems, including certain electrical work, shall be complete factory-assembled units of thoroughly proven type, keyless and fully selective, positive in action, and not subject to unusual wear. They shall function smoothly and with a minimum of noise.

b. Each sliding door and its locking and unlocking means shall be operated by an electric motor, with rack and pinion drive.

c. Selective control of door operation shall normally be by means of electric switches provided on two remote door control

self-tapping screws are not acceptable. Provide machine screws and metal expansion shields for masonry and concrete attachment.

c. Provide "Prison-head" screws for exposed items of hardware. Institutional type spanner head screws may be used for fastening of pulls. Provide 100 extra screws of each size and type used.

d. "Prison-head" screws are hereby defined as those which have two heads: the outer head (cylindrical or hexagonal for use in tightening) to be sheared off after installation, leaving permanently exposed head free of indentations or recesses, ground smooth and flush with adjacent surfaces. Where gauge of material does not permit countersinking, use round head prison-head fastenings.

6. Miscellaneous Items

a. Inmate Room Numbers: Polished cast bronze or aluminum, 3" high, with machine screws of compatible metal. The system of numbering shall be as directed and shall match the cell numbers on the control panels.

b. Plastic Cards: Furnish 1/2" by 3" plastic cards to indicate name and condition of cells and other spaces, per DCPO (DOC) standards.

7. Sliding Steel Doors

a. Furnish and install all sliding security type plate and sheet clad hollow metal doors having a thickness of 2".

b. Doors shall be flush type on exposed faces. Edges, top and bottom of door shall finish flush. Doors shall have faces of 3/16" steel plate or 10- or 12-gauge steel, with 12-gauge inner reinforcement. In cases where face materials are not of equal thickness, the heavier material shall occur on the cell or holding room side. Doors shall be custom made, fully welded, and shall have no visible seams. Welds shall be continuous along entire length of vertical edges. All doors with guide shoes and channels fabricated of not lighter than 10-gauge steel.

c. Each food pass assembly shall include a door or a shutter panel of 1/4" steel shutter panel, lock device and hinges, and fasteners therefor, in a complete and functional arrangement. The assembly should be sized to conveniently accommodate tray size as advised by DCPO.

d. Provide observation light openings.

e. Provide sound deadening and insulation between all internal

panels, located in separate day and night control rooms for each housing unit in accordance with the officer-to-inmate ratios of the Technical Requirements.

d. Additional Requirements: the sliding inmate room doors shall positively lock at three (3) separate locations in both the open and closed positions:

- (1) By means of the vertical lock bar at the top framing member of the door.
- (2) By means of the vertical lock bar at the bottom framing member of the door.
- (3) On the door carriage within the horizontal mechanism housing.

e. The normal force exerted by any sliding cell door during electric operation shall be approximately 40 pounds. If an obstruction presenting a resistance greater than the pressure movement of the door is placed in the oncoming path of the door, the door and mechanism shall stall upon making contact with such object. When the obstruction is removed, the door shall resume movement in the selected direction and lock automatically.

f. All electric wiring between sliding doors and control consoles (and between sliders and emergency release cabinets), including operating devices and appurtenances, factory-wired motors, factory-wired remote and local emergency release control panels, solid state relays, switches, transformers, interlocks and indicator lamps required for a complete installation of these electromechanically operated sliding inmate room door systems shall be furnished and installed as part of the work of this Section. All motors shall be 1/20 horsepower, single phase, 115 volt, 60 hertz as produced by a nationally recognized manufacturer. Wiring within track boxes shall be protected with plastic sheathing and rubber grommets. Wiring shall be continuous, except for specific connectors. Inmate room door rows shall be served by prefabricated wiring harnesses.

g. Manual Operation: Provide a manual emergency release within each local emergency release cabinet, for use in event of a discontinuance of electrical service. This system shall provide for the instantaneous unlocking of all inmate room doors and thereby place such doors in condition to be moved manually at the door to open position. The movement of the emergency release mechanism shall be of a "single step" operation. After unlocking and opening of each local emergency release cabinet door to gain access to the emergency release apparatus, the time required to accomplish unlocking of doors shall not exceed seven (7) seconds.

h. Provide a separate manual arrangement located conveniently within each local emergency release cabinet, to permit unlocking and manually opening or closing of any one or more doors. Movement of this emergency release cabinet "key release" mechanism shall permit insertion of a specially made implement into an otherwise "blocked" aperture located at each door into the underside of the door operating locking device housing to facilitate any selected door to become unlocked.

i. Local Emergency Release cabinets shall be constructed of Number 10-gauge minimum thickness open hearth steel plate and must afford complete housing and protection to all operating components contained therein. Cabinet door shall be securely hung on two heavy-duty security type hinges and shall be locked with a security type deadlock. Cabinet doors shall be constructed of 7-gauge mild steel. The operating panel shall include engraving or permanent engraved plates to identify operational instructions as well as door operating controls.

k. Miscellaneous Subassemblies

(1) The work of this section shall also include all steel closure plates where they are contiguous with covering boxes as shown on the drawing, which are required to extend covering boxes to ceilings or undersides of floor slabs.

(2) Back plates shall be constructed of 3/16" mild steel plate. Cover and ends of mechanism boxes and closure plates shall be constructed of 10-gauge sheet steel and shall afford complete protection to the mechanism and electrical devices therein. Vertical steel lock bar and release columns shall be constructed of 7-gauge sheet steel, with removable covers of 11-gauge steel where required.

(3) Furnish and install all structural steel, shapes, angles, receivers, steel plate or gauge members as required to provide a neat and secure installation. Furnish and install steel shims, scribed plates and closure angles as necessary to insure firmness of the installation, to meet building construction, and to prevent the hiding of contraband.

(4) Covering boxes shall be lengths approximately equal to cell widths, and shall be joined together 1/8" by 2" overlapping battens, securely welded to maintain permanent alignment. Covers shall be removable where required to permit access for maintenance of mechanisms and electrical equipment.

k. Consoles

(1) Furnish and install custom designed free standing (floor

mounted) control consoles, to be located in each unit Control Room at housing wing locations. Panel layout shall be arranged to group the individual door controls by level and locations and shall also contain switches for gang emergency release of inmate rooms.

(2) Control consoles shall be constructed of 14-gauge steel body construction with a tapered top (control panel) surface that shall bear a stainless steel plate, to contain all switching devices and indication lamps and which shall be engraved or permanently etched to indicate service locations and switch positions. Provide doors or easily removable panels, complete with operating hardware to permit easy access to wiring and terminal blocks contained within the body of the control cabinet.

(3) Each console shall be furnished with a push button on the panel for testing of all lights. By pushing this button, all panel lights shall illuminate, thus indicating a malfunction of lamps.

(4) Each door control shall consist of the following:

(a) A three-position AML Series Microswitch, with integral red and green indicator lamps having an adjustable resistor to modulate lamp intensity. This switch shall be used to select and indicate the proper function of each door, the upper position being to open doors, the lower to close them, and the neutral to place control under normal group control.

(5) All circuits shall be protected by circuit breakers accessible from the control panel front. The panel shall also contain a power cut-off switch. All electrical works shall comply with National Electric Code standards.

(6) To facilitate the Institution's ease of replacement of any electronic component required in the operation of the doors, the manufacturer shall supply the resident engineer with one extra "plug-in" type switching module of each 50 devices or fraction thereof as spare replacement parts. This module can be used to replace any of the door control modules by means of pulling the defective module from the panel and replacing with a spare module.

(7) Submit detail drawings of panel arrangement and console design to DCPO for review before fabrication.

I. Individual Electromechanically Operated Sliding Door Units

(1) Furnish and install complete operating and locking device systems and enclosures for individual sliding doors at entrances, saltport, corridors, and other locations where

appropriate for the containment of no more than 25% of the Phase I population. These units, including certain electrical work, shall be a complete factory assembled unit of thoroughly proven type, keyless, positive in action and not subject to unusual wear. It shall function smoothly and with a minimum of noise.

(2) Each sliding door and its locking and unlocking means shall be operated by an electric motor with rack and pinion drive. The motor and drive mechanism shall be mounted in the horizontal covering box above each door.

(3) Control of door operation shall normally be by means of electric switches located in Control Rooms.

(4) In normal operation, manipulation of switch referred to above shall enable the operator to unlock, open, and lock open a door in not more than 7 seconds and/or unlock, close and deadlock the door in the same period.

(5) Additional requirements: the sliding door shall positively lock at three (3) separate locations in both the open and closed positions:

(a) By means of the vertical lock bar at the top framing member of the door.

(b) By means of the vertical lock bar at the bottom framing member of the door.

(c) On the door carriage within the horizontal mechanism housing.

(6) All moving locking parts shall be concealed within the cover box and the front or rear door jamb, or both the door jamb and the vertical framing members of the door, and shall be free of any projecting lugs or hooks, used for locking or any other purpose, which project into the door opening either when the door is in motion or fully open.

(7) The normal force exerted by these sliding doors during electric operation shall be approximately 40 pounds. If an obstruction presenting a resistance greater than the pressure movement of the door is placed in the oncoming path of the door, the door and mechanism shall stall upon making contact with such object. When the obstruction is removed, the door shall resume movement in the selected direction and lock automatically.

(8) Electric energy service, including conduit, wiring, circuit protection devices and final connections, shall be provided from the building's electrical center to each remote switch and from the switch to a point within the door operating

mechanism enclosure by the DBT electrical subcontractor. Service connections shall be made within the mechanism enclosure to a factory wired terminal block, furnished and installed as part of this Section.

- (9) All other electrical wiring, operating devices and appurtenances, including factory-wired motors, solid state relays, switches, interlock transformers and indicator lamps required for a complete installation of these electromechanically operated sliding door units shall be furnished and installed as part of the work of this Section. All motors shall be 1/20 horsepower, single phase, 115 volt, 60 Hertz as produced by a nationally recognized manufacturer. Interlock switching control shall be provided for all locations where two or more doors occur at a given passage location.

(10) Provide a mechanically operated emergency release system that shall be operated manually in the event of current failure or accident to electric parts. This system release shall be arranged to permit the following manual operation of the device:

- (a) Position (1) Electric - All locking points engaged for normal operation and function of the doors.
- (b) Position (2) Open - All locking points disengaged by the mechanical release system: the door may be opened or closed manually at the door. The manual cell door release mechanism shall release the door whether it is in the closed, opened, or in any intermediate position when operated. The mechanism release handle shall be housed in and protected by the vertical locking column and shall be accessible by means of a hinged panel secured by a prison type deadlock equal to Folger-Adam No. 12.

(c) The operating handle for the horizontal housing cover locking mechanism shall also be located in the upper portion of the vertical locking housing. The cover lock operating handle shall be securely locked in place by the lock indicated above. It shall not be possible to close and lock the hinged access panel at the upper portion of the vertical housing unless the horizontal cover locking mechanism is in the locked position.

(11) Door openings shall be properly formed with suitable bars and/or shapes as required to properly fit and coordinate with door frame and wall construction. Provide heavy rubber bumpers to quiet and cushion the door at each limit of its travel. The slots in the bottom of locking device housing, through which the sliding door hangers move, shall be covered at all times by means of steel

members attached to the door carrier in a manner that prevents the entrance through the slot of any contraband that could be used to obstruct movement of the sliding doors or cause malfunction of the door operating/locking device mechanism.

(12) Furnish and install horizontal and vertical steel covering boxes, lock bar housings and appurtenances as require to render a complete installation. Covering boxes shall contain all mechanical and electrical operating mechanisms including motors, wiring, and accessories required for the operation of sliding door units. Back plates shall be constructed of 3/16" mild steel plate. Cover and ends of mechanism boxes and closure plates shall be constructed of 10 -gauge sheet steel and shall afford complete protection to the mechanism and electrical devices therein.

Vertical steel lock bars and release columns shall be constructed of 7 -gauge sheet steel, with removable covers of 11 -gauge steel where required. Furnish and install all structural steel, shapes, angles, receivers, steel plate or gauge members as required to provide a neat and secure installation. Furnish and install steel shims, scroed plates and closure angles as necessary to insure firmness of the installation, to meet building construction, and to prevent the hiding of contraband.

Covering boxes shall be constructed to be without joints or battens for the full length. Covers shall be removable where required to permit access for maintenance of mechanisms and electrical equipment.

(13) Furnish to the DBT electrical subcontractor for installation one control switch for each door assembly. Control switch shall be a three-position AML Series Microswitch, with integral red and green indicator lamps. The work of this Section shall include the preparation of electrical circuiting drawings, which shall be issued to the DBT Electrical Subcontractor, pursuant to approval, to establish field wiring requirements.

11A.03 EXECUTION

A. The work must conform to requirements contained in the Massachusetts Instructions and Procedures document, Bureau of Building Construction Form #9 (latest edition), and to recognized standards of the industry, including:

1. Material Standards

a. Steel Plate: Open-hearth mild steel produced especially for

standard gray enamel.

(3) Metallic Filler: MIL-F5252 "MR".

B. Manufacturer and Intent:

1. Principals and key personnel of the detention hardware provider shall have been engaged in furnishing and installing security and detention equipment for a minimum of five years. The DBT shall furnish a list of at least five installations of security and detention equipment, including locking mechanisms, similar in scope to the requirements of this project. (For each facility, state: name and location; date of occupancy; Owner's representative and telephone number to contact; and Construction Manager or General Contractor for the listed project.)
2. All steel security work, doors, hardware, etc., herein specified shall be erected in place by the DBT under this Section of the Specifications, with workmen experienced in security equipment installation under the supervision of a Superintendent especially trained and experienced in this particular line of work.
3. Qualified and authorized factory-trained representatives of the manufacturer of the detention equipment shall coordinate the planning, delivery, and installation of this equipment and other related work prior to and during construction of the facility and until all related work and this equipment has been completed. Representatives shall give full-time supervision of installation at the site.

11A.04 CONSTRUCTION SAMPLES, TESTS AND SUBMISSIONS

- A. The DBT shall, within 45 days of the execution Contract, submit for review four (4) copies of a complete list of descriptive literature and samples as follows:
 1. Descriptive literature shall consist of complete specifications for proposed materials and construction. Submittals shall include motors, switches, locking devices, standard construction details.
 2. Samples shall be submitted, for operating and locking devices, fastenings, hardware items and switches.
- B. After approval of the above submittal, the DBT shall submit for approval six (6) complete sets of detailed information, consisting of manufacturer's bulletins, shop drawings and parts lists of all material to be provided for the project.
- C. The DBT shall assume the responsibility for, and entire cost of, any changes in the work, which may be occasioned by the review of materials other than those required.

detention use; ASTM A-36.

b. Miscellaneous Steel Shapes and Bars: ASTM A-36, unless otherwise indicated.

c. Steel Sheet

(1) Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A-569 and ASTM A-568.

(2) Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A-366 and ASTM A-568.

d. Stainless Steel: Type 302; ASTM A-167 for plate, sheet and strip; ASTM A-276 for bars and shapes.

(1) Finish: No. 4 satin, unless otherwise indicated.

e. Bolts and Nuts: ASTM A-307, Grade A, unless otherwise indicated.

(1) Concealed Bolts: Standard common bolts with lock washers and nuts.

(a) For items requiring servicing or replacement, drill the bolts and equip them with cotter pins and flat washers.

(2) Exposed Bolts: Countersunk flathead security bolts with lock washers and nuts.

(a) Security head shall be torque twist-off type unless otherwise indicated, except spanner type heads may be approved for certain conditions and applications.

f. Machine Screws: FS FF-S-92, unless otherwise indicated.

(1) Exposed Machine Screws: Countersunk flathead security bolts with lock washers and nuts.

g. Conduit: Rigid steel: galvanized on the outside and enameled on the inside, or hot-dip galvanized on outside and inside.

h. Shop paint: FS TT-P-645m unless otherwise indicated.

(1) Shop Paint for Galvanized Steel: FS TT-P-641, Type II.

(a) Cold Galvanized Compound: Single component compound giving 93% pure zinc in dried film, and meeting requirements of MIL-P-21035 (Bushings).

(2) Shop paint for inside of control cabinets: Manufacturer's

DIVISION 15 - MECHANICAL

SECTION 15A - PLUMBING AND FIRE PROTECTION

15A.01 GENERAL

- A. The scope of this Section involves the mechanical systems required, including plumbing, fire protection and related work.
 - B. Existing and Future Conditions of MCI Concord: The complex will be supplied water by an 8" underground pipe loop. The source of the water is two services from the town of Concord. The sanitary system consists of a series of manholes interconnected with piping that terminates at an onsite treatment facility. The systems will be used to supply the water and waste demands for the proposed construction. The existing conditions and capacities of the distribution system shall be verified as part of the Contract to ensure proper tie-in points and system operation.
 - C. Existing conditions of Bay State Correctional Center (BSCC): The existing systems will be used to supply the water and waste demands for the proposed renovation and new construction. Sanitary, hot and cold water piping systems, hot water heater and plumbing fixtures and related components appear to be operating at their maximum limits with no surplus capacity available for future expansion. All existing conditions and capacities of the distribution systems shall be verified as part of the Contract to ensure proper tie-in points and system operations.
1. The BSCC building is supplied water by a 4" underground pipe system. The sources of water are wells and town main. A single unmetered four-inch main enters the building at the same location as the sanitary line, in the woodworking shop area. The cold water main reduces to a 3" copper line, rises to the ceiling, and branches in both directions serving all fixtures with with separate bi-valves for each wing. The piping is all type "L" copper sweat joints.
 2. Hot water for the building is furnished through a tankless hot water heater. This is presently located in a mechanical and pump room at one wing of the building in the basement.
 3. The existing sanitary system consists of a series of manholes interconnected with piping that terminates at an off-site treatment facility. The system exits the BSCC building at the basement level in the woodworking shop area. In this area the 4" sanitary line branches to both wings with risers serving the toilet rooms in each wing. A small kitchen area and public toilet area are picked up on one branch of the 4" sanitary line. The piping is 4" cast iron hub and spigot pipe with lead and oakum joints.

D. Upon completion of the work and at a time acceptable to DCPO, furnish operation instruction brochures, parts manuals and warranties and instruct the Owner's representative as to the arrangement, location and operation of systems. Instruction brochures and parts manuals shall be furnished in duplicate, as required by the RFP, and shall describe the operation and suggested maintenance program for the systems as well as a parts list and the name, address, and telephone number of the manufacturer's representative and service company for each system or equipment category.

1. Operating and maintenance brochures shall also include copies of all approved shop drawings and catalog data sheets of materials and equipment, to include the wattage and type lamp of each type of electrical device.
- E. Written and Video Format Equipment Manuals are required for training personnel in the use of all essential operating systems. Each training video tape shall be developed and produced in conjunction with a qualified professional with demonstrated experience in producing similar Video Training Programs.
1. Each tape shall cover the complete operations, maintenance, tools and licenses that will be required for the safe and efficient operation of the products and systems contained in this section.
2. Three months prior to delivery of these manuals the DBI shall deliver draft copies of the text and video material for review and comment by DCPO.

4. The existing plumbing fixtures are in good condition and well maintained.

5. There is no interior storm water system in the building.

D. Existing conditions of South Middlesex Pre-Release Center (SMPRC): The complex is supplied water by an 2'-underground pipe. The source of the water is the town main. The sanitary system consists of a 6" sanitary line from the street. The existing systems will be used to supply the water and waste demands for the renovation and new construction. The existing conditions and capacities of the distribution system shall be verified as part of this Contract to ensure the proper tie-in point and system operation.

E. The description of the following recommended systems presume that architectural plans prepared by the DBT are similar to those shown in the RFP. Other architectural arrangements might suggest different solutions.

F. Scope of Work

1. The scope of the work is to furnish all labor, materials transportation, tools, and equipment required to furnish and install a complete plumbing and, in the case of MCI Concord and BSCC, a complete sprinkler system. The plumbing and sprinkler system shall include but shall not limited be to the following:

- a. Engineered and stamped drawings
- b. Water, storm, and sewer services to the building. (Verify at SMPRC)
- c. Complete water distribution piping system. (Modify at SMPRC)
- d. Complete roof drain piping systems. (Modify at S. Middlesex)
- e. Complete waste and vent piping system. (Modify at SMPRC)
- f. Complete hot water heating system.
- g. Required plumbing fixtures, including trim.
- h. Plumbing connections to equipment furnished/installed by others.
- i. Complete sprinkler and standpipe system. (MCI Concord and BSCC)
- j. Permits, fees and associated back charges.
- k. Shop drawings.
- l. Testing, balancing and disinfecting.

m. Pipe insulation and supports.

n. Guarantee.

o. Record drawings and valve charts.

p. Waste water holding tanks, submit itemized pricing. (MCI Concord)

q. Operations manuals and seminars.

2. All work shall be in accordance with the Massachusetts State Building, NFPA and Plumbing Codes, and shall comply with all applicable sections of the Massachusetts State Correctional Codes.

3. The complete plumbing and sprinkler system shall be designed for, and the equipment installed shall be rated for, an institutional type of occupancy. All equipment installed shall be designed for maximum structural integrity and must not compromise the security of the institution.

4. The complete plumbing and sprinkler system shall be tested in accordance with all applicable codes and regulations. Certified test results shall be submitted for review as part of this Contract.

5. Special Conditions at SMPRC:

a. Existing Building: Remove existing fixtures not required for reuse. Retain existing supply and drain system, modify piping and add as required for new fixture locations. Provide new fixtures at all new locations (e.g., existing plumbing fixtures will only remain where the scheme does not call for them to be relocated in any way). New piping for washing machine hookups in the laundry room is required.

b. New Construction: The existing water service, sewer service and hot water system will be used to serve the new as well as the renovated structure. Modify piping to the hot water storage tank, including a new valve to provide hot water for the new area. Install a new hot water circulation system. Install new plumbing fixtures and piping to all new locations.

15A.02 PRODUCT/SYSTEM REQUIREMENTS

A. Design Elements

1. Cold water system:

a. Provide water service from existing system to supply cold and hot water demands for the project.

- b. Circulating pumps: Bell & Gossett.
- c. Roof, floor and showe drains: Zurn. (vandal proof)
- d. Administrative area water closets: vitreous china, elongated bowl, flush valve: American Standard.
- e. Inmate toilet room water closets at SMPRC and BSCC:same as above.
- f. All inmate room water closets/lavatories at MCI Concord: compact welded 14-gauge.
- g. Staff lavatories: 20" x 18" vitreous china wall, lever, grid stainer: American Standard.
- h. Inmate lavatories, BSCC and SMPRC: same as above except self-closing metered faucets: American Standard.
- i. Staff urinals: wall-hung, wash-out type, flush valve, vitreous china: American Standard.
- j. Inmate urinals, BSCC & SMPRC: same as above.
- k. Staff urinals: wall-hung, wash-out type, flush valve, vitreous china, American Standard or approved equal.
- l. Showers: vandal-proof heads and anti-scald mixing valves.
- m. Underground water piping: cast iron water piping, mechanical joints, ASA A21.1; AWWA-C111 standardized joints in combination with ASA A21.6, AWWA-C106 pipe barrel, PVC where required to connect to existing system.
- n. Waste piping: cast iron soil pipe and fittings, ASTM A-74, uncoated service weight bell and spigot.
- o. Vent piping 2-1/2" and larger: same as h above.
- p. Vent piping 2" and smaller: galvanized steel, type M/DWV copper.
- q. Exterior waste piping: vitrified clay sewer pipe, ASTM C-200, extra heavy.
- r. Copper tubing: ASTM B-88, type K or L.
- s. Domestic hot water heaters and storage tanks: Patterson Kelly.
- t. Plumbing specialties: Zurn.
- u. Sprinkler system: MCI Concord and BSCC.

- b. Provide piping system for a. above.
- 2. Hot water system:
 - a. Provide heat exchanger and storage tank to supply 110 degree Fahrenheit water to all required fixtures.
 - b. Provide piping distribution system for above.
 - c. Provide recirculating system for above.
- 3. Sanitary, waste and vent system:
 - a. Provide waste connection to existing system sized for the project demands.
 - b. Provide sanitary, waste and vent piping system sized for the project demands. System shall be gravity flow.
- 4. Plumbing fixtures
 - a. Provide plumbing fixtures and associated trim and specialties as required by the final architectural layout.
- 5. Roof drains:
 - a. Provide a storm drain connection to the existing system sized to the project demands.
 - b. Provide a piping system for the drain system sized for the project demands.
- 6. Sprinkler system (MCI Concord and BSCC):
 - a. Run flow test to determine hydraulic system design base.
 - b. Provide water service entrance sized by hydraulic design.
 - c. Provide a complete hydraulic sprinkler system including piping, heads, valves, flow and tamper switches, fire department connections and fire pump (if required).
 - d. Anti-suicide heads in all inmate areas.
 - e. System approved by the State Insurance Office.
- B. System Requirements
 - 1. The major components shall include, but shall not be limited to the following:
 - a. Steam to hot water heat exchanger and storage tank at MCI Concord and SMPRC; hot water to hot water at BSCC.

- v. Roof drain piping: same as waste piping.
 - w. Sprinkler piping: MCI Concord and BSCC, Schedule 40 black iron screw or victaulic joints.
2. The sprinkler systems at MCI Concord and BSCC shall be zoned in accordance with the fire wall separations of the building and coordinated with the fire alarm system.
 3. The waste water holding system at MCI Concord shall consist of three (3) 25,000-gallon holding tanks, piping and pumping system. The system will be installed adjacent to the existing treatment plant and will act as a buffer/holding facility to level out the flow of waste water through the plant. The pumping will be sized to match the peak flow rate of the plant (262 GPM). The existing piping to the plant will be diverted to the tanks and then pumped back to the plant. The system shall be complete with screens and grinders as required. Itemized pricing for this work is required.
 4. The existing facility at BSCC is having problems with an underground waste piping system consisting of manholes and piping. The problem seems to be in a pipe approximately 400 feet from the building. The pipe in question shall be dug up and replaced. Itemized pricing for this work is required.
- C. Materials
1. Hot and cold water, horizontal roof drainage, piping insulation: 1" fiberglass with ASJ jacket and Zeston PVC fittings, fire and smoke ratings shall be 25 and 50, respectively.
 2. Solder: lead free.
 3. Wall and floor penetrations: provide chrome-plated escutcheons.
 4. Ball valves: Appollo.
 5. Shock absorbers: Taco.
 6. Copper pipe below slab: Type K soft copper.
- 15A.03 Execution
- A. The work shall conform to the recognized standards of the industry and be installed in a workmanlike manner by tradesmen skilled in their profession.
- 15A.05 CONSTRUCTION SAMPLES, TESTS AND SUBMISSIONS
- A. Shop drawings shall be submitted for approval for all equipment furnished and installed as part of this Contract.
 - B. Record drawings on reproducible mylar shall be submitted for review prior to final approval of the project. Indicate valve numbers for all systems and all as-built conditions.
 - C. Certified testing, balancing and temperature reports shall be forwarded to DCPO for review prior to final approval of the project.
 - D. The installation shall be guaranteed for a minimum of two (2) years after final acceptance/approval of the project.
 - E. Equipment Manuals are required for training personnel in the use of all essential operating systems.
 1. Each manual shall cover the complete operations, maintenance, tools and licenses that will be required for the safe and efficient operation of the products and systems contained in this Section.
 2. Three months prior to delivery of these manuals the DBT shall deliver draft copies of the text for review and comment by DCPO.
 3. Operations seminars shall be conducted for Institution operating personnel.

SECTION 15B - HEATING, VENTILATING AND AIR CONDITIONING

15B.01 GENERAL

A. The scope of this Section involves the mechanical systems required, including HVAC and related work to provide a complete and operational system.

B. Existing conditions of MCI Concord: The complex is heated from a central boiler plant outside the security wall. The 15 psi steam supply and condensate return system is distributed throughout the site through an underground piping and manhole system. Steam is produced by three high pressure steam boilers in the power plant. The boilers and distribution system appear to have the capacity to accept the supply requirements of Phase I construction. The existing distribution system is insulated schedule 40 black iron pipe. It shall be used to supply the heating and hot water demands for Phase I. The existing conditions and capacities of the distribution system shall be verified by the DBT to ensure the proper tie-in points and determine that adequate capacity does in fact exist for the design proposed.

C. Existing conditions of BSCC: BSCC is heated by a bank of boilers in weatherproof enclosures. The boilers supply an 11-zone hot water heating system. The boilers are supplied fuel from an on-site 10,000-gallon underground storage tank. The existing boilers are in poor condition and it is recommended that the entire heating plant be removed and replaced with new equipment. It does, however, appear that the existing fuel tank could be used to supply fuel to a new heating plant. It is requested, therefore, that a No. 2 oil-fired system be installed. The existing tank's construction, condition and capacities shall be verified by the DBT to ensure the proper tie-in points and determine that the tank can in fact be legally utilized within current EPA guidelines.

D. Existing conditions of SMPRC:

1. The existing heating system will be reused. Relocate radiators where required by renovation; other radiators should remain. Relocate kitchen makeup air unit to allow reallocation of space. Replace existing condensate pumps. Provide mechanical ventilation for toilet rooms. Provide a laundry dryer exhaust system. Provide conditioning to areas as shown in architectural program.

2. Existing 15-psi steam service coming to existing building appears adequate to provide energy for the new structure. It is the responsibility of the DBT to verify that adequate capacity exists for the design proposed.

Modify steam piping to accommodate a new heat exchanger in the

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14. Mass State Building Code: all applicable rules and regulations to which the Office is subject and which are contained in the code authorized by Chapter 802 of the Acts of 1972 including all amendments thereto.

15. Plan(s): drawing(s).

16. Change Order: a written order not requiring the consent of the Design/Builder, signed by the Project Manager and designated as an approved change order, directing the Design/Builder to make changes in the work within the general scope of the contract, or, any written order from the Project Manager which causes any change in the work.

17. Contract Modifications: any written alteration in the contract documents, period of performance, price, quantity, or any other provisions of the contract accomplished by mutual action of the parties to the contract.

Where reference is made in the contract documents to Publications, Standards or Codes issued by Associations or Societies, the intent shall be to specify the current edition of such publication or standard.

ARTICLE II - DESCRIPTION OF WORK - TWO PHASE CONTRACT - INTERPRETATION - INTENT

1. Phase I - Design Obligations; Phase II - Construction Obligations

(a) This design/build contract is divided into two distinct but related phases, Phase I - Design Obligations and Phase II - Construction Obligations. The services to be performed under Phase I - Design Obligations are covered by Articles I - XVI. The services to be performed under Phase II - Construction Obligations are covered by Articles XVII - XXI.

(b) The Office and the Design/Builder shall execute Article XVI, Contract Signatures Phase I - Design Obligations before proceeding with design of the Project. In the event that the Office continues the Design/Builder's services into Phase II - Construction Obligations, the Office and the Design/Builder shall execute Article XXI, Contract Signatures Phase II - Construction Obligations.

(c) The Director of the Office shall, in his sole discretion, determine if the Design/Builder shall be continued into the Phase II - Construction Obligations phase of the contract. In the event that the Design/Builder is not continued into Phase II, the Design/Builder shall have no further claim against the Office on account of such failure to continue other than claims submitted pursuant to Article XIV, provided however, that if the termination is due to unsatisfactory performance, as described in Article XXII Paragraph 1, the Design/Builder shall not be entitled to a termination charge.

2. The work consists of the design and construction of Mass. State Project No. P86-3 Design/Build for three Correctional Facilities.

The Design/Builder agrees to design and construct at his own expense all the work and furnish all the materials required by the Contract Documents in a proper, thorough and workmanlike manner, in accordance with the terms of this contract, and to complete the entire work in this contract.

The Contract Documents are to be considered together, and are intended to be mutually complementary, so that any work shown on the plans, though not specified in the specifications, and any work specified in the specifications though not shown on the plans, is to be executed by the contractor as part of this contract. Figured dimensions are to prevail over scale. All things which in the opinion of the Office may reasonably be inferred from the contract documents are to be executed by the contractor under the terms of the contract. In case of discrepancies within the Contract Documents the discrepancy shall be resolved in a manner that provides the Office with the more valuable material, equipment, or system.

3. Precedence Clause

In the event of conflict or inconsistency between any of the provisions of the various portions of this contract (the reconciliation of which is not otherwise provided for here) precedence shall be given in the following order, the provisions of any particular portion prevailing over those of a subsequently listed portion.

- (1) The provisions of the "Request for Proposals" issued in connection with this contract (including all addenda, amendments, or other modifications issued thereunder).
- (2) Provisions of the Contract and General Conditions including any mutually agreed revisions or amendments thereto.
- (3) The contents of the Design/Builder's proposal, including but not limited to his forwarding letter, drawings, outline specifications, accepted alternates or additives, and materials, tests or other data (including all supplements, amendments and modifications thereto).
- (4) The Office-reviewed Design/Builder-prepared working documents, except to the extent that any variation therein has been specifically approved in writing pursuant to Article VII or Article VIII.

ARTICLE III - DESIGN/BUILDER'S DESIGN OBLIGATIONS - GENERAL

1. Design services shall be performed by the registered architects, engineers and other qualified professionals identified by the Design/Builder in the request for qualification and selected and paid by the Design/Builder. The Design/Builder shall not employ consultants, sublet, assign or transfer any part of his services or obligations under this agreement without the prior approval of and written consent of the Director. The written consent shall not in any way relieve the Design/Builder from his responsibility for the professional and technical accuracy and the coordination of all data, designs, drawings, specifications, estimates, construction and other work or materials furnished.

2. Except as otherwise provided in this contract or authorized by the Director, the Design/Builder shall employ within the lump sum contract amount for this project the following consultants where their specific services are required: Structural Engineer, Electrical Engineer, Mechanical Engineer, Civil Engineer, Sanitary Engineer, Architect, Landscape Architects, Cost Estimators, Correctional Consultant, Geotechnical Engineer and any other consultants the Design/Builder determines are required during the design and construction of the Project. Consultants must be registered in their respective disciplines if registration is required under the applicable Massachusetts General Laws.

3. When the Design/Builder receives payment from the Commonwealth, the Design/Builder shall promptly make payments to each consultant whose work was included in the work for which such payment was received from the Commonwealth.

4. The Design/Builder's attention is directed to Article XXVII 2(d) requiring minority business enterprise set aside during the design phase of the project.

ARTICLE IV - SURVEYS, BORINGS, BUILDING PLANS, TESTS, LABORATORIES

1. The Office shall furnish to the Design/Builder available surveys of the project's building site, or sites, showing the grades and lines of streets, pavements and adjoining properties; the rights, restrictions, easements, boundaries and contours of the site, or sites; reports from any borings, test pits, chemical, mechanical or other tests, any photographs and information as to water, sewer, electricity, steam, gas, telephone and other services.

1A. The Office shall furnish to the Design/Builder measured drawings of existing buildings at Bay State Correctional Center and South Middlesex Pre-Release Center.

2. The Office does not guarantee the accuracy of information furnished and the Design/Builder must satisfy himself as to the correctness of data. If the Design/Builder considers the information supplied by the Office to be insufficient, the Design/Builder, may at its own expense obtain the services of a consultant or perform the work necessary to provide correct data with his own employees.

3. Drawings and/or specifications needed to obtain survey or subsoil information, and any other soils engineering shall be prepared by the Design/Builder within the lump sum contract amount. The Design/Builder shall then analyze and evaluate such surveys and tests and make his design conform to the results of such evaluation.

4. The Design/Builder shall be responsible for inspecting and verifying existing conditions and shall upon proper notice and scheduling of the user agency, be provided the opportunity to do reasonable exploratory testing of existing buildings scheduled for renovation.

ARTICLE V - CODE REQUIREMENTS, STANDARDS

The Design/Builder shall perform its design under this contract in conformity with requirements, codes, and standards of the Office and all applicable laws of the Commonwealth of Massachusetts, its political subdivisions and the Federal Government.

ARTICLE VI - PROFESSIONAL RESPONSIBILITY AND SERVICES TO BE PERFORMED

1. The Design/Builder shall be solely responsible for the professional and technical accuracy and the coordination of all designs, drawings, specifications, cost estimates, construction, and other work furnished by him or his consultants and subcontractors. The Design/Builder shall staff his office with sufficient personnel to complete the services required under this contract in a prompt and continuous manner, and shall meet the approval schedule and submittal dates established during the course of this contract.

2. The Design/Builder shall furnish appropriate competent professional services for each of the phases to the point where detail checking or reviewing by the Office will not be necessary. Any changes, corrections, additions or deletions proposed by the Project Manager shall be incorporated into the design of the project. Except as otherwise provided in this agreement, the Design/Builder shall be permitted to determine materials, equipment, component systems and types of construction to be included in the design of the project.

ARTICLE VII - DESIGN SCHEDULE

Design Phase I -- Design Development Documents

Upon receipt of a Notice to Proceed the Design/Builder shall meet as necessary with agents of DCPO and the operating agency and shall prepare, from the approved Design/Builder's proposal, complete preliminary plans and outline specifications to enable the Office and the operating agency to study and understand the progress and development of the Project. Such plans and outline specifications shall be submitted to the Office for its review on or before the date specified in the Notice to Proceed. The Design/Builder shall submit to the Director for review six (6) copies of said preliminary plans and specifications, on or before the date or time for submission specified in the Notice to Proceed or any supplement thereto, unless the Design/Builder shall have obtained from the Director a written extension of time. The preliminary plans shall: (a) develop the intent of the Design/Builder's Proposal in sufficient detail to clearly define every feature of the building system; (b) provide information customarily necessary for the use of those in the building trades; (c) include documents customarily required for regulatory agency approvals; (d) include a detailed cost estimate; (e) include any other information reasonably requested by the Office.

Design Phase 2 -- Working Documents

Upon receipt of a Notice to Proceed for Phase 2 of the design of the project, the Design/Builder shall meet as necessary with agents of the Office and the operating agency, and shall prepare and submit to the Director on or before the date specified in the Notice to Proceed complete working plans and specifications, hereinafter "working documents", in sufficient detail to permit the Design/Builder to proceed into construction of the project. Said working documents shall be based on the design development, outline specifications and construction cost estimate approved in Design Phase 1 of the project, the Notice to Proceed with Design Phase 2, or any subsequent modifications thereto. Design calculations shall be submitted for mechanical, electrical, structural (include structural design criteria used in design, boring logs, wind loading analysis, etc.) plumbing work, pavements, all utilities, storm drainage, heat transmission coefficients, and as otherwise necessary for a complete review of all architectural and engineering design work. Electrical design calculations shall include voltage drop computations, short circuit analysis, load calculations, and lighting calculations. This submission shall include a detailed cost estimate and a color board to indicate color selection for paint, stain, flooring, carpet, and other materials, coatings, and surfaces to be used on the Project. Working documents and any changes to those documents shall be approved by a registered professional architect or engineer before submittal to the Office for review. Upon completion of Office review of the working documents (see Article XVII, Paragraph 3 entitled "Reviews Prior to Construction"), the Design/Builder shall furnish the Office one reproducible copy of the working documents. The Design/Builder shall furnish to the Director six (6) sets of the working documents. From the working documents, with changes incorporated as so endorsed, the Design/Builder shall prepare and transmit to the Director a set of reproducible plans on cloth or mylar, (4 mil.) and original specifications on high quality white bond paper properly packaged, suitable for blueprinting, which shall become the property of the Commonwealth. See Article XVII, Paragraph 3 providing for the submission of partial working documents and for the commencement of partial construction prior to the acceptance by DCPO of all the working documents.

ARTICLE VIII - OFFICE REVIEW OF DESIGN SUBMISSIONS

1. The Design/Builder is solely responsible for the design of the Project. Whenever this contract requires the Design/Builder to make design submissions to the Office, those submissions shall be subject to the review of the Office and its agents. The Office may disapprove or require revisions to design submissions whenever the Office determines that submissions do not conform to the contract requirements or professional design standards customary for a project of the size and scope covered by the contract. Such right to revise or disapprove design submissions shall under no circumstances be considered to relieve the Design/Builder of the sole responsibility for those design submissions that are not revised or disapproved by the Office.
2. Contract completion time (see paragraph entitled "Commencement, Prosecution, and Completion of Work") includes time for government review of drawings and specifications. Normally the Office will not require more than 20 days to review the design submissions. Final design submissions found to be incomplete or not in compliance with the Request for Proposals will be returned

to the Design/Builder for correction and resubmission. Under such circumstances the Office shall have an additional 20 day period to review the revised submittals with no increase in the total contract completion date provided.

ARTICLE IX - AWARD PRICE - PHASE I DESIGN OBLIGATIONS

The Commonwealth shall pay and the Design/Builder shall receive as full compensation for everything furnished and done by the Design/Builder under the Phase I - Design Obligations phase of the contract, for well and faithfully completing the work, as herein provided, as follows:

ARTICLE X - METHOD OF PAYMENT TO DESIGN/BUILDER

For purposes of payment, the award price shall be separated into the following two categories: (1) basic design fee, (2) construction services and the amount designated for each category shall be as designated on Schedule B.

A. Method of Payment - Design Services.

- (a) Upon submission of preliminary design development documents as specified in Article VII, the Design/Builder shall be paid 25% of the basic design fee.
- (b) Upon acceptance by the Office of preliminary design development documents as specified in Article VII, the Design/Builder shall be paid 30% of the basic design fee, less the amount previously paid under sub-paragraph (a).
- (c) Upon submission of working documents as specified in Article VII, the Design/Builder shall be paid 55% of the basic design fee, less the amount previously paid under sub-paragraph (b).
- (d) Upon acceptance by the Office of working documents as specified in Article VII, the Design/Builder shall be paid 70% of the basic design fee, less the amount previously paid under sub-paragraph (c).
- (e) For architectural and engineering services of the Design/Builder during the construction of the Project the Design/Builder shall be paid the remaining balance of its basic design fee in accordance with a payment schedule to be submitted to the Office for its review and approval, at the pre-construction meeting described in Article XVII, Paragraph 4 provided, however, that said payment schedule shall entitle the Office to retain 5% of the basic design fee until final acceptance of the project has been taken by the Office.

(f) Where multiple buildings are included in a contract or phased design submittals are approved by DCPO, the payment provisions of sub-paragraphs (a), (b), (c), and (d) shall be subject to mutually acceptable revision.

ARTICLE XI - EXTRA COMPENSATION - DESIGN SERVICES

1. With the formal written approval of the Director, the Design/Builder shall perform all or any of the following additional design services. For such services the Design/Builder shall be compensated by the Commonwealth at the rate of sixty (\$60.00) dollars per hour for the time of any principal architect or engineer of the Design/Builder or any approved consultant to the Design/Builder and for the time for any technical employee of the Design/Builder or any such Consultant at the rate of two and one-half (2½) times the wages of such employee, provided that in no event shall the hourly rate of said technical employee exceed the total sum of sixty (\$60.00) dollars per hour: (1) revising previously submitted drawings, specifications or other documents to accomplish changes authorized by the Director, (2) making studies other than those normally required as determined in the sole discretion of the Director, and preparing applications and reports to assist the Office in obtaining federal or state regulatory approvals, (3) performing services for interior design, and (4) performing any other professional services authorized by the Office not otherwise required under this contract. In no event shall the Design/Builder be entitled to extra compensation for design services expended in correcting discrepancies or omissions in any design submissions regardless of the time of discovery by the Office.

ARTICLE XII - REIMBURSEMENT

1. If the Director directs the Design/Builder to hire a consultant not included in the Designer team included in the Design/Builder's request for qualification, to undertake special studies or tests not customarily performed in the design or construction of a project of similar size and type as the subject project, the Design/Builder shall be entitled to be reimbursed for the reasonable costs expended on said consultant. The Design/Builder and the Office may agree to compensate the consultant on an hourly, lump sum, or unit price basis.
2. The Design/Builder shall be paid an additional ten percent (10%) of its actual costs for a special consultant hired under paragraph 1 of this article and said mark-up shall compensate the Design/Builder for the coordination, supervision, and responsibility for the special consultant's work.

ARTICLE XIII - DESIGN SERVICES DISPUTES BETWEEN OFFICE AND DESIGN/BUILDER

Disputes that may from time to time arise between the Design/Builder and the Office, regarding the interpretation of the contract documents, the quality of the Design/Builder's design, the compensation of the Design/Builder for design services claimed pursuant to Articles XI and XII, or any other

disagreement over the design of the project and the Design/Builder's or Office's costs related thereto, shall be documented in the form of a change order as provided in Article XX and resolved pursuant to the procedures contained in Article XX 4 (c).

ARTICLE XIV - TERMINATION PRIOR TO CONSTRUCTION

In the event that this contract is terminated by the Office, prior to the commencement of construction, and such termination is not based on a reason listed in Paragraph 1, the Design/Builder shall be compensated for its design services calculated pursuant to Article XI 5A, covering the period of time between the last periodic payment and the date of termination. Design/Builder shall, in addition, be paid a termination charge equal to 5% of the total amount previously paid during the design services phase of the project, including the amount payable under the previous sentence, and said termination charge shall be considered as full compensation to the Design/Builder for all of its claims and expenses and those of its subcontractors and suppliers, directly or indirectly attributable to the termination.

ARTICLE XV - PHASE II CONTRACT PROVISIONS APPLICABLE TO PHASE I

The following provisions of the contract shall apply fully to Phase I -Design Obligations, as well as Phase II - Construction Obligations and are incorporated by reference into the Phase I contract:

- Article XXVII Minority and Women Business Enterprise Set Aside Requirement
- Article XXVIII Design/Builder's Accounting Method Requirements
- Article XXIX Insurance Requirements Paragraphs A, H, I
- Article XXX Indemnification
- Article XXII Termination

ARTICLE XVI - CONTRACT SIGNATURES - PHASE I - DESIGN OBLIGATIONS

In Witness Whereof, the parties have hereunto set their hands and seals, the Comptroller by the Director of the Office, who incurs no personal liability by reason of the execution hereof of anything herein contained and who hereby certifies under penalties of perjury that this contract is executed in accordance with a prior approval of the Deputy Commissioner of Capital Planning and Operations and that all the applicable provisions of General Law Chapter 149, section 44J, have been complied with, to the extent that they apply to this contract.

PHASE II - CONSTRUCTION SERVICES

ARTICLE XVII - GENERAL PERFORMANCE OBLIGATIONS OF THE DESIGN/BUILDER - PHASE II - CONSTRUCTION SERVICES

1. Continuation Into Phase II: Upon the decision by the Director of the Office to continue the Design/Builder into Phase II - Construction Obligations, the Office and the Design/Builder shall execute Article XXI, Contract Signatures for Phase II - Construction Obligations.
2. Single Contract: Upon continuation into Phase II - Construction Obligations, the Phase I and Phase II contract provisions shall be considered a single contract.
3. Reviews Prior to Construction: Construction is not to commence until the Office has reviewed the working documents and provided the Design/Builder with a Notice to Proceed into the construction of the Project. Such review does not constitute approval or acceptance of any variations from the Request for Proposals or from the proposal unless such variations have been specifically pointed out in writing by the Design/Builder and specifically approved in writing by the Office. To expedite project development the Office may accept a design submission for site development, foundations and long lead-time equipment and hardware, and if found satisfactory, allow the Design/Builder to proceed with earthwork and other elements of site development, foundations, and ordering long-lead time equipment and hardware, while final plans and specifications for the total work are completed. The responsibility for a totally integrated design in accordance with the contract will remain with the Design/Builder and this interim Notice to Proceed, if exercised, will in no way mitigate against that responsibility.
4. Pre-Construction Conference: Prior to commencement of the work, the Design/Builder shall meet in conference with representatives of the Office to discuss and develop mutual understandings relative to administration of the quality assurance program, safety program, labor provisions, and other contract procedures.
5. Design Services During Construction
 - (a) Upon the commencement of construction, and with the direct involvement of its registered architect and engineers, and qualified testing firms, the Design/Builder shall promptly check the work and review and approve samples, schedules, shop drawings, and other submissions customarily made during the construction of a project to insure that the progress and quality of construction is in accordance with the construction documents and customs, standards of the construction industry for construction projects of similar size and type.
 - (b) The samples, schedules, shop drawings, and other submissions approved by the Design/Builder pursuant to the prior paragraph, shall be submitted to the Office for its review and approval. If, within fifteen days of submission to the Office, the Office notifies the Design/Builder in writing, that submissions made pursuant to this paragraph have been disapproved, or that the Office requires additional information or time to evaluate the submission, the

Design/Builder shall forthwith provide the Office with new submissions or the additional information required by the Office, and the Office's tier for review of the re-submittals shall commence upon receipt.

(c) As-Built Drawings: Prior to final payment, the Design/Builder shall enter all changes and corrections on the original tracings. Changes and corrections so entered shall be indicated by a lettered circle and noted "as-builts" in the revisions space provided. In the case where no revisions or corrections on an individual drawing were necessary, the notation "As-Built - No Changes" shall be made directly below the revision block. The Design/Builder shall submit the "as-built" tracings to the Office for acceptance and retention.

6. In general, the Design/Builder shall:

(a) Give all notices, take out all permits, pay all charges, fees, water and other rates therefor, give personal supervision to the work, keep a full time competent superintendent and sufficient competent employees on the site until the completion of the work, carry on the work with all proper speed, and in accordance with the requirements of law and of all other public authorities, and to the satisfaction of the Office, and furnish the Office with such information and vouchers relative to the work, the materials therefor, and the persons employed thereon, as the Office shall from time to time request.

(b) Furnish to the Office in a timely manner all coordination drawings, shop details, shop drawings, and setting diagrams which may be necessary to acquiring and installing materials. These shall be reviewed as required by the Office and a minimum of four (4) copies shall be submitted for final approval, one of which shall be returned to the Design/Builder, one to the Resident Engineer, two to the Office. The inspection and acceptance by the Office of shop drawings, etc. shall be general and shall in no way relieve the Design/Builder from responsibility for the design, proper fitting, construction, and construction sequencing of the project.

(c) Furnish such batter boards and stakes and cause to be placed thereon so as to be easily read, such lines, marks and directions relating to the work as the Office may from time to time direct, and if any are removed or cannot be easily read, replace same.

(d) Prevent, by sheeting and shoring or bracing, if necessary, any caving or bulging of the sides of any excavation made by the Design/Builder, leaving sheeting and shoring in place, and if any is removed, fill solid the spaces left thereby.

(e) Provide pumping, drainage, and disposal of all water and/or whatever flows in any conduit interfered with by the Design/Builder so that no puddle or nuisance will be caused by water or flood; protect everything from injury by water, frost, wind, fire, accident or other cause, and from any interference.

attached or affixed to the work or the soil; but all such materials shall, upon being so attached or affixed, become the property of the Commonwealth. Approvals or determinations of acceptability of materials by the Office shall not in any way be construed to relieve the Design/Builder of its full responsibilities under this Contract.

ARTICLE XIX - PROSECUTION AND PROGRESS - LIQUIDATED DAMAGES - BONUS CLAUSE

1. Beginning, Progress Schedule and Completion of Work.

(a) The schedule for work is indicated on Schedule A.

(b) The contract time commences immediately from the date that the executed copy of the contract accompanied by a NOTICE TO PROCEED is mailed or presented to the Design/Builder or within such other period as the Office shall authorize in writing. The Design/Builder shall begin work on the project within five days of the date that a properly executed copy of this contract is delivered to the Design/Builder, unless otherwise ordered in writing by the Office.

(c) Prior to commencement of the work the Design/Builder shall submit to the Office for approval, a progress schedule in satisfactory form, showing in detail his proposed progress for the construction of the various parts of the work and the proposed times for receiving materials required. He shall at the end of each month, or more often if required, furnish the Office, a schedule showing actual progress of the various parts of the work in comparison with the originally proposed progress schedule as approved.

(d) Time is of the essence in the performance of work under this contract which shall be completed on or before the number of calendar days (or date) specified in Schedule A. Should the Design/Builder require additional time to complete the work he shall document his reasons therefor and request an extension of time at the time the alleged delay occurred, as provided in this Article and Article XX. Failure to notify the Office of any delay as provided in this Article shall preclude the Design/Builder from subsequently claiming any damages due to said delay. Requests for extension of time shall be submitted to the Office under Article XX.

2. Failure to Complete Work on Time - Liquidated Damages.

(a) Since time is of the essence and since, moreover, the amount of damage and loss to the Commonwealth which will result from the Design/Builder's failure to turn the building or buildings over to the operating agency for use and occupancy within the time specified in this contract (see Schedule A) will be difficult or impracticable to ascertain if use and occupancy has not been realized by the date specified (as extended by any authorized extension of time granted in accordance with the provisions of Article XX) the Design/Builder shall pay to the Office the sum of (see Schedule B), for each and every calendar day that he is in default in reaching the use and occupancy date(s). Such moneys shall be paid as liquidated damages, not as a penalty, to partially cover losses and expenses to the Office. Schedule A indicates the use and occupancy dates for each building.

(b) The Office shall recover such liquidated damages by deducting the amount thereof out of any moneys due or that might become due the Design/Builder, and if such moneys be insufficient to cover the liquidated damages, then the Design/Builder or the Surety shall pay the amount due.

Permitting the Design/Builder to continue and finish the work or any portion of it after the time fixed in the Contract for use and occupancy (as extended by an authorized extension of time granted in accordance with the provisions of Article XX), shall not operate as a waiver on the part of the Office of any of its rights under the Contract.

The assessment of liquidated damages or a portion thereof may be waived by the Office if the Director, in his sole discretion, determines that the delays were caused solely by conditions beyond the control of the Design/Builder and that the Commonwealth has not suffered any damages as a result of said delay.

3. Bonus Clause.

(1) In the event that the Director, with the advice of the operating agency, approves use and occupancy of the construction required at any site prior to the date for final completion of such construction as specified in Schedule A, the Office shall pay the Design/Builder an additional amount in accordance with Schedule B for each day remaining up to the date specified for use and occupancy of the project, such sum shall not to exceed \$210,000.

(2) As a pre-requisite to the Design/Builder's receiving additional compensation pursuant to subparagraph 1 of this Article, use and occupancy must be approved prior to the date specified in Schedule A. If use and occupancy is not approved by the Director prior to the date specified in Schedule A, regardless of time extensions approved, pending, or requested due to the issuance of contract modifications, change orders, acts of God, strikes, and any other delay whether caused by the Design/Builder, the Office, or any other entity, or combination thereof, then the Design/Builder shall have no claim for additional compensation pursuant to this Article.

(3) For the purposes of this Article and subparagraph 3 of this Article, the term "use and occupancy" means that the work or a specified portion of the work has been completed sufficiently to be utilized for the intended purpose of the project, as determined by the Director in his absolute discretion.

4. Delays.

Except as provided in subparagraph (a) and (b) of this paragraph, the Design/Builder shall not be entitled to damages on account of any hindrances or delays, avoidable or unavoidable; but if such delays be occasioned by the Office, the Design/Builder may be entitled to an extension of time only, in which to complete the work, for a period to be determined reasonable by the Office.

(a) The Office may order the Design/Builder, in writing, to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the Office; provided however, that if there is a suspension, delay or interruption for fifteen days or more or a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the Design/Builder on account of such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The Design/Builder must submit the amount of a claim under subparagraph (a) to the Office in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract, and, except for costs due to a suspension order, the Office shall not approve any costs in the claim incurred more than twenty days before the Design/Builder notified the awarding authority in writing of the act or failure to act involved in the claim.

5. Use and Occupancy Prior to Final Acceptance.

(a) Upon request of the Office, the Design/Builder shall make reasonable efforts to provide the Commonwealth with use and occupancy of the project before final acceptance by the Office.

(b) The Agency will cooperate with the Design/Builder in respect to the completion of the work by taking such reasonable steps as may be possible to avoid interference with the Design/Builder's work provided it does not interfere with the proper functioning of the facility.

(c) The Design/Builder shall not be responsible for wear and tear or damage resulting solely from temporary occupancy.

(d) Use and occupancy of all or any part of the work prior to final acceptance does not relieve the Design/Builder from maintaining the required payment and performance bonds, and insurance requirements under this Contract.

ARTICLE XX - CHANGES IN WORK

1. General.

A change order request may be submitted to the Office by the Design/Builder, Project Manager, Resident Engineer, or using agency. The change order request must be made in writing, and in accordance with the provisions of this Contract, the General Laws, rules, regulations, and other procedures of the Office. See DCPO Form 13 included herein.

A change order may be submitted for changes in the work within the scope of the contract, including but not limited to, changes in: (a) the plans and specifications; (b) in the method or manner of performance of the work; (c) in the Commonwealth furnished facilities, equipment materials, services or site; (d) in the schedule for performance of the work.

Since the Design/Builder is responsible for the design and construction of the project, the Design/Builder shall not be entitled to additional compensation associated with design deficiencies, omissions, or conflicts in the Contract Documents, nor will the Design/Builder be entitled to extensions of time in which to resolve or correct such deficiencies, omissions or conflicts.

The Design/Builder shall only be entitled to additional compensation when one of the following situations applies: (a) the Office directs a program change; (b) the Office directs a change in the Contract Documents; (c) the Design/Builder encounters unanticipated sub-surface conditions that were not reasonably foreseeable during the design of the project; (d) the Office fails to act within the time limits provided in this Contract and said failure results in a significant delay in the work.

The Project Manager, subject to the approval of the Director when necessary as provided in G.L. c. 7 section 42E, may direct the Design/Builder to perform any change order work and the Design/Builder shall immediately do any and all work required to effect the change in Contract.

Whenever a change order is requested or ordered, and said change will cause an adjustment in the Design/Builder's cost, the Design/Builder or Project Manager may request an equitable adjustment in the Contract price. A request for such an adjustment shall be in writing and shall be submitted by the party making such claim to the other party before commencement of the pertinent work or as soon thereafter as possible.

The Project Manager and the Design/Builder shall attempt to negotiate an equitable adjustment in the contract price before commencement of the pertinent work, or as soon thereafter as possible. In the absence of an agreement for an equitable adjustment, the Project Manager shall unilaterally determine the costs attributable to the change, and provide the Design/Builder with a written notice to that effect. The Design/Builder may appeal the decision of the Project Manager within thirty days of receipt of said notice, to the Deputy Commissioner or his designee, said appeal to be subject to further review pursuant to G.L. Chapter 30, §39Q.

During the negotiation of an equitable adjustment in contract price, the Design/Builder shall, if requested, provide the project manager with all cost and pricing data used by him in computing the amount of the equitable adjustment, and the Design/Builder shall certify that the pricing data used was accurate, complete and current. If the project manager subsequently determines that the data submitted by the Design/Builder was incomplete, incorrect, or not current, the project manager may exclude such data from consideration under the equitable adjustment request.

2. Methods of Computing Equitable Adjustments.

Equitable adjustments in the contract price shall be determined according to one of the following methods, or a combination thereof; as determined by the project manager:

- (1) fixed price basis, provided that the fixed price shall be inclusive of items a. through e. (below) and shall be computed in accordance with those provisions.
- (2) estimated lump sum basis to be adjusted in accordance with contract unit prices, or other agreed upon unit prices provided that the unit prices shall be inclusive of all costs related to such equitable adjustment.
- (3) time and materials basis - on a not-to-exceed predetermined upset amount to be subsequently adjusted on the basis of actual costs based on a. through e. below.

- a. the cost at prevailing rates for direct labor, material and use of equipment.
- b. plus cost of Workmen's Compensation Insurance, Liability Insurance, Federal Social Security and Massachusetts Unemployment Compensation, or as an alternative the Design/Builder may elect to use a flat 25% of the total labor rate in (a).
- c. plus 20% of (a) for overhead, superintendence and profit which will be paid to the Design/Builder for the work of the Design/Builder and all his subcontractors. The Design/Builder and his subcontractors shall agree upon the distribution of the 20% as a matter of contract between each other.
- d. If the net change is in addition to the contract price it shall include the Design/Builder's overhead, superintendence and profit. On any change which involves a net credit, no allowance for overhead, superintendence and profit shall be figured. For any change that does not include labor performed or materials installed in the project, there will be no markup for the Design/Builder's overhead, superintendence, and profit, although there is a net increase in the contract. Charges for small tools known as "tools of the trade" are not be computed in the amount of a change.
- e. plus actual direct premium cost of payment and performance bonds required of the Design/Builder and its subcontractors, provided there will be an appropriate credit for premiums for a credit change order.

3. Work Performed Under Protest.

The Design/Builder shall perform all work as directed by the Office, and if the Project Manager determines that certain work for which the Design/Builder

has requested a change order under this Article, does not represent a change in work, the Design/Builder shall perform said work under protest and must follow the procedures described in paragraph 2 (3) of this Article if the Design/Builder intends to pursue a claim against the Office pursuant to this Article. Whenever a Design/Builder performs work under protest he shall comply with the following sub-paragraphs (a) and (b):

(a) If the Design/Builder claims compensation for a change not approved by the Office, he shall on or before the first working day following commencement of any such work or sustaining of any such damage submit to the Resident Engineer and the Office a written statement of the nature of such work or damage sustained. Any work performed or damage sustained prior to the time specified above, even though similar in character, will not be considered as warranting compensation, it being clearly understood that the commencement of any such work or sustaining of any such damage will be recognized only when and as submitted in writing in accordance with this paragraph 3.

(b) On or before the second working day after the commencement of such work or sustaining of such damage, and daily thereafter, the Design/Builder shall file to the extent possible with the Resident Engineer and the Office, itemized statements of the details and costs of such work performed or damage sustained; and unless such statements shall be made as so required, his claim for such compensation shall be forfeited and invalid; and he shall not be entitled to payment on account of any such work or damage.

4. Statutory Change Order Provisions.

Design/Builder's attention is directed to Massachusetts General Law, Chapter 30, sections 39I, 39J, Massachusetts General Law, Chapter 7, sections 42E - 42I, the provisions of which shall be considered to apply to this contract.

(a) Differing Site Conditions, M.G.L. Chapter 30, Section 39N. If, during the progress of the work, the Design/Builder or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the Design/Builder or the Office may request an equitable adjustment in the contract price applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a Design/Builder, or upon its own initiative, the Office shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the Office shall upon a properly submitted change order request by the Design/Builder make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly. Since the Design/Builder is responsible for the design of the project, he shall not be entitled to an

equitable adjustment pursuant to this paragraph 4 (a) unless the unanticipated sub-surface conditions encountered were not reasonably foreseeable during the design of the project.

(b) Timely Decision by Awarding Authority. Whenever this contract requires the Office or its agent to make a decision during construction of the Project, on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, that decision shall be made promptly and, in any event, no later than thirty days after the written submission for decision by the Design/Builder; but if such decision requires extended investigation and study, the Office shall, within thirty days after the receipt of the submission, give the Design/Builder written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made.

(c) Change Order Appeal Procedure, M.G.L. Chapter 30, Section 39O.

(1) Disputes regarding changes in and interpretations of the terms or scope of the contract and denials of or failure to act upon claims for payment for extra work or materials shall be resolved according to the following procedures, which shall constitute the exclusive method for resolving such disputes. After the Office has issued a decision on a change order, the Design/Builder may submit written notice of the matter in dispute promptly to the Deputy Commissioner of the Division of Capital Planning and Operations. The Design/Builder shall not delay, suspend, or curtail performance under the contract as a result of any dispute subject to this section. Any disputed order, decision or action by the agency or its authorized representative shall be fully performed or complied with pending resolution of the dispute.

(2) Within thirty days of submission of the dispute to the Deputy Commissioner, he shall issue a written decision stating the reasons therefore, and shall notify the Design/Builder of its right to appeal under this section. If the deputy commissioner is unable to issue a decision within thirty days, he shall notify the Design/Builder in writing of the reasons why a decision cannot be issued within thirty days and of the date by which the decision shall be issued. Failure to issue a decision within the thirty-day period or within the additional time period specified in such written notice shall be deemed to constitute a denial of the claim and shall authorize resort to the appeal procedure described below. The decision of the deputy commissioner shall be final and conclusive unless an appeal is taken as provided below.

(3) Within twenty-one calendar days of the receipt of a written decision or of the failure to issue a decision as stated in the preceding subparagraph, the Design/Builder may file a notice of claim for an adjudicatory hearing with the Division of Administrative Law Appeals or if the amount in controversy exceeds ten thousand dollars in lieu of appealing the decision to said Division, the Design/Builder may file an action directly in a court of competent jurisdiction and shall serve copies thereof upon all other parties in the form and manner prescribed by the rules of court. If the appeal is filed with the Division of

Administrative Law Appeals it shall be prosecuted in accordance with the formal rules of procedure for the conduct of adjudicatory hearings of said Division, except as provided below. The Administrative Magistrate shall issue a final decision as expeditiously as possible, but in no event more than one hundred and twenty calendar days after conclusion of the adjudicatory hearing, unless the decision is delayed by a request for extension of time for filing post-hearing briefs or other submissions assented to by all parties. Whenever, because an extension of time has been granted, the Administrative Magistrate is unable to issue a decision within one hundred and twenty days, s/he shall notify all parties of the reasons for the delay and the date when the decision will issue. Failure to issue a decision within the one hundred and twenty day period or within the additional period specified in such written notice shall give the petitioner the right to pursue any legal remedies available to him/her without further delay.

(4) When the amount in dispute is less than ten thousand dollars, the Design/Builder may elect to submit the appeal to an Administrative Magistrate experienced in construction law for expedited hearing in accordance with the informal rules of practice and procedure of the Division of Administrative Law Appeals. An expedited hearing under this subparagraph shall be available at the sole option of the Design/Builder. The Administrative Magistrate shall issue a decision no later than sixty days following the conclusion of any hearing conducted pursuant to this subparagraph. The Administrative Magistrate's decision shall be final and conclusive, and shall not be set aside except in cases of fraud.

ARTICLE XXI - PAYMENT PROVISIONS

1. Payment Liabilities of Design/Builder.

The Design/Builder shall pay to the Commonwealth all its expenses, losses, and damages, as reasonably determined by the Office, incurred in consequence of any defect, omission or mistake of the Design/Builder or his employees or the making good thereof.

In case the work embraced in this contract shall not be completed by the time herein appointed, the Design/Builder shall pay to the Commonwealth as liquidated damages and in full compensation for such delay the sum specified hereinbefore (see Article XIX, Paragraph 2).

2. Retention of Moneys by Office.

The Office may keep any moneys which would otherwise be payable at any time hereunder, and apply the same, or so much as may be necessary, therefore, to the payment of any expenses, losses or damages incurred by the Commonwealth, the Office of the Operating Agency, and determined as herein provided.