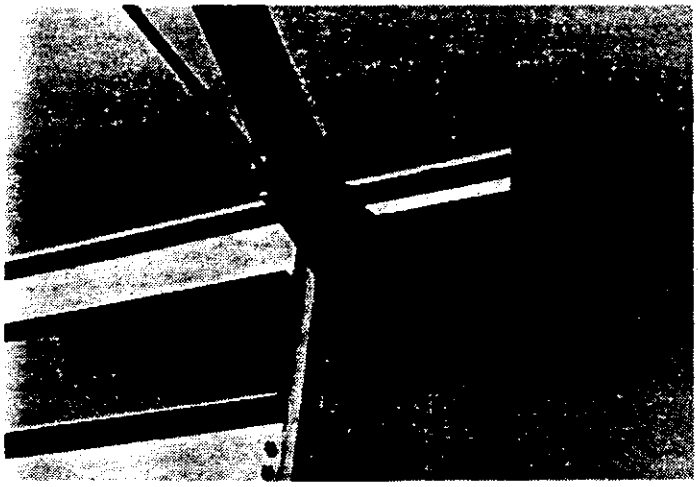
TECHNICAL PUBLICATION NO. 73

THE CONSTRUCTION MANAGEMENT APPROACH - AN INDUSTRY EXECUTIVE CONSENSUS

SPONSORED BY A GRANT FROM THE BUILDING

CONSTRUCTION INDUSTRY ADVISORY COMMITTEE



Dr. George Birrell

School of Building Construction
University of Florida
1991

THE CONSTRUCTION MANAGEMENT APPROACH - AN INDUSTRY EXECUTIVE CONSENSUS

by

Dr. George S. Birrell
Professor
Department of Architecture
University of Florida
Gainesville, FL 32611
(904) 392-0215

September 1990

Support for the research from which this report was written was provided by the State of Florida Building Construction Industry Advisory Committee (Chairman, Mr. Bill Conway; Project Managers, Mr. Paul Scheele, Mr. Charles Perry, and Mr. Daniel Whiteman) under contract UPN# 88092713, "A Study of Construction Management" with the School of Building Construction, University of Florida

CONTENTS

EXECUTIVE SUMMARY

THE CONSTRUCTION MANAGEMENT APPROACH- AN INDUSTRY EXECUTIVE CONSENSUS

by
Dr. George S. Birrell, Professor
Department of Architecture
University of Florida
Gainesville, Florida 32611
(904) 392-0215

INTRODUCTION This research report presents the consensus on the Construction Management approach to procuring buildings from an array of current top quality building industry executives who have considerable experiences of all procurement approaches in the building industry. The report presents the features and services of a Construction Manager to the client.

The information for this research report primarily came from the results of a series of six lengthy roundtable, guided but open ended discussions on construction management. Each meeting was guided by the same carefully prepared discussion guide/questionnaire and took place in a major urban area in Florida, U.S.A. Usually attending each meeting were two top quality representatives of building clients, architects, construction managers, general contractors and subcontractors.

MAJOR PARTS OF THE REPORT After introducing the evolution of construction management, the research process and uses of the report, the first major part of the report presents the conceptual and literal objectives of construction management and when and how construction management can be of greatest benefit to the client. Also presented are the major early decision variables which can affect the success potential of construction management, the factors by which to decide to use or not use construction management, the most appropriate organizational structure/communications pattern for construction management in the design, contracting and construction phases and the two feasible alternative contractual linkages between the client and the construction manager. The second major part of the report presents the features thought appropriate in a construction manager, how such services should be paid for and consideration of licensing for construction managers. It goes on to present the array of interactive normal services which should be available from a construction manager.

An appendix to the full report guides the reader to a set of key pages which respond to specific questions put in the initiating research contract regarding Construction Management.

In the remainder of this Executive Summary, some major points from the report are presented under its two major segments of Construction Management and The Construction Manager.

CONSTRUCTION MANAGEMENT The construction management approach provides building procurement and construction advice from an expert as a service agent to the client. That advice and work should provide the client with the best balance between all the benefits from the building and all the costs of the building.

It is complexity features, singly or in permutation, in the procurement process, in the client's situation, in the marketplace or in an unusual building or a desire for high quality agency advice by the client, rather than the building's size or total price, which should cause the client to use construction management.

Fast tracking i.e. the overlapping of the processes of design, contracting and construction in calendar time should be considered as an elective option rather than as a fixed feature of construction management.

Knowledge and appraisal of the local construction marketplace should enable the most appropriate segmentation of all construction work to contracts which best match the nature of that local construction marketplace as well as the procurement process.

The most appropriate organizational structure is the triumvirate of the client, the architect and the construction manager forming the core of the organization. Separately each usually communicates with secondary sub groups of roles. The client communicates with the departments of his organization, the architect with the array of design disciplines and the construction manager with the array of trade/subcontractors. All information flows pass through the triumvirate and it makes all major decisions regarding the building and its procurement. Each of the client, architect, and construction manager should not make major decisions outwith the triumvirate.

There are two major approaches to construction management seen as feasible in the industry. These are (i) the pure construction management approach in which the construction manager is the agent advisor of the client through all sub phases of procurement and (ii) the quasi general contractor approach in which at some point in time the construction manager changes roles from agent advisor to that of a general contractor. In the former, the client carries all costs and entrepreneurial risks and receives all benefits from the advice of the construction manager throughout procurement. In the latter, the client receives the agency advice usually during design or until a guaranteed maximum bid price is offered by the construction manager as a sole source bidder. Upon acceptance of that offer the construction manager becomes the general contractor to the client and the client loses the agency advice of the construction manager.

THE CONSTRUCTION MANAGER The major characteristic to be looked for in a construction manager is the ability to provide building procurement and construction knowledge as an integrated network of advice within the triumvirate team of the client, architect and construction manager. It is by the higher quality decisions and choices achieved in the creative and efficiency seeking discussions in the design and construction contracting sub processes that the client can most benefit from the advice and work of the construction manager. That the construction manager has ability to efficiently manage the subsequent actual construction process is beneficial and over the duration of agency service he may also manage all information flows among all agents and contractors as well as maintaining the project's information base. The construction manager should have a flexible approach to managerial work and inter-role communications to encompass whatever is needed on each project rather than operate with a single, rigorous approach to all projects. It is advantageous that the construction manager has knowledge of the local construction marketplace but should not bring to the client's service a detrimental reputation in the minds of the local trade contractors or have a too close relationship with them.

COPIES OF THIS REPORT Copies of the full report can be obtained from the Executive Secretary of the Florida Building Construction Industry Advisory Board, c/o School of Building Construction, University of Florida, Gainesville, FL 32611

ACKNOWLEDGEMENTS

Many people have contributed information and expertise to this report on Construction Management. Some have provided fundamental information while others have provided input to enable achieving the best research process and others have assisted with critiques.

Primarily to be thanked, are the building industry executives who gave their time and expertise, volubly or quietly, at the lengthy roundtable discussions as they presented the views of building clients, private and public, architects from large and small practices, construction managers of national and Floridian companies, general contractors from large national to medium Floridian companies, and subcontractors who were mainly from large major building trades. This report is based on their contributions and although they remain as the anonymous experts, much thanks must go to them. Their professional and industrial organizations must be thanked for advice given to assist selecting such high quality and vocal contributors from the industry and for the use of their offices as venues for the meetings.

The work was funded by the Florida Building Construction Industry Advisory Committee (Mr. Bill Conway, Chairman). The sub committee of Mr. Paul Scheele, Mr. Charles Perry and Mr. Daniel Whiteman prepared the short set of specific subtopics before the work began and which guided the preparation of the discussion guide questionnaire which, in turn, guided the actual discussions to such fruitful results. All of the above people must be recognized for their contribution.

Individual recognition should go to Mr. Rick McGarry of the Program in Linguistics of the University of Florida for his help in the formulation of the discussion guide questionnaire and for his guidance and help with the first roundtable discussion.

Special thanks must go to Dr. Ralph Swain, Vice President for Facilities and Support Services at Shands Hospital, Gainesville, Florida, for his insightful and thorough review of the draft report and to Mr. Joe Mastrucci, Florida area manager for CRSS, the national construction management organization who provided overview comments on the draft report.

Last, but not least, thanks must go to Libby Lewitt who took my hand written draft and the numerous iterations of editing and made each come out as clear text while perking up my enthusiasm to keep it all moving to completion. In the same mode, Tammy and Jean in the Department of Architecture must be thanked for humoring me as I worked to finish the report to be as complete as possible but also as simple as possible.

Dr. George S. Birrell
Professor, Department of Architecture
University of Florida
Gainesville, Florida 32611
(904) 392-0215

14 December 1990

I. INTRODUCTION TO THE REPORT

A. GENERAL
B. QUALITATIVE VALIDITY OF THE DATA
C. QUANTITATIVE VALIDITY OF THE DATA
D. USES OF THE REPORT

I. INTRODUCTION TO THE REPORT

A. GENERAL

This report describes the approach to procurement for new buildings and adding to existing buildings known as construction management. The major source of the information on which it was based was a set of face to face group discussions among senior people from major roles in the building industry in major urban areas of Florida. The report is a consensus and explanation of the views these experts expressed on construction management.

This report finds and presents that construction management is a service to a client by an agent advisor which is considerably different from what is done by other existing roles in the building industry. Construction management is not just another way of traditional contracting, it is a source of construction and management agency advice at the service of the client throughout the sequential or partially overlapped phases of the whole procurement of a building. The construction manager's services should start before the design phase begins and be continuous through all phases and sub phases of procurement until the building is in use by its client and users. Construction management is not another way for general contractors or other construction consultants to market their existing services.

The construction manager should provide advice from his construction based expertise on whatever issues, decisions, choices, processes are being considered for that building's procurement. Once the construction management core triumvirate team of client, architect, and construction manager have discussed and then crystallized aspects of the building or its procurement as a result of their team decision making, the construction manager will be responsible for carrying out some of the results from these decisions when they relate to construction and as they pertain to future decisions and work in subsequent phases of procurement.

The primary benefits to the client from the construction manager's services can be harvested in higher quality results from the many decisions and choices which have to be made in the design and contracting phases of building procurement. These should facilitate solving and handling the needs of the client in later phases of procurement such as construction or intrinsically providing a more appropriate building or one which is more easily constructed. To these the construction manager should primarily bring his expertise on costs of construction, scheduling of construction, contracting for construction, constructability of buildings and the coordinating of interaction among these and other matters. In addition, he must keep his thinking open and flexible to serve the particular needs of the client's building procurement being handled at that time under its particular circumstances. Primarily in the design and contracting phases these construction management experts should be able to think and act interactively with experts from other professions as a team to best procure the building in circumstances which in some important way are unique and abnormal but which have to be faced by the client. Furthermore, what is required from the construction manager will vary from building project to building project. The construction manager, along with the architect and client as a team, should provide expertise, energy and stability to the trajectory of the building as it evolves through the procurement process and blend that process to the situation faced by the client and that building's procurement in the local and entrepreneurial building market place at the time of procurement. During all of the above, the construction manager should be aware of and relate to, the level of knowledge the client has of building procurement.

Throughout the reading of this report it should be borne in mind that the term normal construction management is somewhat oxymoronic. The existence of normality either in the building or its procurement process (or even that the building and its procurement are unique but have been already carried out for a few of such similar buildings) should suggest that the use of construction management may be providing management which is too skilled or inappropriate in such repetitive situations.

Normality of construction management should be seen as being derived from any one of or permutation of an unusual procurement process or an unusual set of circumstances under which the client has to procure his building or an unusual building. Construction management is to use the agency advice services of people knowledgeable and capable in construction to advise and carry out high quality building procurement in situations which are wholly or partially unique and abnormal or more complicated than normal. In addition, a building client may use a construction manager to enhance the advice received on a comparatively normal building project.

B. QUALITATIVE VALIDITY OF THE DATA

Most building procurement takes place in urban areas and for a particular building that procurement involves many major and minor roles. To gather the opinions of top quality executives in the major roles of building client, architect, construction manager, general contractor and sub contractor, meetings were held in the major urban areas of Miami, Orlando, Tampa, Jacksonville, Tallahassee, and Gainesville, Florida. At each of these meetings, two representatives of each of the above roles were sought out to participate. The selection of people to be the role representatives was carried out by seeking the advice of professional and trade organizations and knowledgeable members of the building community in each location. Bringing such people to the same table probably induced more focus on construction management as a process in a stimulating discussion environment than would have occurred if individual interviews had been carried out with each role representative. Also, this approach provided a data base more oriented to a consensus result than one of each role presenting their own factional views.

All discussions were guided by the same carefully prepared questionnaire which covered all major aspects of construction management with questions designed to stimulate discussion rather than simply seek a yes/no answer. Discussion on all specific topics were allowed to follow the stimulation of comment and counter comment to fully harness the normal lack of shyness of building industry executives. Also, there were open ended questions to seek out views adjacent to the specifics of construction management. The questionnaire was created by considering the literature available on construction management and then shaped to be an open questionnaire by the guidance of approaches from social science research.

This report presents the consensus of the views of top quality exponents of building clients from private, quasi public and public organizations; architects for public and private buildings and from large and small organizations; construction managers from local and national organizations; general contractors of large and small organizations; and sub contractors, mainly from the large, major trades of electrical and mechanical work.

Each group discussion lasted about three to four hours duration and each was recorded to capture all comments by all participants. The recorded tapes for each meeting were replayed to transfer the essence of all comments to writing against the questions used as the discussion framework. The resulting data base from all meetings was then carefully analyzed and considered to create a set of topics which would best present the contents of that data base of results as a written consensus report on construction management. The report was then drafted and its contents and structure revised and edited to an initial state. The report was then reviewed and commented upon by construction management knowledgeable people and then fine tuning adjustments made to produce the text of the final report.

C. QUANTITATIVE VALIDITY OF THE DATA

Most of what has been written on construction management in books and articles has been by individual people presenting their views. Even if that person had a great deal of experience of construction management it might be somewhat biased from the role that person played in the building industry. Expressed quantitatively such a book written by one person may be based on some twenty or thirty years of experience.

Here each discussion group was set up to contain two top quality executives from each role and their responses, comments and views could be responded to by representatives of each other

role. The data base for this report was derived from six meetings each usually comprising ten people each having considerable experience, probably equivalent to about an average of twenty five years in the building industry, and selected as being very knowledgeable in their role and having experience of construction management and other building procurement processes.

D. USES OF THE REPORT

This report is the consensus of what practicing experts think about construction management as a process of procuring a new building or adding to or modifying an existing building. These are the major issues and topics they consider, raise and decide upon and work with under the construction management approach. These are the views of top quality exponents of these roles in the building industry in major urban locations where most building work takes place.

An appendix to the full report that guides the reader to a set of key pages which respond to specific questions put in the initiating research contract regarding Construction Management.

Much can be learned from the report regarding the reality of how to achieve high quality construction management by anyone less knowledgeable than these experts. Such learners can be students entering the building industry, people already working in any of the major roles in the industry and even government officials considering public policy regarding the use of construction management and all other processes of procuring buildings. The report can also provide considerable benefits to the customers of the building industry by educating them on how to most effectively harness to their service the potential of procuring their future buildings by the construction management approach.

Learning from this report can increase the effectiveness and efficiency of the whole building industry as it serves its customers, large or small, public or private.

Dr. George S. Birrell
Professor
Department of Architecture
University of Florida
Gainesville, FL 32611
(904) 392-0215

22 September, 1990

II. BACKGROUND OF CONSTRUCTION MANAGEMENT

A. DEFINING PROCUREMENT OF A BUILDING
B. OUTLINE OF THE BUILDING PROCUREMENT PROCESS
    1. Building Needs
    2. Feasibility Study
    3. Design Phase
    4. Contracting Phase
    5. Construction Phase
    6. Commissioning Phase
C. OUTLINE OF THE ORIGINS OF CONSTRUCTION MANAGEMENT
D. THE DEGREE OF SUCCESS OF CONSTRUCTION MANAGEMENT IN THE PAST

II. BACKGROUND OF CONSTRUCTION MANAGEMENT

A. DEFINING PROCUREMENT OF A BUILDING

Procurement implies receiving something or having it delivered to them but also having to pay for it. Within that there is the concept of value by trying to maximize the difference between what the client receives and what the client pays for it. These are relative terms rather than absolutes. It may be wiser to spend more on something or incorporate additional features even of very abstract natures or combinations because the end product building is more valuable in the above ratio. Equally, where the client only needs a very simple building it is not necessarily more valuable to provide, even for the budgeted price, a larger or very sophisticated building.

Similarly, the point in time of maximizing that value will, most likely not be now before procurement begins, but will be at some point in time in the future. That future point in time will vary from client to client and even for different buildings for the same client. It appears that for the client, the major parameters of value in a building should be its scope, its cost, its quality and its duration of procurement.

Construction expertise implies being capable of providing valid, effective, current and building specific advice on construction costs and prices, constructability of alternative design options and arrays of options, scheduling of construction and design, wisely handling entrepreneurial risks within the boundaries of the client and the situation of this building's procurement, matching the local construction contractors with contractual packages derived from the design of the future building, managing and expediting the actual construction process and its preparation for use. All of the above has to take place within the context of the procurement process for this building and the client's needs and having regard to above concepts of procurement and value. Of course, there will be other services needed on specific building procurement processes and there has to be the flexibility to establish what these are and provide them harmoniously with all other services.

B. OUTLINE OF THE BUILDING PROCUREMENT PROCESS

The building procurement process may comprise the sequential set of phases comprising Building Needs, Feasibility Study, Design Process, Contracting for Construction, Constructing and lastly, the Commissioning phase. All work in all such phases should be directed at providing the client with the use of the building in the best state relating to his needs. Of course, some clients may only wish the service of a construction manager during a shorter set of phases than above and that is their prerogative. For some buildings the most appropriate set of phases may be shorter than above and for others these phases may be overlapped in calendar time. For more unique projects these phases may be related to each other in whatever is an appropriate procurement process for each building and its circumstances.

1. Building Needs

The building needs phase comprises the gathering of why the building may be needed by the client and what will be needed as accommodation in the building. More specifically for construction management this phase may include establishing the parameters the client desires in the building. Normally, such parameters are scope, cost, quality, economic life and duration of procurement. The relative value of these parameters for each building should be established at this time by the client or the construction management triumvirate, of client, architect and construction manager. The main use of such parameters and their interactive values from the desired ratio among them is that they form the framework of thinking of the triumvirate against which advice is given and decisions are made regarding the procurement of the building. Without such parameters and their values, the decisions made about the building and its procurement process will vary across a wide, uncontrolled, subjective range with the considerable risk of suboptimal benefits and costs to the client throughout the whole procurement process.

2. Feasibility Study

The feasibility study is the phase in which all the features of the building, positive and negative are evaluated as to their costs, pecuniary and social, and to their benefits, pecuniary and social. These should be considered as both a capital investment and for the building as an ongoing facility in use for a desired period of time subsequent to completion of its procurement. This phase should consider the needs and desires of the client and the resources he is willing to invest in the project as well as the relationship of the finished facility to the economic, social and physical environment in which it will be located and used. For many building projects the work of this phase is done subjectively, rather superficially and seldom is done thoroughly although it is crucial and should lead to a "go" or "no go" decision for the future building and its procurement. Alternatively, if carried out thoroughly, this phase can be used either to test against an investment break off ratio or as pressure to more carefully establish more sophisticated building parameters and values by which to control the subsequent phases of procurement. This subsequent clarification of parameters and values may include structuring the components of project financing, including sizing and raising fixed capital in the form a bond issue.

3. Design Phase

The design phase comprises the transforming the building needs and the results of the feasibility study into the physical design of the building ready for contracting and construction. The normal design phase will comprise subphases such as programming, conceptual design, design development and working drawings.

Usually the architect will take the lead of the triumvirate in this phase. In its early subphases, he will tend to interact more with the client and in the later subphases tend to interact more with the construction manager. It should be borne in mind that in the early subphases of the design phase are the major decisions regarding the major building parameters of scope, cost, quality, economic life and duration for procurement. The expression of these in the physical building tends to be crystallized in these early design decisions. These decisions may be made by default of non participation or non interest by the construction manager. This should not be the way under construction management but it may be difficult for a construction manager steeped in the deterministic construction process and its internal formats of costing, scheduling, construction and quality control to be able to participate in the interactive, iterative "what if" discussions and multi role trade off decisions which are made with sketches and diagrams and verbal interactions. However, to develop a superior service as a construction manager requires the ability to participate constructively, interactively and iteratively with the client and architect in the design phase and especially in the early, major decisions therein.

4. Contracting Phase

Under construction management, the contracting phase analyzes the building designed or being designed and matches it with an analysis of the available local construction marketplace and its availability of trade/subcontractors. Also, work in this phase calls for the evaluation of the capabilities of each possible bidder for each such contractual package of work. As a result of this comparison, the content and scope of contractual packages is fixed to be advantageous to the client's parameters and values for each building and the marketplace situation in which it will be built. Then all the contract documents should be written to express the matching of the content and scope of the work required with the local construction marketplace. These documents should be segmented to appropriately match the trade structure of the construction industry of the locality in which the building will be built. Only those contractors perceived of having the capabilities required for this building's procurement should be selected as competitive bidders for each contractual package. Then the bidding process for each such contractual package should be set up, managed and carried out to select which trade/subcontractors will carry out each such contractual work package.

5. Construction Phase

The construction phase comprises the carrying out of the construction work and its management as a constituent of the whole procurement process. This phase is when the client is spending the largest amount of money per unit of time and a return will not be received until the process is complete. Hence minimizing the duration of the construction phase is a wise economic attitude but this must be done within the context of providing the building desired and with the correct quality of both materials and workmanship in the building. While the construction work tends to be fairly deterministic in sequence there are many contractors each with many workers carrying out work simultaneously. If there be discontinuities in the construction process derived from lack of preconstruction planning and scheduling or by changes in such plans caused by whatever reasons, then there can be confusion, delay, idle workers and machinery which can increase the cost of the building, lengthen the duration of construction and lower the quality of workmanship in the resulting building and increase the probability of litigation either during or after construction.

6. Commissioning Phase

Commissioning of a building comprises the finalization of all details of construction in harmony with the moving in of tenants and users so that the building can, as soon as possible, be fully operational as a building and fully utilized as designed physically and as an economic producer of a flow of benefits. It may take some time to fully harmonize all the subsystems of the building over the weather seasons in which it will have to operate. Tenant finish work for many different tenants or different departments of one large organization may be of considerable volume. Design, contracting and construction of tenant work should be managed to occur in a coordinated manner with the construction process or carried out as constituent parts of procuring the whole building to meet the contracted delivery dates for occupancy by each tenant.

C. OUTLINE OF ORIGINS OF CONSTRUCTION MANAGEMENT

The origins of construction management come from the confluence of a number forces which have been at play, interactively, for a few decades in the building industry.

Over the past few decades, architects have tended to reduce the scope of service they provide to clients. Put simply, many years ago they tended to provide a full array of professional building procurement advice and service to clients including building construction, building procurement as well as building design services. Over these past few decades architects have tended to shrink their services, or more pertinently focus their energy, interest and capabilities to design services. Even within the design process there has been a focussing of architects activities from the more mundane such as working drawings and contract documents towards the more intellectual activities of conceptual design or aesthetic imaging of a future building.

Even where professional architects provide a full array of required services there are inhibitions to high quality in all such subservices in that over the past few decades architectural education has followed a similar path to shrinkage and focussing on the design work and conceptual design in particular. Hence the people entering and available for the architectural profession have a tendency to be biased as above and the aspects of professional services less desired tend to be less well performed or less desirable as a career. Consequently, their non-design sub services have tended to atrophy in the architectural profession.

Meanwhile, over the same time span, building projects have become more complex and comprise more interactive subsystems in the building and of more complicated relationships with their physical location etc. Also, the array of subdisciplines in each of the major phases of building procurement has increased with the above move to specialization. It is very unusual now for a single architect to carry out all aspects of building procurement or even of the whole design process. This creates a situation of greater interactivity and coordination complexity among human expert specialists. Similarly, the client for a building is now more likely to be an organization, private or public, made up of many people or at least a number of departments. Now,

all of these above forces have to be coordinated so that their interactive complex needs and capabilities in a future building can be optimized for incorporation into a future building. While that building as an end product has to provide the physical array of spaces to clothe the activities of such a client, it also has to satisfy the client's abstract needs for tolerable budget, tolerable duration before use, quality and aesthetic image of the building, satisfy desires regarding its future real estate value in that location, as well as the client's ability to handle entrepreneurial risk in the procurement of that building.

A couple of decades ago, monetary inflation was rampant. This meant that clients would have to pay more for the same building the longer it took in calendar time for the building's procurement prior to use. Hence, shortening the calendar duration of the procurement process could save capital costs of the building for the client. Also, over the past few decades, in the broad economic sense, there has been a considerable demand for construction of new buildings to meet burgeoning economic and social activities and population increases. As well as increasing prices of buildings to clients and lengthening their procurement, this has tended to put the building construction industry, the supply side of the industry at a marketplace advantage over the demand side of the industry i.e. the clients for buildings.

Meanwhile, construction contractors have continued to carry out work under contract for clients. This means they build, for a sum of money, the building described in the contract and if it needs to be changed because of the lack of perception by the client or his design agent of what he has agreed to receive as a building then there has been usually an increase in the price for the building, plus usually an increase in the duration of its procurement and usually some sense of acrimony in the minds of the client. Furthermore, the processes of interaction between client and contractors have been set to a large extent and still is dominated by the contractors controlling all information and expertise regarding building costs and process coordination and procurement etc. In this situation, the client has been comparatively naked of building procurement expertise in his dealings with contractors and over the past few decades this has tended to increase rather than decrease. This means the contractors enter into a contract to build a building which is their field of expertise for a client who typically is considerably less knowledgeable about building procurement than is the contractor.

Some few clients such as private real estate companies who are extremely knowledgeable about building procurement by having such expertise in their organizations, can and do procure their new buildings with considerable effectiveness and efficiency. Many other clients for buildings have had very unhappy experiences in their building procurement and only have found out their "expertise nakedness" once their building has been procured or upon realizing same when facing issues in the building procurement process.

Now, over the past few decades all of the above forces have been at play in building procurement. To a large extent their interaction has created a vacuum in the marketplace. That vacuum has the characteristics of a client who lacks expertise and knowledge of building procurement and who realizes that he is or has been naked of procurement expertise by the existence of that vacuum.

Some such clients have tried to fill that vacuum by drawing participants from the construction contractors side of the marketplace equation to their side as agency advisors to help redress that imbalance in the their business affairs regarding building procurement. There have been varying degrees of success from such efforts. Some such new agents have successfully transferred their expertise to an agency advisor role and others have fallen back to continue to do what they did before. Others have had some successes and failures and some of these have continued to try to be advisory agents to building procurement clients. Some have even tried to split into two parts and some try to carry out the two types of work with the same people. All of them have had varying degrees of success.

Furthermore, some participants in the building industry, also seeing the above vacuum have moved to expand their scope of business by beginning to provide services they think needed by the building client. As in any marketplace, some of these providers have carried out quality

servicing of their clients. Others have misled their clients, some have stopped providing such services and others have learned from their experiences and gone on to provide better services to the clients of building projects. Others have continued to misserve their clients.

All of the above, comprise the origins of construction management and where it's participants are today.

D. THE DEGREE OF SUCCESS OF CONSTRUCTION MANAGEMENT IN THE PAST

Overall, as best as can be ascertained, construction management has been successful most times it has been used in the past.

Generally, construction management has been more beneficial for clients and construction managers than for other roles involved in buildings built by construction management. This is because the process of construction management is different from the traditional construction procurement approach by placing construction expertise at the elbow of the client and architect during the whole process of procurement. Thus the additional advice provided to the client, in a situation where previously he had virtually no such advice, can provide considerable benefits to him.

For construction managers operating successfully today by the quality of their service, the process has been beneficial for them in the sense that it has increased their volume of work by having to provide construction advice during design and contracting phases as well as managing the construction process. This additional work has also meant that the volume of construction work they have managed has increased because it comes to them as a result of providing the earlier advice (of whatever quality and appropriateness) without having to bid competitively for it. Also, such managing of construction work has generally tended to be with less entrepreneurial risk because they are managing the construction process as an agent of the owner paid by fee or under a guaranteed maximum contract arranged with them as a sole source bidder after they have participated in its design phase and maybe part of its contracting phase.

For many subcontractors construction management has not been a success. This is because most subcontractors have organized themselves to work under the wing of a general contractor during construction and the general contractor handles the contractual interface with the client and the architect on behalf of subcontractors. Under construction management it is normal that the intermediate role of the general contractor does not exist between the subcontractor and the construction manager with his client. Those subcontractors not experienced or skilled at handling their own affairs at such an interface can find themselves at a disadvantage or at least they may so claim. This is not to say that all subcontractors are in this state but the majority of subcontractors tend to see this situation causing them to work in business and contractual matters with which they are unfamiliar and by which they may lose money because of their previous lack of skills in these matters. The construction manager should remember these characteristics of trade subcontractors when recommending them for a client's building team.

For architects, the existence of the construction manager appears to cause more work or it may only move the locus of some of their work to earlier in the procurement process than under a traditional approach to building procurement. This is because the design subphases involve the construction manager as another source of input information. Balancing against that greater volume or displacement of work is the benefit of the specialized input of the construction manager as another agent on the owner's procurement team. This additional input usually reduces the risks faced by the architect when working alone and improves the procurement of the building for the client. This is especially valued when contemporary and local and specialized cost, scheduling and constructability advice is provided during the design process by the construction manager.

Some clients recognize these problems for architects and trade/subcontractors. They may be willing to pay more to the architects for their services and instruct their construction manager to be considerate of the business weaknesses of trade/subcontractors or only qualify for bidding

those trade/subcontractors who can have the management capability as well as the technical capability to do the work required on their building project.

III. OBJECTIVES OF CONSTRUCTION MANAGEMENT

A. CONCEPTUAL OBJECTIVE OF CONSTRUCTION MANAGEMENT
B. LITERAL OBJECTIVES OF CONSTRUCTION MANAGEMENT
   1. Provision of Construction Related Advice
      a. Scheduling
      b. Constructability
      c. Estimating and Cost Controlling
      d. Local Construction Marketplace
      e. Hiring Trade/Subcontractors
      f. Managing the Construction Process
      g. Enabling Prequalification of Trade/Subcontractors

   2. Management of Procurement Phases
      a. Managerial Action
         (1) Design Process
         (2) Contracting Process
         (3) Construction Process
      b. Managing the Information Flows and Data Base For That Building's Procurement

III THE OBJECTIVES OF CONSTRUCTION MANAGEMENT

The objectives of construction management will be addressed by presenting the conceptual and more literal objectives of services by the construction manager. Then later in the report these will be expanded by more specific sections on major features of construction management and characteristics and expected services of a construction manager.

A. CONCEPTUAL OBJECTIVE OF CONSTRUCTION MANAGEMENT

The conceptual objective of construction management is to provide the client for a future building, throughout its procurement process, with a building procurement and construction expert mind or minds which can participate with the client and his architect to guide and execute the building procurement process. The output from such agency advice should be a building which provides the client with the greatest value within the context of his needs for that future building and his available resources and under the situation he faces at that time of procurement.

The core of achieving successful procurement of a building under construction management is the triumvirate team of the client, the architect and the construction manager. Each must know his own business thoroughly and work interactively with and trust the capabilities and motives of the other two parties towards successful procurement of the building. Each, including the construction manager, must contribute to the whole team's success given the array of needs of that particular building and all aspects of the situation in which its client is trying to procure that building. If any one participant of the core triumvirate of team roles, through incapability or unwillingness, does not try to work as above, then the degree of success of the construction management approach will be severely inhibited. It is to this situation that the construction manager should bring his specific construction skills and his broader and deeper managerial skills.

In addition to providing specific facets of construction expertise, the construction manager may have to manage the coordination of the whole complex process of procurement including the activities of the architects and clients staff and consultants particular to this building's procurement. This may extend to managing the communications and contracts among all parties while appropriately expediting the whole process without inadequately allocating time or resources to important aspects of that building's procurement.

A primary attitude of the successful construction manager will be that at any point in time during the procurement process his current thinking is directed at looking forward to simplifying the needs of future phases of the procurement process. The construction manager should be providing advice and management relevant to today's procurement activities but tempered with minimizing changes causing iterations of activities from what will occur in future phases of procurement of that building back to what is being discussed and decided by the procurement team today. All of this advising before activities take place must still be within the context of providing value to the client. In addition, as some of what the building needs will not be known until the procurement process has begun, the construction manager will need to have a flexible, interactive mode of providing advice and an ability of inducing from other participants the same mode of giving advice as well as handling mutual concerns in decision making in their work. Such management approach is that of managing a team of almost equals which has to be appropriately expedited. It is the whole team that will create the final building in place ready for use and these team members have to be coached and coaxed and coordinated to that completion of the teams mission. Construction management also requires the client to be an active participant in the core triumvirate which leads all the other participants to project success. Also, the architect has to participate in the same mode as the construction manager although he may not be charged with overall management of the procurement process.

B. Literal Objectives of Construction Management

The literal objective of construction management is best expressed as an array of subobjectives which are interactive. The two main groups of sub- objectives are the provision of construction related advice and the management of the procurement in the separate functional and usually sequential phases. These will be guided by the clients parameters and values for the building which should be set before design begins and which are discussed in the next section of this report.

The provision of advice breaks down into an array of interactive sub topics upon which construction related advice is usually required of the construction manager during most phases of each building's procurement. These aspects of advice may or may not be desired on one building and they may be provided at varying levels of service by the chosen construction manager. These are outlined below and discussed more fully in a later section of this report. Also, additional aspects of construction advice may be required to meet specific building's procurement and these cannot be stated here as they are specific to a particular building.

The management of procurement can be considered in two dimensions, firstly the carrying out of work in the various procurement phases once the triumvirate team has made its consensus decisions regarding that matter and secondly the management or expediting of the required information flows for the activities required of any role in the procurement of the building as it evolves through the phases of the building procurement process.

When considering all of the following literal objectives of construction management it must be realized that virtually all buildings are different, and probably all building procurement processes are different, especially as to the relative value or weighting of one sub objective or parameter to another. The strategic ability of the construction manager to handle such variety across an array of procurement processes for different buildings while keeping to the values set for such sub objectives or parameters in each building's procurement is important to fully achieving the potential of construction management on each building's procurement.

1. Provision of Construction Related Advice

This major segment of the literal objective of construction management comprises the parts of (a) scheduling, (b) constructability, (c) estimating and cost controlling, (d) local construction marketplace, (e) hiring trade/subcontractors (f) managing the construction process and (g) enabling prequalification of trade subcontractors.

a. Scheduling

Clearly, the whole procurement process is a set of subprocesses and the construction process itself take place over time. In both, very complex activities and interactions between activities will take place among a plethora of participants. Leaving all such interactions by so many participants to happen on a volunteer basis would certainly preclude completion of the building's procurement. Also, the longer is the procurement process the higher will be the indirect costs of that process to the client. Hence, scheduling of both the overall procurement process and the specific construction process can be of considerable advantage to the client. Scheduling implies knowing what activities are required in each of the above processes and the arranging their occurrence to take place, sequentially or concurrently, for the best process for the whole procurement of that building.

Construction Process The schedule for the construction process has to be thought out as the most appropriate construction process for that building. It should attempt to create a solution bearing in mind the parameters and values set for the building's procurement. Then it has to be expressed clearly so that all participants and contractors to the construction process can estimate their costs, mobilize their resources, begin work, do their work as scheduled interactively with all other participants and move out. To this objective the construction schedule will tend to be

somewhat deterministic in guiding all participants to carry out their work as and when best for the whole construction process.

Time considerations of constructability can be dramatically affected by durations required for manufacture, contracting, transportation and delivery of manufactured materials and equipment to trade/subcontractors. Here the marketplace and constructability knowledge of the construction manager can be brought to play on what materials are to be incorporated into the design for duration minimization and scheduling efficiency of both the actual construction process and its material procurement subprocesses.

The best schedule for the actual construction process should be carefully thought out by the construction manager and discussed with the client and architect prior to beginning the contracting phase so that it can be input to the estimating and bidding by the trade/subcontractors as well as being the controlling datum for the actual construction process.

Network scheduling would appear to be the best approach to providing the schedule for the construction process.

Overall Procurement Process The overall process of procurement is much more complex that the construction process because, especially in the design and contracting processes, it is one of many professionals interacting together, bringing advice and expertise to bear on issues involving many interactive topics regarding both the physical and abstract aspects of the building itself. Also, the actual construction process should blend with the needs of building users as they move into the building or continue to work during the construction. Thus a schedule of the overall procurement process must tolerate these complicated aspects of the interactive and iterative work of combining many professional inputs into optimal decisions regarding the design and procurement of that building. Often, the questions to be answered for the design and procurement of that future building by these professionals have to be found prior to their being answered wisely. This requires duration allowances for such work and discipline to avoid rushing to primitive or incomplete decisions. This can be facilitated by allowing sufficient but not superfluous time to consider options, alternatives and interactions as part of the multi-human expert, multi-decision making, process that is procurement of buildings. Overly tight scheduling of durations for the above activities can preclude achieving desired levels of success in quality of design and decision making on major aspects of contracting. Nonetheless, scheduling should be carried out for this overall procurement process but bearing in mind the above nature of that process.

Establishing appropriate durations for each phase and sub phase within the whole procurement process and then establishing the end calendar date for each of them appears to be the best form of scheduling for these interactive and iterative types of work. This provides time control as the best balance between (i) deterministic time control for expediting the procurement process and (ii) the needs for complex, interactive, iterative relationships, information transfers and wise decision making required for successful procurement of a building of the appropriate quality for use.

This overall schedule would appear to be best served by a set of required phases and subphases, each with a calendar time milestone by which it has to be completed.

b. Constructability

The cost of construction work is dependent mainly upon the consumption of resources over time to carry out each piece of work. The parts of a building's design which dictate considerable consumption of resources will cause higher construction costs and probably longer durations and more risks than a simple design feature to satisfy the same design function. Having a building's design at various levels from overall to detail, examined by a mind skilled in the construction process can provide advice to simplify the design as to its construction work to control costs of the building and reduce work durations of the construction process. Such examination should be a regular part of the design process and be carried out by the construction manager.

Such advice from the construction manager is beneficial to the triumvirate carrying out the procurement of the building especially if it is input while the design is evolving. Many construction executives can do this once a building's design has been completed and this is known as value engineering. However, by that time most designs for buildings and all major design decisions have been locked together as the best interactive solution to interactive design issues affecting many sub systems of the building. Hence, after design is complete there is considerably less potential for benefits from constructability advice than there is from a construction manager providing constructability advice as the design is being created by the array of different professional experts.

Clearly, constructability advice will affect the durations of construction work for specific parts of the building and perhaps for the whole construction process. Hence issues of how the constructability of the building should be adjusted to meet the building's scheduling needs i.e. time needs of procurement, are very important advice inputs to be sought from the construction manager.

c. Estimating and Cost Controlling

These two modes of construction advice are closely related to each other. Estimating is the creation of a realistic estimate of future costs for something. Once created, the estimate tends to become a budget for controlling future actions regarding that matter. Cost control is the control of subsequent direct or related activities or suggestions on aspects of that matter to maintain the viability of the estimate/budget already set.

The construction manager will usually be required to produce one or more estimates for the whole building including all foreseen but probably not yet specifically designed aspects of the building. This estimate is to produce a total cost of construction of the building for consideration by the triumvirate, especially the client and from which they will cost control subsequent decisions and actions in the design and contracting to a lesser extent in the construction phase.

Within the context of the above, more specific detailed estimates may be required of various alternative parts of the building's design. At their largest, these alternatives of which the cost is to be estimated, could be for two or three alternative conceptual designs of the whole building in the early design stages or as small as considering the cost effect of two different materials to perform the same function in one trade contract within the whole design of the building.

Building scope expansion during the design process and, to a lesser extent, during the contracting and construction phases is one of the more insidious but real forces which disrupt the balance of services provided by the construction manager. Unless all these changes are expressed in writing by the construction manager when they appear and are conveyed to the client and architect it will tend to be in the contracting and construction phases that their effect on increasing costs and schedule duration will become apparent.

Throughout the whole procurement process estimates will be required for the whole building at least at the end of each phase and sub phase of procurement and the detailed estimates for comparing alternatives will be required as and when decisions on their inclusion or exclusion from the building will be required.

Furthermore, later in the procurement process, the above whole building estimate/budget may be required to be presented as cash flows over time for one or more durations or for construction schedules on different work profiles. Both of these may be required in real and calendar time in order to establish the best profile of funding tranches to match between the clients available flow of funding and a feasible construction process. Similarly, prior to contracting the trade packages, this overall estimate/budget should be required to be arranged per the scope contents of each proposed trade contractual package as a datum for evaluating bids to be received from trade/subcontractors within the context of the estimate/budget for the whole building.

d. Local Construction Marketplace

The nature and players in the construction marketplace in which the building is to be built must be investigated by the construction manager. The degree of efficiency of the future construction process for this building will be affected to the extent there is incompatibility between that construction process and the normal construction process and size of trade/subcontracts in that locality. Put another way, for the construction process to be at its most efficient in cost and time for the client and with least contractual risk to the client, the array of trade contract packages from the building should be as compatible as possible to the normal nature of the local construction industry as to its practices and participants. This may be even further enhanced for the client by carefully packaging the work in each trade contract to be compatible to the local marketplace approach, the strengths of particular local contractors and to the nature of the building to be built. Furthermore, the advice on constructability of the building itself should to some extent be derived from this knowledge of the practices, strengths and weaknesses of the local construction industry.

The client should always seek the results of the construction manager's investigations to establish all of these pros and cons because to expedite the building's procurement requires fast communications and trust among all parties who have to work together as a team.

The provision of all required information to the bidding trade/subcontractors in writing as well as through appropriate meetings and the non biased handling of bid evaluations and post bid negotiations also have to be carried out by the construction manager on behalf of the client.

The client should take care that a local construction manager does not bring interactive detrimental attitudes, costs and durations from his previous work in that locality with local trade/subcontractors to the clients building's procurement. On the other hand, a local construction manager with a high reputation locally should already know the local marketplace thoroughly, as well as being a known commodity in it. Whether such a local construction manager is respected or not as regards his behavior to trade/subcontractors should be sought out by the client himself before hiring his construction manager.

e. Hiring Trade/Subcontractors

All the available local contractors for each contractual work package should be investigated as to their managerial capabilities and their general behavior under contractual relationships. How each might operate under the usually relatively high speed and complex construction process and high quality workmanship expected on buildings procured by construction management should be investigated. Their past willingness to expedite their own work within the context of the whole construction process and their willingness to work compatibly with other subcontractors should be established by the construction manager. The objective of these investigations is to form short lists of contractors appropriate for each required future trade/subcontract package for this building in this local marketplace. Trade/subcontractors financial capabilities, present and future work loads and any other appropriately pertinent information for this buildings procurement should be sought out as part of this investigation. Also to be investigated should be the reactions, positive and negative, on the interactions between the different local contractors in different trades. Minimizing animosities from previous projects and local rivalries are well within the universe of this investigation as they can have considerable negative or positive effect on the potential of the trade/subcontractors to work together as a team. Only trade/subcontractors found to be of the appropriate and desired quality should be invited to bid for the contractual packages of work.

The construction manager has to set up the bid packages of contracts, specification and drawings upon which bids will be received by the client or construction manager. The contracts of all trade/subcontractors must be compatible with each other and with the contract under which the construction manager will be working in the construction process.

Appropriate appraisal of risks to the client from the construction process under the prevailing nature of the project, the local industry and that it will be under the construction

management approach should be made. From the results of such an appraisal the construction manager should advise the client on the need for bonding and insurance for the likely contractors working on this project. Also, the amount of such coverage needed and how they are to be contracted should be established by the construction manager.

f. Managing the Construction Process

Knowledge of managing the construction process is usually a mainstay of the advice of the construction manager to the client. The main thrust of such advice is the effect of the construction process on the work of the design and contracting phases. Such advice tends to be expressed as scheduling and constructability of construction but also is interactive with the estimating and cost controlling base set up or to be set up for this building's procurement. Such management capability and advice is usually derived from the construction manager already having a thorough knowledge of the array of possibilities and constraints of all construction processes and resources as well as the internal interactions among most facets of the construction process.

Once the building begins to move into the construction phase most of the thinking as to the optimal construction process should have been already crystallized. However, changes do take place in the construction process sometimes benefitting from or necessitating design changes which can cause considerable perturbations to the already set optimal schedule for the construction process. This can be true especially where construction of some trade contract packages begins before completion of the design of others. Such changes which may be simple changes to the design of the building can affect the work within numerous different trade/subcontracts. If a small number of such multi trade changes are required then the originally optimal construction process may change towards redundancy and the construction manager must redress this suboptimal state based on his knowledge of the initial construction process and his knowledge of workable construction alternatives to reach the original scheduled goal set for the construction process. His objective should be to maintain the viability of the major parameters of cost, quality and schedule by modifying their contents to meet the changes which have to be made.

Put rather simply but effectively, under such circumstances, the construction manager must have considerable knowledge of construction sub processes to present advice on valid construction process alternatives to respond to these changing situations which will maintain the overall values and objectives for the procurement of the building.

g. Enabling Prequalification of Trade/Subcontractors

For public clients, the whole construction management approach enables them to create and include in their building procurement process a mechanism to prequalify trade/subcontractors for each trade required and each contractual package of work desired on each project. Without construction management most such public owners are held to accepting bids from virtually all bidders regardless of their quality of work and management and that they must accept the lowest bid received. This can be detrimental to such a client's construction process and interests. Through the use of construction management, the public client can use prequalification of trade/subcontractor bidders and so can at least minimize such risks to his interests.

2. Management of Procurement Phases

This major segment of the literal objective of construction management comprises the two parts of (a) managerial action and (b) maintaining the information base for the procurement of each building.

a. Managerial Action

Advice is the provision of verbal or written knowledge and expertise to describe how to make something as good as it can be in the future - be it a building for future use or a future

process to achieve some objective. However, advice not enough to make the whole procurement process happen. That is, each phase and the whole process has to be planned, people chosen and motivated, advice proferred, decisions made and actions taken and the whole process has to be controlled as close to its best thought out plan as possible and allowing for the nature of the work in each phase. Although the construction process tends to be later in the whole process, the construction manager tends to be experienced as a manager of that complex process so it sometimes simply occurs that he manages not only the construction process but also all the work in the preceding phases of procurement.

Quite often, the construction manager is the role which manages the whole procurement process for the client. If he will be required to manage the whole process, it certainly should be explicitly stated in his construction management contract to do so. Alternatively, it may be left to occur by default of no one being specifically given that duty but the task is picked up by the construction manager.

(1) Design Process Probably managing the design process is both the most difficult to manage and type of management work most foreign to a construction manager accustomed to only managing construction work. However, the design process must be managed and it may be made more complex because the architect will be the leader of the design team within the construction management team while the construction manager is its manager. There should also be the full involvement of the client in this phase, and his activities in design work also requires to be managed.

In the design phase of procurement there is the basic, interactive, iterative design process involving many professional experts. The input of each has to be sought, gathered and evaluated and decisions made from which future design work will be carried forward. It would appear that breaking the design process into sub processes by time phases is a valid approach to managing it. While all of the above goes on in each design sub phase, by having each design sub phase as finite as possible will minimize the iterations of reconsideration of design features from later design sub phases to an earlier design sub phase.

While the size and detail of the design information base will increase in size by number of details over its evolution, only a minimum of the crystallization a design details should be allowed to change a larger design decision made in an earlier sub phase of that design process. Thus the management of the design phase should be attempting to sequentialize the design process with more important, large decisions made early and details decisions made later. While doing this absolutely may be impossible because there can be fresh insight into a better overall design once repetitive details have been considered, the manager of design should try to "tend towards" this objective. Milestone dates should be discussed and set with the architect for ending each sub phase of design which are realistic given the nature of the building to be designed, the needs of the design process and especially the parameter boundary conditions set by the client in cost, quality and duration for procurement of this building. Every effort should be made to maintain the progress of design to meet these sub phase time milestones. Failure to do so should be a major issue to be settled by the three major members of the building procurement triumvirate. Such a managerial control of design implies careful and complete consideration of design decisions from alternatives presented prior to making of such decisions. Also, the implication is that the decision will, most likely, not be revisited later in the design process. While this can induce more efficient use of design resources the downside is that a less effective design for the building may be produced due to the lack of much contemplation of the design once it has been crystallized. However, too much contemplation implies enough contemplation plus unneeded contemplation and it is this latter increment that should be minimized by procurement managers. Probably such post design contemplation should be broken down and occur towards the end of each sub phase of design prior to cost estimating and presentation to the client for discussion and approval prior to moving to the next design sub phase.

The construction manager, to achieve most success in the management of the design sub phase should tend towards the "coaching of expert team players" approach rather than tending towards a somewhat dictatorial manager approach. He should be attempting to extract the best performance for this building from each individual expert designer, trying to have each expert offer and provide his input rather than extracting it from him, inducing multi interactions among these design experts but all towards evolving the best design for the whole building given the clients parameter boundary conditions of cost, quality, scope and duration of procurement.

(2) Contracting Process The contracting process requires the prequalifying of trade/subcontractors, the completion of viable and compatible contract documents for bidding, holding prebid meetings as well as receiving and evaluating bids and carrying out required post bid negotiations etc to hire each trade/subcontractor required for the construction process.

Other inputs to this phase of procurement will be the building's cost estimate structured to match the scope and contents of each anticipated trade contract and the preconstruction schedule for the construction process.

The management of this process or probably more exactly, these processes for each trade package, should be set as to their timing from the already produced overall schedule for construction work. This enables the contracting sub phases to be calibrated in calendar time with the winning bidder's need for time to mobilize his resources so that he can begin work under his contract as presented in the already thought out best construction schedule. The major objective of this is that the hiring of trade subcontractors for each trade work package should be in harmony with the desired and prescheduled overall construction process.

A secondary objective of the construction manager's work in this phase will be to buy out all trade/subcontracts for a sum of money equal to or less than the estimate for the whole building. While some contracts will be able to be bought out at less than the estimate for that trade there may well be others for which the bids come in higher than their estimate. Failure to maintain the viability of the estimate for the whole building as the bids for each trade package are being evaluated will mean either changing the design to meet the total estimate or the client putting up more money for the whole building. Many factors are at play here in an interactive mode and most have a direct influence on the building's parameters of cost, quality, schedule and scope of the building.

As these trade contract packages are bought out usually in sequence of the need for beginning of their construction work by the construction process the client, over time is transforming a list of estimated sums for each trade into a list of contracted lump sum bids under the above conditions.

The above situation describes the "pure" construction management approach. Alternatively, the "quasi general contractor" approach to construction management has the construction manager furnishing a lump sum guaranteed maximum bid based on his estimates for these contracts not yet let, plus the sums of the bids on those which have been let by that point in time. However, the quasi general contractor approach introduces to the overall construction management approach the issues of the client then not having the agency advice of the former construction manager who is now an entrepreneurial contractor to him after having been an intimate agency advisor to him. This issue is discussed further, later in the report, but its resolution considerably colors the management of the contracting phase and also may affect the nature and quality of agency advice provided to the client in the early, important design decision making regarding his future building and later when the client and the then general contractor are sharing savings (if any) below the guaranteed maximum lump sum.

(3) Construction Process The management of the construction process requires all the normal duties of managing multi subcontractor construction work as would be carried out by a general contractor.

This management should be to make the actual construction process occur as it has been scheduled and contracted to occur. This implies at least two features (i) careful, valid scheduling of the construction process before beginning of actual construction and all resources and materials flowing to it and (ii) ability and willingness to control the actual construction process to the schedule which has been created as the best preconstruction schedule for construction of that building. Continuous monitoring of progress of the work of each trade/subcontractor should be carried out and their progress expedited to keep their work to the preconstruction schedule.

At its latest, the preconstruction scheduling should be carried out prior to the early parts of the contracting phase so that bidders have been given times of their expected work as input to their bidding for trade/subcontracts. Such preconstruction scheduling should include careful planning and layout of onsite, temporary services compatible to the details of the construction schedule.

All matters relating to interim payments to the trade/subcontractors and the handling of change orders etc should be handled by the construction manager in the normal manner for building projects.

The construction manager should make it his business to check on and support each trade/subcontractor in his effort to expedite the flow of his materials and other resources to the building project as and when they are needed by the construction process. The construction manager should be aware while expediting all of the above, that he should be looking for the exceptions to the norm in the construction process. It could be that as the construction process progresses, opportunities occur to benefit the cost, speed or quality of the end product by adjusting the construction process to such an opportunity.

It is necessary for the construction manager to have staff on the site who are capable of and have the power to make managerial decisions quickly regarding the construction process. Quickly in this context means that decisions are made with both validity and a speed that does not inhibit the work of any participant in the construction process. Such speedy decision making may be a misnomer. The construction manager always should be evaluating the needed construction work a few weeks in advance of its scheduled occurrence on the site for final clarification of all issues regarding it among all trade/subcontractors.

Often managers of construction tend to push construction work to get it started but tend to provide less expediting energy during and especially towards the end of the construction process. Emphasis on expediting construction work should probably increase later in the construction process rather than decrease. For the client the later stages of construction comprises a duration prior to which he has spent much capital investment thus in these later stages he is funding a large construction financing debt. Thus minimizing the durations of that later construction process is of considerable advantage to the client. Also, there is the fundamental issue that, the sooner the construction phase reaches completion, the sooner the client can begin to receive the flows of benefits from the use of the building.

Such on site staff should also be charged with maintaining the required quality of the end product building from the inputs of materials and workmanship by the trade/subcontractor.

Once trade subcontractors are hired they become part of the procurement team. While the construction manager should not do their work for them he should check on the validity of their preparatory work and all aspects of their flows of materials etc to the site, especially as these flows relate to shop drawings and material delivery schedules. Their work should be moved along at the speed desired by the schedule but also the schedule should be realistic in the context of the building and the local construction marketplace.

To expedite the whole construction process requires knowledge of what can be done as productivity rates by all trades so that each can be motivated to work at or near full productivity without being pushed so hard that an anti production psychological boundary is broken by each trade/subcontractor knowing what he is being asked to do is impossible.

Expediting construction work for a building's procurement requires a continuously "pushy" attitude and approach by the construction manager. It is wiser to have the objective of trying to

finish the construction process quickly than to merely try to start construction work as soon as possible in calendar time. Also, the management of construction problems which can result in the greatest detriment to the construction process and to the client tend to occur when most trade/subcontractors are working simultaneously on the site and this tends to occur in the later stages of construction rather than at its beginning. Often it can be congested resource supply lines and traffic on site or in the building that cause problems and disrupt direct work execution. All of these should be scheduled, monitored and managed by the construction manager to expedite the completion of the whole construction process.

b. Managing the Information Flows and Data Base for That Building's Procurement.

This may include the gathering and distribution of information among all roles and parties involved in the procurement of the building. Such information can include suggestions, alternatives, problems, decisions, guidance, contracts, changes required at every phase of the building's procurement.

It will also comprise the maintenance of all data which has flowed among all the participants and keeping records of all decisions made along with their backup data for future reference during this buildings procurement.

Management of information may seem to be a rather abstract matter for the attention of the construction manager but over the whole procurement process, it can be seen that there is the plethora of different roles involved in the procurement at different time phases and with different relative importance. Each of these roles needs information from the common data base for their work in the building and its procurement, each has an array of expertise to proffer to the common cause to maximize value and benefit to the client. All of these information flows must be managed to expedite the whole process. Also, individual professionals working in the process can change while there is a constant evolution of the information base for the building until it is ready for occupation and use.

What will happen in future phases of the procurement process usually should be dependent on advice proffered and decisions made in earlier phases of procurement. Therefore consideration of the movement and use of these numerous pieces of information upon which decisions will be made regarding the building and its procurement should be carefully thought out. Thus, it is clear that management of information flows and the building's data base is very important.

The continuous availability of the client's procurement parameters and their values along with boundary constraints of the client are major pieces of information that must be known to and kept in front of all participants in the procurement process. The results of design and procurement decisions by role participants have to be recorded and conveyed to other roles in the procurement process for these other professionals to do their work for the client procuring his building.

Quite often there is the potential for disputes to arise among roles in the procurement process and to some extent many of these disputes can be eliminated by reference to information already in a project data base (if it has been kept and stored for easy retrieving) as to what was decided at a point in time earlier in the procurement process. Hence the construction manager should maintain a data base of all information proffered, received, approved, decided upon and forwarded to all roles involved in the procurement process.

More formal types of information such as design drafts, estimates, schedules, decisions by local governments, decisions regarding the future building contracts etc, approvals by the client and even dissents by participating professionals should become part of the data base as they are created and discussed and decided upon. The drafting of these more formal documents should be compatible with the parameters and boundary conditions set by the triumvirate of client, architect and construction manager but also be in harmony with the information in the data base for procuring this building.

Because much information is transferred verbally among participants, especially at meetings, minutes should be created of the result of all meetings held in the whole procurement process. These should be circulated to all participants at these meetings and also kept in the data base. Such minutes must be passed through the hands and consideration of the core triumvirate team to ensure compatibility with overall strategy.

In all of the above, the construction manager is often seen as the role best suited for handling and expediting these flows of information and maintaining the projects data base throughout the whole procurement process. Wise management of these can provide benefits to expediting the procurement and minimizing the areas of lack of information among the participants. The construction manager should be supporting the information activities of all the team players involved in expediting the whole procurement process.

IV. MAJOR FEATURES FOR BUILDING PROCUREMENT BY CONSTRUCTION MANAGEMENT

A. WHEN THE CONSTRUCTION MANAGER CAN PROVIDE THE GREATEST BENEFITS TO THE CLIENT

B. MAJOR ABSTRACT ISSUES TO BE CONSIDERED TO INCREASE CONSTRUCTION MANAGEMENT SUCCESS POTENTIAL

1. Client Parameters and Value
    a. Groups of General Parameters
        (1) Building Scope
        (2) Quality of Building
        (3) Cost of the Building
        (4) Duration of Working Life of the Building
        (5) Duration of Procurement
    b. Some Possible Specific Parameters
2. Fast Tracking of Procurement
    a. Origins of Fast Tracking
    b. Status of Past Fast Tracking
    c. Current and Future Status of Fast Tracking
    d. Clients Capability to Handle Entrepreneurial Risk of Fast Tracking
    e. Design and Contracting Issues Relating to Fast Tracking
    f. The Choice to Fast Track or Not to Fast Track
3. Choice of Contractual Format for Construction Management
    a. Pure Construction Management Approach
    b. Quasi General Contractor Approach
    c. The Choice of Pure Construction Management or Quasi General Contractor Construction Management

IV MAJOR FEATURES FOR BUILDING PROCUREMENT BY CONSTRUCTION MANAGEMENT

A. WHEN THE CONSTRUCTION MANAGER CAN PROVIDE THE GREATEST BENEFITS TO THE CLIENT

It is clear that the construction manager can provide the greatest benefits from his services to the client during the design and contracting phases of procurement. It is in these phases that the major decisions are made regarding the major constituents of the future building and their qualitative and quantitative results. Each building's procurement process should be thought out and fixed very early in that process and certainly prior to the design phase. In these early crucial decision making phases, the client's major interactive parameters of building scope, cost, quality and duration of procurement should be the guides to choosing the features of the procurement process.

The construction manager should not behave as a "follower" role which only critiques the work of the architect as to its cost, constructability, quality etc. after it has been designed. While such services might be beneficial to the improvement of the design, the construction manager is being reactive rather than active. Also, the designer would be required to do work which later may have to be changed as a result of the construction manager's criticism. This creates wasted effort by the architect and tends to create animosity between the architect and the construction manager rather than having them working together as members of the client's team. The construction manager should be able to work together with the client and the architect creating and improving the design to achieve the clients objectives from the start of the design process. By inputting construction based advice which helps to shape the design as it evolves, the construction manager is operating positively rather than as a criticizer of the design.

The construction manager should be striving to provide the construction based advice to the design and contracting phases which will bear fruit in lower costs and durations, higher quality of end product building and an easier construction process in the upcoming construction phase of procurement. The advice given should be directed by the parameters set by the client, the architect and the construction manager at the beginning of procurement as well as responding to unique requirements of the client and the building in the context of the local construction marketplace. These may only become known by the client, the architect and the construction manager through their group discussions.

Perhaps the above could be expressed more succinctly by saying the need of the client is to have the advice of a construction expert in design and contracting so that the construction process will be as simple as possible and the whole procurement will give the client the greatest value from the building procured. To some industry participants the name construction manager is a misnomer. More realistically, he should be called a preconstruction advisor and procurement process manager.

The nature of services provided in these two major phases may be different for a private client as compared to those desirable by a public/government client. The private client wants advice to maximize the value of the building in the context of the parameters and their values set from the clients and the building's marketplace. Also he may be willing to incorporate revenue generating features or those which could increase the longevity of use of the building even though these features increase the building cost and construction complexity. The public/government client for construction management tends to have a budget already fixed before he hires his project agents and design begins, and he wants a building that will not exceed that preset budget. This desire of the public client may be sufficiently strong that he is willing to have a building smaller in scope and/or lesser in quality than he could have had by risking a budget overrun even if the overrun does not eventually occur.

Idealistically but infrequently it can be beneficial to such a public client, if a construction manager is called in or hired in the predesign phases to create an estimate of construction as input to establishing the value of a bond to be raised or the budget to be sought from the central

administration of the large public agency or private corporation. To achieve these objectives, the construction manager should be able to produce a viable estimate of total cost of the building's construction as soon as the building's program has been established and before physical design work has started. Viability in this context means that later, when all construction contracts have been let, the total sum of them is close to that initial budget estimated by the construction manager. Clearly, during the design and contracting phases the amounts of the sub budgets will change over time within the total estimated budget but the total should remain viable throughout these phases of procurement. Unfortunately, this type of estimating is neither typical nor easy for many construction managers who continue to operate as general contractors who are accustomed to following the design presented to them as if only what is shown will be built by the somewhat deterministic construction process. Such construction managers also tend to have estimators who cannot or have not developed the ability to operate conceptually in the design process interactively with the architect and the client. Under such circumstances, the construction manager's services will not achieve the full potential for the client.

A deeper more subtle differentiation may depend on whether the client needs agency advice/help primarily in the design and contracting phases or needs or wants such help in only the management of construction phase. While it is very clear that a client will maximize his benefits from construction management as a conceptual service by fully utilizing such services in design and contracting, there can be clients whose primary or real interest is in having better management of construction. Some such client's may have succumbed to the name of construction management and think that it is to a large extent synonymous to managing construction. If the client is satisfied with only such limited benefits, so be it. However such a client, by hiring an expert construction manager to only manage construction may set up such a confusing situation in all the participant's minds that overall, the client has created a grossly suboptimal service by confusing the experts he has hired to serve him.

In the contracting phase the construction manager should be trying to maximize the compatibility between the construction process required for the building which has been designed or is being designed with the capabilities and capacities of the local construction marketplace and its participants. The construction manager should be using its expertise to analyze the whole building to an array of separate contractual work packages which will induce the simplest construction process and hence the cheapest and fastest construction process for that building in that local construction marketplace at that time. Also the construction manager should use market expertise in buying out the contracts by bidding and negotiating with the most appropriate trade/subcontractors from that local marketplace.

Compared to work in helping create the best building design and contracting process, the work of the construction manager in the construction process is considerably more mundane. Here what is required is simply managing and expediting the somewhat deterministic construction process already preordained by the design, prescheduled prior to contracting beginning and with the trade subcontractors bought out in the contracting phase. This management of the construction phase could be contracted out to a general contractor. However, management efficiency can be gained by using the people who already know that information by having learned it during design and contracting.

B. MAJOR ABSTRACT ISSUES TO BE CONSIDERED TO INCREASE CONSTRUCTION MANAGEMENT SUCCESS POTENTIAL

To maximize the potential for construction management to succeed requires many processes, choices, decisions, inputs and outputs, to occur wisely in the temporal situation of the procurement of each building. If all of these for the procurement of every building could be set out as a program, check list or expert system there would be no need for having a human construction management expert to advise and participate with the client and the architect in the core triumvirate of the construction management approach to procuring a building. However, there is too great a variety in the types of clients, buildings, and marketplace situations to be

handled for any such programs and expert systems to be fully successful. Maybe one could be partly successful on one building's procurement but, very probably, such success will be much less than the hiring of a top quality construction manager to participate in the procurement of that building. Also, it should be realized that there is a wide gulf between a top quality construction manager and an ordinary construction manager and that both are considerably different from a normal construction general contractor.

The major differences between a top quality construction manager and these others is mainly an ability to fully and wisely participate with the client and architect in the design and contracting phases of procurement. Another major constituent of such a top quality construction manager is the ability to contribute expertise to satisfy the unique needs of each individual building and its procurement beyond the permutation of normal services of the construction manager.

It appears that major abstract decision issues which have a considerable effect on the degree of success from the use of construction management comprise (a) clearly establishing the client parameters and values for procurement, (b) determining whether or not to fast track the work in the procurement process which is closely related to the degree of client's ability to handle entrepreneurial risk and (c) determining the contractual format of the linkage between the client and the construction manager during the construction phase which also has implications regarding his agency advice in design and contracting.

These are major decision variables to be faced and resolved by the client, either by himself or, as a better decision making mode, in discussion with his architect and construction manager before design work begins or even with outside advisors during the earlier feasibility study phase.

The more clear and valid is the thinking producing the client parameters and their values, the more easily will the whole procurement process flow. The efficiency of the procurement process will be further enhanced by carefully thinking out and reaching a decision on the choice to fast track or not, the design, contracting and construction work. The appropriate choice of contract format for the construction manager services during the construction phase can affect the quality of the advice he receives from the construction manager as well as the costs and notes in procuring the building. These last two are considerably influenced by the client's willingness to handle entrepreneurial risk for this building's procurement. Ideally, all of these decisions should be made prior to or derived from the careful execution of the feasibility study for this proposed building and certainly these decisions should be made before the design phase begins.

1. Client Parameters and Values

Basically, the whole process of construction management deals with considering information from many professionals and making a multitude of wise decisions and choices from general to detail regarding the building and the procurement process. Probably, one of the toughest assignments of the whole procurement process faced by the construction management triumvirate is deciding what it is that the client wants from this building and its procurement. If that can be clearly ascertained at the beginning of the procurement process then much rework and redundancy and wastage would be eliminated from the procurement process. The resulting building throughout its subsequent useful life, is more likely to be of higher value to the client if it has been based on a careful expression of the client's desires and needs which can include the level of quality of service to the future users of the building.

Construction management is mainly used as a professional balance to be used against abnormal and unusual conditions or tight or peculiar constraints on the building or its procurement or a desire for a very high quality of agency service by the client. Therefore, establishing those abnormal and unusual conditions and constraints as being what the client wants is difficult but rewarding because they are then known issues to be solved in the procurement process.

It is probably impossible to define totally what the client wants from the building and the procurement process prior to design but a guidance framework of parameters and their values

thought out carefully by the core triumvirate and with reference to information from other relevant professionals can be set up as the statement of the needs of the client in the building and its procurement process. That guiding framework of parameters and values will be the guide to the choices and decisions to be made in the procurement process by the core triumvirate and professional secondary level roles.

Put too simply, at the beginning of procurement a client would like to receive a building which is of wonderful design, increases effectiveness and efficiency of the building users, is of very high quality materials, has extremely low cost to the client, will last forever, can be received tomorrow, have no subsequent litigation, have it win design awards and have people knocking on his door offering to buy it for much more than the client paid for it etc.... However, these parameters are usually interactive and their values conflict with each other. Therefore, the above simple expression is of little use to the professional advisors to the client in guiding their decision and choice making for the client during the procurement process. However, if the client alone or, better still, in discussion with the architect and construction manager can establish the parameters appropriate for that building and its procurement and then establish their values as priority ratings among them or a ratio of importance between them, then this statement can be a major guide to all parties playing a role in the whole procurement process especially in the most important decisions and choices in the design and contracting phases within the construction management approach.

Such a statement of the parameters and their values for a building and its procurement can be the datum, the magnetic north pole, the shining light in the dark from which the professionals can guide the making of their best choices and decisions regarding this building and its procurement. This datum guide can be applied to both large, broad, major decisions and to small detailed decisions. Thus, at the very least, there can be a harmony amongst all decisions and choices made throughout the whole procurement process by them being guided by the same set of parameters and values.

Probably the simplest approach to forming the list of parameters and their values is for the client, the architect and the construction manager to come together as soon as the two professionals are hired and certainly before design work begins and discuss this matter.

Put simply but with validity, firstly, they should establish the list of parameters, general and specific, for this building and its procurement as one sub process. Secondly, they should allow themselves one hundred points as the total value of all these selected parameters. Then, thirdly, they should allocate to each parameter its value from the one hundred points. It is highly probably that much iterative discussion will be needed to settle on a list of parameters and the relative value for each. However the value from creation of the list of parameters and their relative values at this beginning of their team's work is that it will be the guiding framework for the choices and decisions made by the construction management team during the whole procurement process. Clearly, the client may have to be weaned from the above oversimple "cadillac for a chevy price" model of parameters and values.

Perhaps the architect will have to give in a bit on the design scope and quality parts, perhaps the construction manager will have to slacken desire for easy construction, low cost and short duration of construction and perhaps the client will have to be specific in what is wanted in the building to achieve the best overall balance for the building and its procurement. Each of the three primary members of the construction management triumvirate must participate in creating these parameters and their values. Not only should each participate in this process but they should execute this work together as an interactive group trying to set the most appropriate parameters and values to guide the creation of this building and its procurement to match the needs of the client.

Virtually every decision or choice to be made in the design and contracting phases will involve tradeoffs between general parameters related to all buildings and specific parameters related only to this building and its procurement. Furthermore, virtually every choice and decision will require consideration of the interaction between these parameters for this building

and these interactive decisions will be made more easily by considering which parameters are at play in that particular decision and what is their relative value or ratio between them.

Now presented is an array of groups of general parameters which most likely, will apply to all building projects but clearly, the relative values of each will vary from building procurement to building procurement.

a. Groups of General Parameters

The interactive groups of general parameters which seem to apply to most buildings and their procurement are building scope, quality of the building, cost of the building and duration of its working life and duration of its procurement. Each of these groups is now briefly outlined as a starting point from which to begin this major issue to better satisfy the client's building procurement from construction management.

(1) Building Scope This group parameter relates to what is in the building. The array of types of user spaces in the building and the functioning needs from buildings services of each have to be considered. The size and shape of the user spaces relate to the user functions they house and the juxtaposition of user spaces to each other and the activities outside of the building are other aspects of the building scope that have to be considered for the designed building to effectively satisfy the needs of the envisioned users. Also, the massing of the whole building in the context of the above and its locational surroundings has to be considered and its desired aesthetic impact, externally and internally and other ingredients of building scope.

(2) Quality of the Building The contents of the building, be they expressed via specific materials of varying quality such as bricks and mortar, electric cable, HVAC machinery and ducting, glass, elevators, toilet partitions and marble can each be of varying quality to suit the needs of the users, the client and the building. Decisions have to be made on what quality level should be in the building and what different quality levels should be at different locations in the building. Then what materials may be chosen to express that desired quality as well as the numbers of different materials thought appropriate to express the desired style of the building may be relevant to the quality parameter. Also, consideration of the desired degree of dimensional coordination control allowed to play on this building should be established. While all of the above has impact on aesthetic effect it also has strong linkages to variable costs of the building and variable durations of construction as well as to the spatial aspects of building scope.

(3) Cost of the Building The cost of the building comprises two major components i.e. capital cost and functioning cost. Both can be brought together through calculations for comparison or confluence under the concept of life cycle costing. It is also valid to establish the status of the client as being capital rich or poor and/or cash flow rich or poor. Whether the building is for his own use or for renting to others who will or will not pay the operating and maintenance costs of the building spaces they rent are valid parameters to be established by the core triumvirate. Who pays for these functioning costs affects the rent rates achievable in the building but these can be combined with high or low functioning costs as input to or influences upon the choice of quality of materials to be incorporated in the building. The capital costs will be dependent on the volume and cost rates of resources consumed in the construction process as well as being influenced by the duration of their consumption during construction. The duration of the whole procurement process is an important influence on indirect costs especially if the cost of funding the construction process has to be paid as part of the capital cost of the building. To quite an extent these capital costs can be influenced by the ease or difficulty of constructability of the building designed which relate to building scope and building quality above.

All of the above cost features should be considered to produce a budget capital cost which allows the building to be economically feasible in the eyes of the client. A building should then be procured to meet that capital budget.

(4) Duration of Working Life of the Building The planned duration of working life of the building can be related to matters such as the speed of evolution of the urban scenario around the building site, the normal duration of building space leases in that real estate marketplace and to the speed of technological obsolescence of the ingredients of the users needs for the spaces in the building Also, the capability of the design to be easily retrofitted to another user function would be valid for probing and establishment as a parameter within this general group of parameters. All of these and others are ingredients to establish the economic life span of the building towards which many of the design decisions regarding materials and equipment have to be geared. Also the careful establishment of the planned economic life of the building can be used to more rationally allocate cost decisions between capital and functioning components of life cycle costing prior to more specific design decision making.

Put simply, it is very useful to establish the planned economic life of the building as a guide to selecting materials and components which will remain functional for that duration.

(5) Duration of Procurement The duration of the construction process is the time when the client is spending by far the greatest part of the capital investment. Therefore minimizing its duration means minimizing the duration of negative cash flow. On the other hand, too short a duration of construction can create confusion, increase costs and may reduce the quality of the building. Thus careful thinking has to be applied to this issue of minimizing the duration of negative cash flow for the client. Spending more time for careful thinking in the design and contracting phases may induce a shorter construction process. On the other hand the longer is the duration of procurement; the longer will be the duration over which the cost of capital already laid out in land, professional's time, client's efforts in procurement and construction resources has to be financed without the offsetting income from an operating building.

External issues to be considered affecting duration of procurement can be that the building, if not ready for use by a certain date, is usually partially or completely useless to the client because it is not ready to satisfy a predetermined or even contracted for rental use/need by a particular date. The client may suffer pecuniary damages because of such incompletion of procurement until the building can be used. The client may actually suffer losses from the costs of having to provide temporary accommodation to meet his contractual obligations to users and tenants of the unfinished building. Furthermore, to minimize the above it is even more valid to carefully schedule the commissioning of the building and the moving in of users and tenants with the ending of the construction process.

b. Some Possible Specific Parameters

To a large extent, these specific parameters have to come out of discussions among the core triumvirate of the construction management team when they examine the particulars of the specific building being considered and the nature of the procurement process which blends that building with the nature of the situation faced by the client and the nature of the local construction industry at that time. Some of these specific parameters will be derived from the features of the building and others from the procurement process needed by the client's situation. Other parameters will come from the economic, social and physical situation into which the building will be placed and from the local marketplace for construction etc that will build the building as designed.

There is no way to produce an all encompassing list of such specific parameters and those which follow are provided as examples and come mainly from considering the nature of the building and to a lesser extent the procurement process required.

The peculiarities of surrounding local aesthetics as they are currently and might well be in the future could lead to a specific parameter statement on the value of the building blending into or radically contrasting with the current local aesthetics. Also, the client may have a decided desire in this regard for the future building.

The physical nature of the site for the building may provide opportunities and constraints (which might be turned into opportunities) which have the strength of becoming parameters for procurement. This may be especially valid regarding site development and environmental enhancement of it.

The client may have a desire or need (and these may not be the same) for advanced technology in the building compared to basic technology, or vice versa and the settlement of this matter could be a parameter for some buildings. Another aspect of technology to be considered as a specific parameter may be that the building include some space for the unknown future uses, especially in the realm of communication between users of the building and other people and organizations elsewhere in the world.

A more basic issue might be the ratio of specialized user spaces to generalized user spaces or the strategy of specialized to general spaces and the consideration of the ease of retrofitting the inside of the building after a number of years of initial use. This may be related to the nature of the building users and the longevity of use of the initial designed space in the initial building.

Another consideration that might affect the procurement is the technological obsolescence of machinery required to carry out certain functions in the building. The procurement process for a hospital is long and speed of technological obsolescence of hospital equipment is fast i.e. such equipment has a very short economic life. Therefore, space needs and costs for such machinery may change more than once during procurement for buildings which are to house a large number of such equipment.

The speed of changes in governmental regulations and the subjectivity of their enforcement may have a considerable effect on the approach to what is designed into the building and what design target - simple and get it accepted quickly or vice versa - may be the best strategic approach to achieve procurement. If changes in government regulation will take place at specific future points in time within the expected procurement duration then that issue will play on how procurement is carried out.

The environmental impact of one design for the building may be greater or lesser than for another design and there may be local preferences of profiles/types of impact which may be more tolerable than others and these can affect the building and its procurement process or the interaction between them.

The client may desire an array of spaces in the building which does not meet the zoning regulations but it will take time to change the zoning status of the site. However, by clever design, the building may be able to meet the current zoning as well as making it relatively easy to change the spaces contained in the building the future to the more desired profile of user spaces.

The possibility of major changes in the volume of work in the local construction industry or even in a few major trades required on this building can radically affect the cost of the building and the duration of its construction which, in turn, can affect what constituents are designed into the building given its general parameters.

The nature of the building may be an addition to an existing building and/or requires alterations to an existing building. This means that the scheduling of the construction work and maybe contracting for it must be positioned around maintaining complete ongoing activities in by the client's organization for its customers from its existing building. Thus the design, contracting and construction phases may have to be segmented and structured around this primary need of the client.

There may be a prescribed sequence of completion for the major segments of the proposed building scope from the needs of its users or financier or marketplace demand. This can affect not only the construction process but may even affect the design of the buildings and hence it should be discussed and considered as a parameter. The project may become a set of individual buildings rather than one large building to meet such a situation.

The availability of funding or the changing cost of funding the project or even changes in tax laws which can affect the clients net returns from the building may influence calendar timing of procurement or even influence the makeup of the design of the building. Such changes or

future expectations may induce rapid, costly procurement or slow, costly procurement or some other permutation of these parameters. It may postpone the whole project until an appropriate time window occurs in the future. There may be other building and procurement features which have to be incorporated or excluded due to the nature of financing.

The changing economic climate in the locality of the proposed building or nationally or internationally can influence the potential income or benefits from the use of the building and hence play upon the design and procurement process so that the building can be ready to meet the needs of the economic marketplace the building will serve.

The above are only a few examples of potential specific parameters which could influence and therefore should guide decision making during design and contracting of the building and execution of its construction.

However, the fundamental idea of thinking out what are the parameters and their values is valid for construction management. Put simply, these parameters and their values define as best as can be at the beginning of procurement what the client wants from the building and its procurement. With them existing as described above, the abstract needs of the client have been crystallized and can be used to guide the many choices and decisions, major and minor, which have to be made during the whole procurement process.

2. Fast Tracking of Procurement

Fast tracking of procurement is the overlapping in calendar time of the design, contracting and construction phases for one building. Put another way it is the contracting for individual construction trade subcontracts and beginning of their actual construction work before the design work for all of the whole building and all trade contracts have been completed (although the design and contracting for construction contracts under construction should have been completed).

a. Origins of Fast Tracking

There appears to be two main origins of fast tracking. One comes from the traditional lump sum bidding general contractor work and the other comes from the recent decade in which high rates of inflation were prevalent in the economy.

The first is in the traditional lump sum bid contract for construction between a general contractor and the client. Under such a contract the general contractor while winning the contract for the whole building at one point in time may only have hired each subcontractor shortly before the presence of that subcontractor was needed on the site. For example, under such a building contract the construction phase may be of eighteen months duration. Now, the painting subcontractor and the floor covering subcontractor may not be needed on the site until month fifteen. The general contractor, although he has included in his winning lump sum bid to the client for such painting and floor covering work, may elect not to contract with such subcontractors as soon as he wins the general contract. Rather, he may make a decision, looking at the local construction marketplace that he will buy out these subcontracts later in calendar time, say about months twelve or fourteen of the construction process. He may even eventually hire a specific contractor other than from those from whom he received bids for that sub trade package and which helped him ascertain the dollar figure he put as an ingredient in his original lump sum bid to the client. This general contractor has exercised his right to accept the entrepreneurial risks and benefits in the marketplace in arranging his affairs in this manner. While providing the client with the building contracted for, he chooses to try to benefit himself as an entrepreneur and he may gain or lose on this issue dependent on the validity of his thinking and decision making. Nonetheless, here is one major origin of the idea that trade/subcontractors may be contracted for at different times during the construction process just before they need to begin their work in that process. Also, in decades and centuries past, this separate trade package contracting was the normal mode of carrying out construction contracting by the client prior to the evolution of the general contractor about the time of the Industrial Revolution.

The second origin of fast tracking came one or two decades ago when most national economies were racked with high and sometimes accelerating rates of inflation. Under this situation, construction resource costs were rising rapidly and unpredictably and to the extent that, for example, suppliers would not quote fixed prices for other than a few days after the date of their invoice. This affected the capital cost of buildings to clients to such an extent that if the client could accelerate the construction process of a building to reduce its construction duration they were also holding down the capital costs paid out for that new building. The increment they wished to eliminate from their expenditures was the effect of inflation in the later calendar time durations of the construction process. Also, by bringing its completion of procurement to the earliest calendar date, they were beginning to generate a positive cash flow earlier in calendar time.

To further move construction completion to an earlier date in calendar time was to take the general contractors approach to hiring his subcontractors as required for the start of their work during the construction process and link it to a rearrangement of the work in the design process and contracting process to achieve separate bidding for each trade package as early as possible in the whole procurement process. Thus the client and his construction manager put out each trade contract for separate bidding at separate points in time as required to blend contracting to the construction process schedule before completing the whole design of the whole building.

b. Status of Past Fast Tracking

As with every change in procedures in the marketplace there are side effects and in this change its success is dependent on all facets of the change being handled wisely by the new role of the construction manager.

For fast tracking to be successful it is vital that there is validity of estimating early in the design process, in scheduling of the whole procurement process including construction and in the packaging of the whole building into meaningful trade packages to be contracted in the local marketplace from incomplete designs of the whole building. Also, there has to be careful interaction between all of these trade packages with a wisely executed and managed design process for the whole building. This whole process has to be coordinated with a carefully scheduled construction process to achieve minimum overall calendar duration of the design, contracting and construction processes. This is a very complicated goal and is difficult to achieve unless the construction manager is wise and capable in all such facets of required work as well as their interactions with work of the architect and the client. While the above may be reasonably easy on simple buildings (which are usually outwith the universe for construction management), it is even more difficult than above on the more unusual or complicated buildings and procurement processes which all form the normal universe of services of construction managers.

Primarily, early construction managers came from general contractors who thoroughly understood the construction phase and the contracting phase from the contractors side. They tended to know much less about the design phase and the contracting phase from the clients side but their existing profile of expertise was more crucial to provide benefits to the client under circumstances of high inflation.

Under the previous circumstances of high rates of inflation the client could benefit from the major thrust of fast tracking even through there may have been also an increase in the number of construction change orders and increases in construction costs therefrom. Such increases over the normal number of change orders and their costs were to redress the discontinuities caused in the design and contracting processes due to fast tracking compared to the normal number of change orders in the known traditional procurement process. However, under high inflation overall benefits to the client from fast tracking could be achieved.

c. Current and Future Status of Fast Tracking

Currently, the inflation rate in the economy has dropped from that of previous decades to a more reasonably, normal rate. However, as fast tracking of procurement was a major origin of construction management it remains as a major feature expected of construction managers. This is especially the case with clients who do not fully appreciate that construction management should really be called "pre construction advice and management of procurement of buildings" and that management of the construction process is a somewhat deterministic part of procurement once all the major and minor decisions on the building and its procurement have been made in design and contracting.

Currently, there are a number of aspects to be considered regarding fast tracking of building procurement now. A major point is that whoever is involved in a major role in its management and execution must have expertise in managing and handling each of design, contracting and construction and then be sufficiently proficient at each to do so simultaneously, interactively and harmoniously with the client and architect for it to be successful without the negative side effects to the detriment of the client, especially as to total cost, duration of procurement and quality of the building matching users needs over its economic life. If the chosen construction manager is of low expertise or even normal expertise it is probable that the fast tracking may cause as many negative results in cost, time and confusion as the benefits its creates for the client.

Before now, construction management implied fast tracking of the design, contracting and construction, it was a given in construction management. Now, fast tracking is a choice or alternative available to be used or not used depending on the situation of the client, his building and his procurement needs for that building as expressed in his parameters and values. Thus, to use or not use fast tracking is a major early decision to be made by the construction management triumvirate team depending on the client's parameters and values for that building.

A major aspect of the client must be evaluated prior to deciding to use fast tracking. This is his degree of willingness to accept and carry entrepreneurial risk during all phases of the procurement for this building.

d. Clients Capability To Handle Entrepreneurial Risks of Fast Tracking

The relationship between entrepreneurial risk and the use of fast tracking usually relates to his capability and willingness to contract for some construction work to begin on site while he only has estimates by the construction manager for the whole remaining cost of the construction work under all later trade/subcontracts and that for these later contracts the whole of their design may not yet be complete and their contract documents not yet fully written.

This willingness to carry entrepreneurial risk has a lot to do with the amount of knowledge the client has of building procurement. The more building procurement knowledge and expertise the client has, the more capable will he be to understand, carry and handle the entrepreneurial risks involved in procuring a new building by construction management. Another background feature of this issue is whether the client organization is entrepreneurial or not. To start with, is the client an entrepreneur e.g. a real estate developer or is he not an entrepreneur e. g. a government agency? Also, it should be realized that some executives in private real estate developer clients are always very cautious and minimize risk taking and that some public officials in government agencies as clients have the culture of tending to be bold and entrepreneurial. To what extent is the real estate developer cautious as well as bold in the marketplace to be successful and to what extent can and should the construction procurement knowledgeable government official use his procurement expertise to benefit his agency? These are background forces that play on the people contemplating fast tracking and the whole procurement approach of construction management. The choice of what each should do is not fixed, it should be situational to the specific building, its procurement process and the current and future services from and marketplace for each building. The real estate developer and the government official

should be bold at times and cautious at other times in the marketplace to achieve success for his building and its procurement.

e. Design and Contracting Issues Relating to Fast Tracking

Another key issue in considering to use or not use fast tracking is the nature of work in the design sub phases. It is clear that all of the programming and design concept sub phases should be complete and approved by the client before any individual trade/subcontract package can have its design work developed, working drawings carried out and construction contract documents prepared ready for contracting such a trade package. It would be architecturally wiser that a considerable part of the design development sub phase for the whole building be completed before such individual construction contract packages should begin to be prepared. The result would be a greater chance that only a small number of construction process change orders will be caused by the remainder of the unfinished design work upon all construction trade contracts, already being constructed and still being designed.

An external constraining major factor in the choice to use or not use fast tracking in practice is the issue of governmental approvals of the design, e.g. building permits, approvals by Fire Marshals and even environmental impact evaluation approvals. To receive full approval of designs by such governmental agencies usually will require the presentation of the working drawings to their inspectors. However, working drawings for the whole design comprises the drawings for each trade contract package and these are produced in the last sub phase of the design process after the completion of the design development sub phase for the whole building.

Sometimes maybe the architect and the client and the construction manager may know the governmental needs, they may hold discussion meetings with the government inspectors with initial sketch drawings to ascertain what will be required in the working drawings, there may be understandings, verbal or even written minutes, between the building team and the governmental agency of what is intended to be in the final design but all of that is not acceptance of the working drawings as they finally exist for the whole building at the end of the working drawing sub phase at the end of the whole design process for the whole building.

The result of this situation is that to minimize or eliminate design changes required to satisfy these governmental approvals requires all that all working drawings be produced and then reviewed and approved by the governmental agencies prior to release for contracting. Now, regarding fast tracking in this context, if construction work is already under way and the government inspections of working drawings causes much changing of the design there is a very high probability of considerable changing of the construction work to be done in the future and of the construction work which has already been contracted for by a lump sum price and some of which already may have been built on site.

The client could contract for early work involving construction labor and equipment as a lump sum contract such as site clearing or foundations or some other early trade work with a trade/subcontractor. Such work could begin as soon as possible once the work has been designed and contracted while design work continues on other parts of the building where there is minimum negative relationship between the work and possible late design changes of the whole building. It should be borne in mind that even site clearing contracts imply having the whole design inspected as working drawings as a constituent of obtaining environmental impact clearance from appropriate government agencies. Going ahead with early construction work such as site clearing prior to environmental impact clearances from government agencies can create major risks for the client and the building.

At an extreme, there is nothing but prudence to stop a client having construction workers being paid for "working" on a site before the design has been through its early stages of evolution. If he chose to do so, the client will have to pay for such work much of which may be wasted because its output may have to be changed later. Also, lack of government approvals and clearances may incur large penalties from environmental damage which will not be tolerated by

the environmental agencies of government or from damage to the site which is not needed for that building.

Certainly, the construction manager, at the time of early design work, can have the client place orders at fixed prices for materials which require long lead delivery durations and these contracts are later assigned to the appropriate specific trade subcontractor whenever and whoever contracts for the work requiring that material. Such material delivery contracts will contain clauses that they are assignable to whomever will later entrepreneurially control that construction work if that person is not the client. However, by the client or his agent executing these material delivery contracts, the client is beginning the construction process albeit, only ordering materials for it.

f. The Choice To Fast Track or Not To Fast Track

Thus, in taking an overview of the above major features in relation to fast tracking and entrepreneurial risk by the client it is now the situation that the benefits from beating inflation are much lower than in the past and the costs of the higher probability of construction change orders to already contracted construction work and risks of losses, stoppages and litigation from lack of government approvals are much higher than in the past. Therefore, the overall potential from the use of fast tracking has diminished over the past years to a point where a client for a building may not want to use fast tracking within the universe of construction management services. Such clients will carry their building through a complete, linear set of design sub processes as the design phase and only then move into the contracting phase for construction which may go lump sum with a general contractor or be contracted on a trade by trade basis. Notwithstanding the above, the client, the architect and the construction manager triumvirate will have or should have given a full quotient of thinking and discussion to this choice of fast tracking of design, contracting and construction during the pre design phase as input to carefully choosing to use or not use fast tracking.

On the other hand, the client who tends towards being an entrepreneur along with all other clients whose project parameters and their values, puts a high premium on, say, early calendar completion of the whole building ready for use still have the option to give a high priority to as much fast tracking as can be achieved in the clients parameters and values. In this situation the client should be made aware of the entrepreneurial risks mainly in the higher cost of the process of building procurement, especially in the construction phase and maybe in later litigation. In such a situation the client may wish to set up a cost contingency fund thought appropriate in relation to the value of the early completion of the building to his activities. This sum should cover for the added costs of reworking, redesigning, confusion and additional management staff to handle the high volume of work in the short duration of procurement. In such a situation, construction management is probably the best building procurement approach available but to be as successful as possible it must be done wisely and expeditiously. That puts a considerable premium on the quality and capability of the client, the architect and the construction manager individually as professionals and as a team who trust each other and willingly work together to achieve that difficult common goal.

3. Choice of Contractual Format for Construction Management

There are two major sub approaches and contractual formats by which the client should consider hiring a construction manager. These are (i) the "pure" construction manager approach and (ii) the "quasi general contractor" construction manager approach. This matter is discussed here as well as later in the report in the section dealing with the network of contractual linkages in the context of the organizational structures of construction management.

a. Pure Construction Manager Approach

The "pure" construction manager is hired as an agent of the client to provide construction related advice and perhaps carry out the management of the whole procurement of the building

as part of the core triumvirate of client, architect and construction manager for the construction management approach. This would certainly include the design, contracting and construction phases plus other phases before and after these three major phases if the client so wishes. Such a pure construction manager will remain as an advisory agent to the client throughout the whole procurement process and the client will carry the entrepreneurial risks and receive all benefits during the whole procurement process from the advice provided by the construction manager for his fee. The only entrepreneurial risks which the client would not carry are those contracted to the array of trade/subcontractors hired to carry out the construction work. This will include the contract for what is known as the general items work for on site management services. This on site general items work has to operate within and under the overall management and expediting of the construction manager along with the client and architect of the core triumvirate.

More generally, the pure construction manager is there to provide the complete array of advice and management needed by the client and his building and its procurement process untrammelled by his own personal entrepreneurial gain. He is there as a professional advisor to the client, on a similar footing as the architect, on how best the client can procure the building under the prevailing conditions. The client should feel that the advice he receives is not biased in any way other than to benefit the client. This does not mean that there may not be disagreement between the client and the construction manager and between the architect and the construction manager. Creative conflict among professionals is good and should be tolerated and harnessed to the service of the client and his building. If disagreements exist, they should be seen as the best professional advice needed by the client in that situation and should be resolved within that context. The constitution of the fee could be a fixed sum or an amount dependent on the scope and hours of service provided just like any other professional advisor in the commercial marketplace. The potential fee formats are discussed more fully in the part of this report dealing with payment to the construction manager.

b. Quasi-General Contractor Approach

The "quasi-general contractor" approach to construction management has the construction manager changing from that advisory agent role at some point during the procurement process. He is hired with that understanding at the beginning of the procurement before design work begins. The point in time of change over is when the core triumvirate of the construction management approach consider that the design and contract information and data for the construction work required for the building are sufficiently well defined that a general contractor could provide at least a guaranteed maximum bid to the client for its construction work. At that point in time the construction manager, having up to that point in time acted as an advisory agent to the client, will make up and submit to the client a guaranteed maximum lump sum bid for the construction process of the building as anticipated from the design and all information available at that point in time. There may be post bid negotiating between the parties i.e. the client and the bidding contractor, which may lead to the client and the former construction manager, now a contractor bidder, signing a guaranteed maximum lump sum contract for the construction of the building. At the point in time of signing that contract for construction the construction manager as an advisory agent expires and he becomes a general contractor to the client.

Also, during the "grey time phase", between the triumvirate calling for a guaranteed maximum lump sum bid from the construction manager/quasi general contractor until such a contract is signed by the client and the bidding general contractor, it would be probably best for the client to consider his construction manager not as an advisory agent but as a potential contractor. The client may even wish to utilize this view of his advisor agent from the beginning of procurement i.e. when he signs the contract with the construction manager under this quasi general contractor approach to construction management.

The major advantage to the client from this approach is that he holds a guaranteed maximum lump sum contract for construction of the whole building before any or most individual trade contracts for construction are let and construction work begins. Now, the client knows the

largest sum of money it should take to build the building so the client has greatly reduced the entrepreneurial risk from the total amount of the costly construction process. However, the client is now dealing with a general contractor for construction and has given up the balancing construction advice from an advisory agent who was hired to provide knowledge in construction and contracting, although the architect is still working as an agent expert in design. Also, the client must evaluate the risks from advice given to the client in the earlier part of the procurement process by this type of construction manager who knows that later he will become a contractor to the client under a sole source guaranteed maximum bid. These risks to the client may be especially valid in the crucial decision making in the design phase regarding constructability, in the contracting phase regarding forming trade contract packages, and perhaps even in the decisions on choosing and qualifying of trade subcontractors and of primary importance, the quality of his advice on and the accuracy of estimates for construction costs in all of these phases of procurement. These factors are very important because guaranteed maximum construction contracts usually have a clause allowing the contractor to share in the savings between the guaranteed maximum sums based on estimates and the actual final cost of construction and there may be change orders to be negotiated during the construction process as well as the normal handling of interim payments etc.

c. The Choice of Pure Construction Management or Quasi-General Contractor Management

In comparing the two types of construction manager, the client should weigh up the importance to operations of the building user of having this complex building of the appropriate scope and quality operating effectively by the time it is needed, how much it is worth paying for such a building, the validity of the client's own knowledge of the procurement process for buildings, the client carrying all the entrepreneurial risks and receiving all entrepreneurial benefits from its procurement, the sense of trust of the prospective construction manager in the mind of the client, the possible losses and risks to the client from the construction manager becoming a contractor and by being a sole source bidder for the construction work against the degree of desire of the client to hedge perceived entrepreneurial risk from the construction process by having a guaranteed maximum lump sum bid for the whole of construction rather than only having estimates for the construction work before being committed financially to carry out the construction process.

The client should also clearly evaluate the objective of having (a) a building of best value i.e. maximum difference between the flow of benefits from the flow of costs (with both flows including social and pecuniary components) or (b) having a building designed, contracted and constructed with a fair certainty that its final capital cost will not be greater than a previously set budget for that capital cost while being less concerned with the annual functioning costs of the building. Yet another variable to be considered would be the speed of technological obsolescence in components which will be required to make up the particular building being procured as this factor can have considerable influence on the number and dollar value of change orders in construction process.

The client who wishes to maximize value in the building is most likely to use the pure construction management approach. To do this the client will be carrying most of the risks during the building's procurement to achieve his objective of maximum value from the building now and in the future and from the situation faced by procuring the building in this current marketplace situation. The expertise of the construction manager is hired to support the client in achieving this objective. Also, the client should be willing to expend time and energy in the triumvirate of client, architect and construction manager to achieve that result.

The client who wishes a little construction advice in design and contracting but wants a known contracted sum of money for his construction capital cost prior to beginning construction will tend to use the quasi general contractor approach to construction management.

The public agency client is more likely to use the quasi general contractor with guaranteed maximum bid approach which appears to carry less entrepreneurial risk from the construction process because the client will have received a guaranteed maximum bid for the whole construction process prior to beginning to carry out any onsite trade subcontract work. Usually, this guaranteed maximum bid will be made by the former construction manager who is now in the process of changing into a general contractor to the client.

It should be borne in mind that a guaranteed maximum bid is not a fixed lump sum bid for the construction work. The actual cost of the building to the client will depend on the prices at which the guaranteed maximum bid general contractor buys out all the trade contracts, once their design work has been completed, how saving on such contract buying shall be shared between the client and the general contractor and if change orders will occur in the construction process and whether or not such changes are inside or outside the guaranteed maximum price. Furthermore, during the subsequent construction process, the client will be without the services of any construction manager in managing the interactions and business affairs with the general contractor.

Between these two somewhat polar positions there are many others which have a more mixed array of descriptors of their situation from the above comparative poles. Clients at such intermediate positions should weigh up their closeness to the above two polar positions and decide towards which pole they are closest. While many hybrid approaches were presented and discussed in the research process with each group of building industry executives, only the above two sub approaches were seen as viable alternatives within the construction management approach. Therefore clients should use the evaluation of their own character, procurement situation and position between these two poles as a means of choosing one of these two sub approaches to construction management.

V THRESHOLD FOR USE OF CONSTRUCTION MANAGEMENT

A. GENERALLY
B. CLIENTS DEGREE OF KNOWLEDGE OF BUILDING PROCUREMENT
1. (i) Individuals and Small Tightly Knit Organizations Which Lack Knowledge of Building Procurement
1. (ii) Individuals and Small Tightly Knit Organizations Which Have Considerable Knowledge of Building Procurement
2. (i) Large Multi Department or Multi Function Organizations Which Lack Knowledge of Building Procurement
2. (ii) Large Multi Department or Multi Function Organizations Which Have Considerable Knowledge of Building Procurement
C. NATURE OF THE PROJECT
1. The Anticipated Physical Nature of the Building
2. The Abstract Features of the Clients Needs from the Procurement Process
a. Control of Building Scope
b. Management of Many Complex Role Relationships
c. Additions and Alterations to Buildings Housing Ongoing Activities
d. Quality and Control of Cost Budget
e. Total Dollar Capital Cost of the Building
f. Short Durations for Procurement
g. Relaxing Bureaucratic Constraints on Public Clients
h. Appropriately Packaging Construction Work to Contract Scope
D. CHOOSING TO USE OR NOT USE CONSTRUCTION MANAGEMENT

V THRESHOLD FOR USE OF CONSTRUCTION MANAGEMENT

A. GENERALLY

The factors in the choice to use construction management or not are relative to the situation faced by the client and the capabilities of the client. The permutation of these factors creates a very complicated picture and what is reported here is a guide to the thinking of a client considering the use of construction management.

The decision to use or not use construction management should be made very early in the procurement process for the client to derive the greatest benefits from the process. A client who hires a construction manager after completion of design or even during design will not derive much benefit from construction management. Such late hiring of a construction manager may even produce a negative result for the client compared to other procurement approaches.

The construction manager should be hired at the same time as the architect and both, along with the client should work closely together as a team for the procurement of the building. It should be recognized that the greatest benefits to the client from construction management will be created in the design and contracting phases of procurement.

A client should realize that by using construction management the client will have to participate with the architect and construction manager in making decisions and choices, especially in the design and contracting phases. If the client wants to be uninvolved in the decisions and choices on design, quality, cost and delivery duration, etc of the building then the client might very well not harvest the full potential of construction management.

Some experts consider that it may not be beneficial to the client to use construction management on a building project of a small size or small dollar cost or simple nature. However, most experts agree that a client who is lacks knowledge of the complex processes of building procurement could benefit from construction management advice on even simple projects that industry participants see as small in size or price or simple in nature but which may be a significant investment or of functional importance for that client. Thus any building project, other than ones which have been procured many times by that client and are very simple have potential benefits by the use of construction management.

Put simply, construction management should create the greatest benefits for the client in procuring the building if the client is faced with given constraints such as coordination among a large number of design and construction specialists, a very tight budget, a very complex design process, required unique quality features in the building, a very complicated construction process, complicated interactions between design, contracting and construction, a very short procurement duration or a fixed date by which the building has to be in use etc., or a permutation of any such constraints.

While a client, small or large, who is very knowledgeable of procuring buildings may appear to have less potential from construction management, it is dependent on how the construction management potential is used as to what value will be derived from it. Clients who are very knowledgeable of building procurement have high potential to make construction management work to its fullest capacity because two experts coming together can be motivated to a higher level of professional output. Thus the choice to use or not use construction management is one of relativity. The less the client knows about procuring a new building through the sub phases of user's needs, feasibility, design, contracting, construction and commissioning the greater is the potential for the client to benefit from construction management.

This choice to use or not use construction management can be best expressed as a question, can enough of the potential benefits of construction management be achieved to an extent large enough to more than offset the marginal costs of hiring the construction manager? In answering that question there is the multifaceted nature of the client, the nature of the project to be built and the complicated needs of its procurement process. Also to be considered are the strengths and weaknesses of the construction manager chosen to provide the set of services

required on that building project from among the wide range of quality between the best and worst construction manager.

As has been said many times in more general contexts, when weighing the price of expertise (i.e. of hiring the construction manager) the client should consider the costs of his own lack of knowledge on the subject (building procurement especially in design and contracting). Of course, there may also be situations in which it is better for the client to hire a consultant for occasional projects rather than to have in house staff who may be idle between projects. Also, adding expertise to provide advice can pay off dramatically for the client if the sources of the advice has been wisely chosen in regard to the situation.

The threshold for choosing to use or not use construction management is dependent on the nature of both the client and the proposed building project. The nature of the client tends to affect the threshold based on (a) the client's degree of knowledge (or more realistically, lack of knowledge) on procuring buildings through all phases of that process and (b) if the client is a single person/small organization or a large organization with subparts. The nature of the project affects the threshold of choice by (c) the physical features of the building and (d) the abstract features of the clients needs from the procurement process of the building project.

Of the above four features the one which is most important regarding the choice of the use of construction management is the abstract features of the client's needs from the procurement process. The second most important feature for that choice is the degree of knowledge, from ignorance to full knowledge, of the building procurement process by the client.

Normally, construction management is of greatest benefit to a client who has constraints on the procurement process such as those stated above and to clients who may lack full or local knowledge of the whole building procurement process. However, construction management is also likely to benefit a client who is a large complex organization which has no internal construction procurement expertise to correlate and execute its needs for the future building. If the future building is a very complex building or if the procurement process, mainly in design and contracting requires a complicated synthesis and management then most types of clients can benefit from the use of construction management.

B. CLIENTS DEGREE OF KNOWLEDGE OF BUILDING PROCUREMENT

Regarding the threshold of choice to use construction management, clients can be considered as either (1) individual persons and small tightly knit organizations or (2) large multi department or multi function organizations. Each of these client types (1) and (2) can have (i) little knowledge of building procurement or (ii) be very knowledgeable of building procurement. Those clients whose knowledge of building procurement lies between these polarities should be seen as tending towards these polarities regarding the descriptions which follow or look to the other features of the threshold to decide on their choice to use or not use construction management. Clients can also consider the following as guidance on how to use construction management under different types of clients.

1. (i) Individuals and Small Tightly Knit Organizations Which Lack Knowledge of Building Procurement.

These clients can benefit from the use of the agency advice of construction management which complements their own lack of knowledge on the subject. Two major qualifications on their use of construction management are that such clients must be willing to spend their own energy and time to be involved with the architect and construction manager in making decisions and choices and that they are capable of participating in complex business decision making involving abstract values and money and time. These factors are especially valid in the design and contracting phases of building procurement. If such clients do not want to be involved in the risks and benefits of procurement decision making regarding, for example, overall costs and quality of constituent features of their future buildings and the trade off of these decisions in time and money, then they should not adopt construction management.

If such a client anticipates a growing future program of buildings then using construction management may provide education while evolving an internal building procurement department.

1. (ii) Individuals and Small Tightly Knit Organizations Which Have Considerable Knowledge of Building Procurement.

Such clients can see themselves as either being able to execute building procurement in house or have the building procurement knowledge to make choices interactively with their professional advisors and to realize the full benefit potential from utilizing an agent construction manager for a specific project. The procurement knowledge of the client should mean that wise decisions and choices can be made for themselves or clients while utilizing and enhancing the advice of the architect and construction manager. Also, this client will understand the importance of the client making contributions to the discussions and decisions of the architect, construction manager and client as and when required to facilitate and expedite the procurement processes of the client's building.

If such a procurement knowledgeable client adopts the construction manager approach using an internal building department as the construction manager, problems may arise if, in executing construction management, the client/construction manager may be put under pressure to bias decisions to benefit the client side of the dual role and away from the independent position of a professional agent. Also such a two faceted construction manager may, more improperly, change earlier decisions to create benefits for the client's main operations to the detriment of participants in that particular building procurement process. If this occurs, there will be long term lasting damage for that client in that building marketplace. In the situation of a procurement knowledgeable client it is best to use in-house procurement expertise to play only the client role of the construction management triumvirate and hire an outside construction manager to bring additional needed expertise for the procurement of the particular building to the triumvirate.

2. (i) Large Multi Department or Multi Function Organizations Which Lack Knowledge of Building Procurement.

These clients can benefit from construction management by a construction manager providing the expertise they lack in building procurement. In addition, the construction manager can be the focal point of gathering information from all of the internal operating departments within the client's organization for the future building and as the manager and scheduler of its whole procurement. Again, a client such as this must be willing to commit adequate amounts of in-house resources to provide proper and timely involvement as the client in the construction management process. If the client is unwilling to make that commitment but wants to use construction management, only limited benefits will be derived from construction management. Such limited benefits may be less than those which could accrue by using an alternative procurement process.

2. (ii) Large Multi Department or Multi Function Organizations Which Have Considerable Knowledge of Building Procurement

These clients should have the ability to carry out construction management for themselves by using their in house real estate/construction departments as the construction manager. The problems from such in house construction management mentioned in 1(ii) above also apply here. In a large organization with an internal department with staff and corporate status there is usually less likelihood of the misuse of power as the combined client/construction manager. However the danger does exist and the solution suggested in 1(ii) above should be followed in this organizational situation.

There can be benefits, even to a client such as this, to use the services of an outside construction manager because that client can benefit from the outside construction manager's advice which may have special characteristics such as local knowledge, building functioning

knowledge as well as specialized cost, scheduling and constructability expertise. Also the outside construction manager may have particular expertise in the type of building that is required but not available in the client's organization. There also may be the issue of the considerable additional work load on this type of client from a major project which induces use of an outside construction manager to temporarily augment the expertise of in-house staff.

C. NATURE OF THE PROJECT

Regarding the threshold of choice to use construction management, the nature of the building project can be considered in each of two ways, (1) the anticipated physical nature of the building and (2) the abstract features of the client's needs from the procurement process of the building project. The last of these - (2) - is usually the most important of all features in deciding to use or not use construction management.

1. The Anticipated Physical Nature of the Building

The physical features of the anticipated building which would cause the use of construction management are, above all else, that it will be a very complex or sophisticated building as to its constituents, their juxtaposition and their connections. An extremely large building especially if it has moderate complexity and a project of a number of buildings with interconnections may also benefit from construction management. Buildings which are unique to that local marketplace or have to be built on an already built on site or are major renovations of existing buildings can benefit from the use of construction management. Buildings which will require sophisticated physical features or equipment to be designed and built into them, especially if the technology of such equipment is continuously and rapidly changing, can be better served by procuring them by construction management than other approaches.

2. The Abstract Features of the Client's Needs from the Procurement Process

This group of features is among the most important of all groups of features of the decision threshold to use or not use construction management. Put simply, if the procurement process for the building anticipates the existence of tight constraints or unique features of any type, then construction management should be considered for its procurement. Such tight constraints can be derived from a small budget available for the building's nature or size, achieving the required quality of building for the needs or the uses of the client and/or tenants and users, shortness of available duration for procurement of the building or expected complexity of the procurement process or the need for complex, sophisticated or interactive contractual arrangements among many of the participants in the phases of the procurement process. Also, if the client will have difficulty in defining the needs of the client's organization to be incorporated in the future building or if turbulence is expected in local construction market place then construction management may be able to better alleviate and handle such matters than other procurement processes. Where complex interactions will have to occur between this building work and the ongoing work of the client's business, construction management can be a better procurement process than the alternatives available in the building marketplace.

As tight constraints and unique features are usually derived from the interactions between the future building, the situation in which it will have to be procured and the potential participants in that procurement i.e. non normal relative features that have to be handled, it is very difficult to cite particular features in this group. However, a number of sub topics within abstract aspects of building procurement can exemplify the tight constraints and unique features which heighten the potential benefits from using construction management rather than other procurement approaches. These following examples come from each of the design, contracting and construction sub phases.

a. Control of Building Scope

Above all else, the future building should appropriately clothe the future needs of its users and the client. To achieve this requires that the needs for the building have to be defined. It may seem strange, but usually many clients, especially large organizations, can have considerable difficulty defining those needs. Furthermore, even after such a definition has been created, there can be pressures to add more quality and quantity features to that already decided building scope. This "scope creep" or expansion which usually occurs during design, either has to be controlled or the client made aware of it and its effect on size of budget and procurement duration until the building will be ready for use. The construction manager can play a major role in assisting the client and the architect in this work as the building evolves through design.

b. Management of Many Complex Role Relationships

Very few contemporary buildings are designed wholly by one individual architect. There can be a chief or project architect for each building but for even a normal simple building up to an extremely large or complex building, a vast array of specialist designers and even user functional consultants are employed in the design process. These specialists may be within or outside the entrepreneurial organization of the project architect. However, the complexity of the interactions of the work of all of them, the cost and duration effects of same and the expediting of their decision making during design to meet the schedule set for the design can be assisted by a construction manager's presence in the design team.

c. Additions and Alterations to Buildings Housing Ongoing Activities

The services of a construction manager can be beneficially harvested during the design, contracting and construction of a complex or simple building where that new building has to be joined to a building which houses the ongoing operations of the client, in the same or adjacent buildings. Such interactions can impact not only the scheduling of construction work but also the design of the future building to facilitate the smooth interfacing of the client's ongoing operations with those which will be housed in the new building and both with the required construction process.

d. Quality and Control of Cost Budget

Clearly, a tight budget for the future building regardless of size or complexity means that careful and valid cost advice is beneficial in the design process. Tight budget is a relative term rather than one suitable for clearly splitting projects into "yes" and "no" groups for the use of construction management at a certain capital cost figure. The budget is related to the size and complexity of the building on the one hand but also has to be related to the funding available or set for the array of users needs to be clothed by the building. Construction management providing budgets and estimates and costs of alternative design features during the design process and interacting with the designers can greatly increase the probability of the building meeting its tight budget.

e. Total Dollar Capital Cost of the Building

The client has to pay the fee of the construction manager as part of the cost of the building and should receive benefits to the future building and the client's ongoing activities as well as those in the procurement process greater than such fees. This is perhaps easier to achieve on large buildings than on small buildings. A very vague boundary of about three to four million dollars may be appropriate in that buildings of greater cost have greater chances of benefitting from construction management whereas smaller buildings of lower budget may need to have greater complexities or constraints to make it worthwhile to use construction management. Of course, the cost of the same building in different locations and marketplaces and at different times can differ considerably which increases the vagueness of the above dollar boundary.

More importantly, a small complex building which has to be functional in a short duration may cost the same as a larger, simple building which can have a long procurement duration. Thus, capital cost of a building to the client is a rather weak parameter to be considered as part of the threshold choice to use or not use construction management.

f. Short Durations for Procurement

Design, contracting and construction are affected by and affect time scheduling and control of all work on all phases of procurement. When there is limited time, or more accurately, insufficient duration available to design, contract and construct the future building in a linear process, then construction management should be considered for its procurement. Such limited duration can be from (i) complexity of the building or (ii) complexity of procurement process or (iii) desire by the client to meet marketplace forces by a calendar point in time. The insufficient available overall duration is often caused by the need to have the building ready for use by a specific date and the duration between then and now is seen as insufficient for normal operations. In such a situation the required processes have to be scheduled into the available "duration window" and the required processes of design, contracting and construction managed and expedited to take place when required so that use of the building can begin when desired. If the "duration window" is so short that some design and construction work have to overlap each other, then superior design work and scheduling management of design, contracting and construction and their execution are required to coordinate all work in all three phases. Of course, the time scheduling will be more complex if the building to be constructed is of a complex or unique nature. Another variation on tight time scheduling can be if the project is made up of a number of buildings and all of them are required to begin to be used at the same point in time even though each may require a different duration of construction.

All of the above are examples of situations in a building project in which the time scheduling constraints are very tight or complex and in which construction management should be considered to procure the building within the available duration while also considering all the other features of budget and quality etc. etc.

g. Relaxing Bureaucratic Constraints on Public Clients

In the contracting phases the construction management approach can provide benefits to the public/government client over the required regulation approach of using the conventional lump sum general contract approach to procuring buildings. In the required public conventional lump sum approach, the client must accept the lowest bid whereas by using the construction management process the client can have the construction manager carry out either prebid qualification of bidders or post qualify bidders once they have submitted their initial bid. In either, the client, through the construction manager can make a quality evaluation of bidders for either general contracting or for each trade/subcontract package within the total work for the whole building. This can be especially beneficial on buildings where the cost to the client from poor quality of the actual construction work or inappropriate functioning of the resulting building or poor coordination of any phases of the procurement process, especially its construction phases, is far in excess of any price differential between the lowest bidder and the bid of a capable constructor for some trade contract package in the building construction process.

Also, in contracting situations, if the client wants to start work on site on a particular day for publicity or funding reasons, he can have the construction manager break out a work package from the whole work required and start work on it on the desired date to accommodate such needs. In addition, a client such as a large organization, public government or private corporation, may be under internal political pressure "get something started" too early for the real benefit of the building. If an outside construction manager has been hired for that building's procurement process then the client for the building can cite the views of his outside expert agent, the construction manager, to refute if possible, the invalid pressure to which he does not wish to succumb for the benefit of the building and his organization.

h. Appropriately Packaging Construction Work To Contract Scopes

The contracting for trade/subcontractor packages of work can be difficult in many ways especially for a complex building which has to operate properly after having been built in a very short duration. The building may have to be broken into many work packages either in a traditional set of trade contracts or a complex unique set of contracts given the unique or complex nature of the building and the required construction process. Also to be considered in contracting must be the appropriate grouping of responsibilities in the construction process and ultimate system functions in the finished building. Furthermore, the work packages contracted for should be influenced by the trade practices in the locality of the building and the most simple achievable construction process of the whole building. In addition, having knowledge of the fundamental building work required to put any building in place has to influence how the building being designed can be and will be broken down into contract packages of work for each trade. All of this analysis and synthesis of work into contract packages can be assisted and enhanced by the construction manager during the design and contracting phases of procurement. In addition, the construction management process can allow the client, the architect and the construction manager to discuss what is the best grouping and arrangement of such contract packages for the needs of the construction process for that building and its client. Given that such thinking and discussion has taken place, then the design of the building can be modified so that the actual construction process can be scheduled, carried out and managed more expeditiously while still incorporating into the building what is needed to benefit the client in the use of the finished building.

D. CHOOSING TO USE OR NOT USE CONSTRUCTION MANAGEMENT

As was stated at the beginning of this section of the report and as will have become apparent from reading this section of the report, there are a number of non linear factors which constitute the threshold to choose to use or not use construction management.

Put too simply, but meaningfully, any building project which has unusual or severe constraints on the nature of the building, on the nature of the procurement process in any of its phases, on the nature of the construction industry situation in which it will have to be procured and in the nature of the client's lack of knowledge of building procurement and the willingness of the client to carry entrepreneurial risk and seek maximum value in his future building, will tend to maximize the benefits receivable by the client by him choosing to use construction management without regard to the amount of the capital cost of the future building.

VI ORGANIZATIONAL STRUCTURE FOR CONSTRUCTION MANAGEMENT

VI ORGANIZATIONAL STRUCTURES FOR CONSTRUCTION MANAGEMENT

A. INTRODUCTION

Organizational structures for any human activity, especially complex, multi human activities are not something to be imposed upon situations. Rather the organizational format should be derived from the nature of the situation and the participants in the situation so that all can be combined effectively and efficiently towards the major, overall objective of the group of activities.

The nature of the situation of construction management is that it is primarily the use of human expertise in providing advice, and management and expediting of the whole building procurement process, primarily in the design and contracting phases and secondarily in the management of the subsequent construction process. Any interactions among these three phases should also be accommodated by the organizational structure.

The organizational format should be set up to serve the needs of the situation of each specific building project (and some of these needs may not be definable at the beginning of its procurement process). Hence the flexible, interactive capability of the format of the chosen organization is another essential feature of the organizational structure for construction management.

Because of the temporary nature of the procurement process for each building, the procurement organization or "project team" is usually of an ad hoc nature. Thus while the same roles and communication lines between them may exist on most procurement teams, the players of each role probably will be different entrepreneurial companies, and professional people etc. Variations in the basic organizational structures may be valid to serve specific needs of specific building procurement processes.

Organizational structures for any organization should reflect two major linkages between the participants in their activities. These two linkages are (a) communications between roles and (b) contracts between executants of roles.

It should be clear that to think out the most appropriate organizational structure for the temporary ad hoc construction management organization or team serving the client that firstly the best and most appropriate communications patterns for effective and efficient service should be thought out and crystallized. Once that has been established it can be most properly expressed in contractual linkages between the executants of the pairs of roles desired by the most appropriate communication patterns. Contracts are the legal bindings between pairs of specific players of each role on each procurement team. Such contracts should clearly state the duties and responsibilities, processes of payment and deliverables etc under each contract between each pair of participating executants of the roles.

Where a client or advisors rush to define contracts before considering the appropriate lines of communications there is a high probability of less effective and efficient service. Indeed, in such a situation, overlaps and omissions in defining duties and responsibilities will exacerbate those initial failings. This can lead to a situation of destructive conflict among the roles rather than their coming together as a creative team of professional advisors and contractors.

Communication lines should represent the required flows of information between the participants in the whole process and situation to be served by the whole organization. Communications which flow through such networks should encompass both written and verbal communications. It tends to be easier to make written communications flow along desired appropriate lines to help all appropriate roles be aware of what is happening which affects their work and responsibilities.

Verbal communications are less easy to guide and control and on many occasions free verbal interactions are valuable, especially in the mode of questions and answers among diverse professionals as they seek to reach optimal balances and decisions especially in the interactive design and contracting work phases. However, the resulting conclusions from such interactive,

verbal discussions/communications should be reduced to writing and so conveyed through the communications networks mentioned above.

The networks for flows of communications should also be used for requests for information by particular roles in the whole project organization. By so doing they can be guided to the most appropriate role to provide the best response while keeping all other necessarily involved roles informed of such requests for information and the nature and extent of the provision of a response along with dates of both the request and its answer and the duration taken to make the response. The seeking of information can become bogged down if most of this process is by memo between team roles and or others necessary for the procurement of that particular building. Some participants may use this memo approach to try to show how superior they are at doing their work compared to others. Also, seeking information by memo maybe used as a means of pushing their responsibilities on to another role from whom they seek the information and many such memos may be directed at slowing down the pace of the procurement to meet the staff capacity of the sender of the memos or point out inadequacies of other participants. This should be actively discouraged by the senior members of the organization. Rather than the above, requests for information may be handled faster verbally, face to face or by phone while dating and logging the request. The distribution of results can be by memo or at regular meetings of the whole organization or core groups of the organization. The chosen communications approach should be used to foster team work and cooperation and trust among the participants to the building procurement rather than to slow down the construction management process and to make it more bureaucratic.

B. COMMUNICATION NETWORKS FOR CONSTRUCTION MANAGEMENT

These communication networks will be described separately for two segments of the building procurement process, (i) the design and contracting phases where construction management is providing advice and maybe managing and expediting these processes and (ii) the construction phase where construction management is managing the ongoing actual construction process being carried out by the trade/subcontractors hired in the contracting phase.

1. Communication Network For Construction Management In The Design and Contracting Phases

The best, most appropriate communication network for these phases of procurement is the "triumvirate" of the client, the architect and the construction manager. Each of these three roles must communicate easily, clearly and continuously with each other. It will always be less than optimal for any pair or any one role of the triumvirate to dominate the triumvirate. Each role player must see their position as that of a team player suggesting information and alternatives, asking questions of the other two and suggesting answers to questions put by the other two. These three role players should reach combined decisions on all major issues. Each should temper the force of their input etc to decision making by giving weight to the expertise of the others on that issue. If and when the three players cannot reach a combined resolution of inconsistencies, the client should make the decisions which "cuts the gordian knot" for his own interests for this building and its procurement. However, such unilateral decisions by the client should be kept to a minimum and only made after he has received and considered input information from both of the other roles on the issue as well as group discussion on the issue to provide him with the best available information on which to make this unusual decision.

It should be clear to clients that in using construction management the client will be required to spend more of his own time and energy than he would do on other procurement approaches. However, by so doing and fully utilizing the expert advice of the architect and construction manager a more optimal, higher quality solution should be achieved to the client's complex needs for a building and its procurement.

Each of the client, the architect and construction manager may be required to call on specialized expertise either outside their own organization or from elsewhere within it depending on the needs of the particular building being designed and contracted. It is normal for the

architect to carry out all subphases of design with an array of subdiscipline experts coordinated by the architect. Such sub discipline design experts may be employed in the same entrepreneurial design practice as the architect or they may be from specialist design practices and be working as design subcontractors to the coordinating architect. These are contractual matters which should not change the communication lines or activities required to fulfill the design process. It is more usual for the construction manager to rely on in-house experts such as estimators, schedulers, purchasing agents and contract drafters but if additional expertise is needed to address specific construction matters it should be sought out and provided as advice to the discussions and decision making of the basic triumvirate of client, architect and construction manager. A client who is a large organization should clearly define to everyone that his building project director or coordinator is the designated client member of the construction management triumvirate. Also, that specific person filling the client role of the triumvirate should be the specific role to seek out information in other parts of the client organization which is needed by the three major roles of the triumvirate for any purpose by the construction management team. The results of any secondary level interactions between organizations should be notified to and cleared by the core triumvirate prior to use in the procurement process.

Seeking out of information or provision of advice from experts who are not specifically members of the triumvirate should be the responsibility of the most appropriate of its major members. However, it may be that the interaction between separate experts such as a design programmer of the architect and eventual space users of the large client or the electrical design engineer and an electrical expert in an electrical trade/sub contractor may be beneficial to the design of the building. In such situations such interactions should be fostered but the results of such meetings should be reduced to writing and provided to the members of the core triumvirate to make the choices and decisions regarding the future building. Only then should such information be disbursed to the other participants in the team of design and contracting agents. Never should such second tier specialists make choices or decisions alone. Rather, they should provide optimal solutions to the core triumvirate team to decide and convey results to all necessary parties to the building's procurement. Of course, interactions such as the above but of a cross discipline nature should be treated similarly. For example, the elevator engineer, the structural engineer, and the interior designer may meet with the construction estimator and construction scheduler as well as with the client's real estate space rental expert to discuss, clarify and suggest optimal solutions to the interactions of their special expertise. The results of such discussions should always be conveyed to the three principal members of the triumvirate to enable them to make the best design decisions for such parts of the building and its interactions with design of other parts of the building. Once the core triumvirate has made their choice or decision based on the advice of their supporting experts will they pass that choice or decision to all who need to know its contents.

At certain times of the design and contracting phases there may be greater volume of communications between two of the three roles of the triumvirate. During design programming architect and the client may be in that category. During contracting the client and the construction manager may have considerable volume of communication. However, in all such situations it can be beneficial for the whole building that the third party who is less directly involved than the other two maintains interest and participation to hold the balance between these two while also watching out for detrimental features creeping into the building or its procurement which are unseen by the two roles who are carrying out most of the communications at that time.

While other communication networks were presented in this study and discussed by the experts, there was no support for any communication network other than the triumvirate network for design work. As the contracting phase has the construction manager still working as an advisory agent to the client, rather than as a manager of actual construction work already contracted and the trade/subcontractors are not yet second tier members of the building project team, it was considered appropriate that the triumvirate network be maintained for contracting as well as design. Furthermore, it was found that the triumvirate of client, architect and

construction manager continued to be the core of the communications network most suitable for the construction process.

2. Communication Network For Construction Management In The Construction Phase

The best and most appropriate communication network for construction management in the construction phase of building procurement is virtually the same as the best one in the design and contracting phases. That best construction phase network starts with the triumvirate of the client, architect and the construction manager and adds lines of communication from the construction manager to each trade/subcontractor upon their hiring and for the duration of the construction process.

The original triumvirate of client, architect and construction manager set up and used in the design and contracting phases will continue to operate through the construction phase as the key decision making team. Now, in the construction phase, the construction manager is the primary communicator with the array of trade/subcontractors while the architect continues to communicate with the array of specialist designers. However, the triumvirate of client, architect and construction manager remain as the key focus of management decision making and origins of expediting and communicating for all participants in the construction process (as well as the remainder of the design work if it has been considered beneficial that design and construction work are overlapped in calendar time). The three central roles remain as the management leaders of building procurement and their approach to making decisions, receiving and disseminating information etc from and to all other roles involved should remain the same as described in the best communications network for design and contracting. The only difference in the construction phase from the earlier phases is that the universe of roles involved has increased by the addition of the linkages between the trade/subcontractors, and the construction manager. The processes and approach to communications should remain the same as described for the design and contracting phases and in the introduction to this section of the report.

To expedite communications during the construction phase it is advantageous that the construction manager and the architect have capable executives on site (as well as in their office), each with the designated power to make decisions for their major roles regarding activities in the construction process on site. Perhaps on a major project, the client should also be so represented on site. While this on site triumvirate are primarily there to expedite both work and communications onsite they should do so within the context of decisions of the major triumvirate who worked together during design and contracting. If major issues arise they should be deferred to or at least referred to the members of the major triumvirate at least for their combined opinion or even decision making. Such referrals and responses should be made with such speed as to not inhibit the construction work.

3. A Major Variation in the Communication Network

A variation that should be carefully considered in all phases of procurement which has greatest impact during contracting and construction is when the construction manager is an in-house facility planning, real estate or construction department of the client's organization. Ideally, this should not be so, but it does exist sometimes. Then, because the construction manager will be both the client and the construction manager compounds and debilitates the triumvirate concept of construction management. To avoid such a situation many clients will use their in-house facility planning real estate or construction department to execute the client role in the triumvirate and hire an outside construction manager to fulfill that role. In such situations it is good that the client's in house department is the only party to interact with other internal departments of the client's organization. The only exception to this would be to use the procedures stated above for communication between second level roles behind each member of the triumvirate.

During the construction phase, if the above separation is not made there is potential for the "two hat" construction manager, i.e. one person or party being both client and construction

manager. Under such a circumstance there is the risk that the two hat decision maker will make a decision under one hat then later change it from under the other hat. Also, the person overtly playing the construction manager role may not be impartial by being mostly biased to performing covertly under the client "hat". This can be especially important in the context of change orders and interim payments for trade subcontractors and should be avoided by having separate players for each of these roles.

4. Clearly Expressed Communication Networks

Clear and full communications are required to satisfy the complex interactions among many designers and construction management advisors in what is basically an extremely complex, interactive and iterative design process. This requires that all major communication networks and linkages be clearly understood by all participants, to the construction management process. Presentation of these communication networks should be in the contract of each and every party, to the building project. This can and should be reinforced to all participants of predesign conferences, pre bid conferences and at preconstruction meetings. Also, a project procedures manual may be prepared for each construction management project and it should include the appropriate communications networks to be used in each phase of procurement. If this is produced a copy should be given to all parties participating in the project.

Regularly called meetings of the three major roles of the core triumvirate team can contain clearing house segments for batches of communications since their last meeting. The minutes of such meetings can be the written expression of such decisions which can then flow through the networks to the parties who need to know because of their involvement. Also, such minutes can be the focal repository of all communications regarding the building and the procurement process under construction management.

5. Potential Inhibitors and Enhancers of Network Communications by the Construction Manager.

The flow of required information through the communication network can be inhibited or enhanced by the actions of the people playing each role in the communication network. One of these roles is the construction manager and its executant may inhibit or enhance the communications among all participants by the background attitude brought to the management of the communication processes. Unfortunately, some construction managers, as all managers and professionals do, tend to bias communications by what they see as the best for the project. However, if such bias originated from an overnarrow perception of "best for the project" then such biases will be detrimental for the project. It should always be realized that it is the team of equals, client, architect and construction manager, which sets what is best for this project at hand. Whatever is seen as best by the construction manager alone by whatever is used to define best will probably be different from what is seen as best for the building and its procurement as seen by the core triumvirate of the construction management team.

Clearly all communications should be open to all three participants. One role should not try to improperly bias communications by going first to another role in an attempt to influence the third role of the triumvirate and this should be held to by the client, the architect and the construction manager.

a. Some Communication Inhibitors By The Construction Manager While the construction manager may be responsible for expediting the procurement process there should be the appropriate amount of time required to execute the complexities of the multi interprofessional interactions and iterations needed in the design process. This begins with the analysis and thinking required to establish the program for the building and its translation into an abstract concept for the future building which then has to be further translated into a conceptual design or array of alternative conceptual designs. While time milestones are useful to express control in this respect through the procurement process, if the construction manager pushes too hard for decisions to be made and concepts to be finalized too soon or even worse, to suit what is needed for the construction process alone or cost estimate alone or by schedule milestones, the quality

of the end product building, its goodness of fit to the client's needs over its lifespan of use after construction may be inhibited. The construction manager should have the capability of understanding the whole design process so that communications are not inhibited in it which cause design problems which have to be solved expensively in money, time and frustration later in the procurement process or more importantly over the duration of its use. The above can arise when the construction manager has preconceived ideas on design solutions or construction contents or rightly or wrongly pushes for design decisions to be made on only a capital costs basis because he has furnished the construction cost estimates.

Continuous criticism of a design for construction cost and duration reasons or construction process difficulties can cause serious inhibitions to the whole team trying to provide the best building solution to the client given the need for the building, the situation faced or location for the building, the time available for procurement and the client's considerations for life cycle costs rather than capital costs the client's parameters and values for this building.

Put over simply for effect, the construction manager who starts with an attitude of only being concerned with the construction a building but who has to manage the whole procurement process of building needs, feasibility study, design, contracting, construction, commissioning to best meet the use of the building will probably seriously inhibit the needed array of communications to best serve the client under construction management.

The construction manager should not suggest or dwell on the causes of issues but should seek to participate in the provision of wise solutions and decisions to issues raised. Also, the construction manager should not be very opinionated in statements unless they can be validated by facts and experience supporting such statements. Even with such validation at hand for opinions the construction manager would be wise to approach discussions on issues with participating roles by not too vehemently stating opinions.

b. Some Communication Enhancers By The Construction Manager On the positive side, communications among the construction management triumvirate and their supporting roles, can be enhanced when the construction manager acts as a team integrator and facilitator and expeditor of communications for all roles. Operating as a chairman rather than a director would be a better approach. The construction manager should emphasize positive factors in communications and interactions and seek joint and combined solutions to issues among the appropriate parties. Support should be given to the expertise of professionals in their own field and respect the expertise of each professional as the group seeks solutions and decisions on interprofessional and inter role issues. All of this positive attitude should be directed at propelling the project to the future, later phases of its execution for the benefit of the client in the future use of the building.

In moving the project forward, the communications should include open, healthy, debates, discussions and even creative arguments among the major roles and on inputs to and from the supporting roles. Binding all of this together should be the constant reminder that all parties are working as a team to benefit the client's future building. Differences among the parties are to be expected and discussed and decided in the above positive, future orientated manner by the group of required roles for each topic raised.

To assist the above positive communications, the construction manager should be reasonably fully aware of the capabilities of all required professionals and contractors as well as knowing normal, repetitive issues of conflict among all participants to procuring buildings. The construction manager should also keep in mind the objective of the client for the future building and its major parameters such as function, aesthetics, costs -capital and functioning, duration of procurement, willingness to accept risks and abilities and knowledge of the client on procurement of buildings.

In the facilitating of communications the construction manager should expedite fast resolution of issues raised by the team or a single member of the team. The solution should not necessarily be the first alternative suggested but the construction manager should seek

alternatives from which to choose the best solution to the issue raised within a reasonable duration given the relevance of the issue to the whole project and the situation in which the issue has been raised.

As part of this management and expediting communications of the team, the construction manager should bring to the group the various issues to be discussed and decided. As input to such decisions the construction manager should also bring to the discussion specialized input on cost estimates, duration effects, constructability and any other needed specialized advice unavailable from the other normal participants in the procurement process.

C. NETWORK OF CONTRACTUAL LINKAGES IN THE CONSTRUCTION MANAGEMENT ORGANIZATIONAL STRUCTURE

This aspect of construction management is secondary to the communications patterns as input to organizational structure but it remains a crucial variable in how the process of construction will be carried out and it will affect the interests of the client. Its two alternatives should be carefully considered by clients prior to crystallizing their choice between the two and who they will choose as their construction manager on each building they intend to procure by construction management. The two contractual approaches to construction management will be titled (a) pure construction management and (b) quasi general contractor construction management.

Put simply for initial consideration of their differences, the pure construction management approach has the construction manager as an advisor agent to the client throughout the whole set of sub processes of procuring the building and the contracts for actual construction work are between the client and each trade/subcontractor for the construction process. Under the quasi general contractor construction manager approach the construction manager is an advisory agent to the client until the building design, contract and situation are (i) sufficiently well defined or definable that the construction manager can be called upon to provide a lump sum bid or a guaranteed maximum lump sum bid for its construction and (ii) that the risks inherent in the lack of building project definition at that point in time are acceptable by the client for whatever reasons the client deems appropriate.

Under the quasi general contractor approach the contracts for actual construction work will be between the then general contractor (who was formerly the construction management advisory agent of the client) and each trade/subcontractor. There will also be a single contract between the general contractor (i.e. the former construction manager) and the client for the construction of the whole building. The guaranteed maximum bid should be looked at carefully by the client because such a bid would be from a sole source bidder who knows that is his position. Also, such a bid might cause the client to not receive full value from cost saving design changes suggested only after the change of the construction manager into a general contractor. Such a future construction phase situation could also bias the agency advice given to the client in the duration of services as construction manager prior to becoming the bidder for the whole construction work. As agency advice during design is such a major part of construction management this approach tends to limit the potential benefits to the client from construction management. Of course, there can be an overall bias towards more general benefits achieved in the design phase for the client which may offset the above potential detriments of this contracting approach.

A client who is very knowledgeable of building procurement may choose to arrange a hybrid approach comprising elements of each of the above two approaches. Such mixing to create a hybrid should not be tried by a client who is of limited knowledge of building procurement because the participants from the industry, drawn into such a hybrid may be confused and the client who is of limited knowledge will have difficulty in clarifying and holding the balance in such a situation. Any such hybrid should be clearly stated in every contract related to its procurement phase.

The fulcrum upon which this crucial choice by the client has to be made between these two approaches is (1) whether or not the client wishes to have the degree of certainty of a known and contracted construction price from at least a guaranteed maximum price contract for the whole building's construction prior to starting construction before letting any one trade contract for part of the building's construction or its whole construction and (2) the degree of uncertainty and entrepreneurial risk that the client is capable of handling in the whole processes of procuring a building. Prior to reaching this choice of pure construction management or quasi general contractor construction management is the desire of the client to benefit from the agency advice of a construction expert on the constructability, costing, scheduling and management during the earlier design phase of the procurement of his building as well as have that agency advice during the contracting phase.

A client who wishes to satisfy this need for the above degree of price certainty will benefit most from the quasi general contractor approach including the guaranteed maximum contract in which the construction contracts will be held by the former construction manager as the general contractor to the client. The client who is confident in his own knowledge of issues and aspects of the building procurement process to seek out the optimum design, contracting and construction decisions as well as validity of cost estimates from the construction manager will benefit most from the pure construction management approach. A client who leans to his own expertise in entrepreneurial matters or is comfortable in operating in situations of entrepreneurial risk will tend to be able to operate well in the procurement of buildings by the pure construction management approach. Whichever approach is chosen has important ramifications as to the format of contractual linkages between the parties in the construction process.

The client-architect contract should include a clear statement of what is the nature of the contract between the client and the construction manager during the different phases of procurement. If applicable, the architect's contract should also state the points in the process where the nature of the construction manager's contract will change from one of being an advisory agent to one of being a construction contractor with a construction guaranteed maximum contract with the client. The duties of the architect under each different form of construction management should be clearly stated in the contract between the client and the architect. Those duties should also be stated in the contract between the client and the construction manager.

1. Contracts Under Pure Construction Management

Under the pure construction manager approach, during the whole of design, contracting and construction phases, the construction manager, as well as the architect, is a professional advisory agent to the client. The contracts of the construction manager and the architect with the client should be of that nature. There is also the minor potential for a building sophisticated client to have the specialist design subconsultants in direct contract with the client, rather than have them as consultants subcontracted to the architect. The trade/subcontractors who carry out the construction work in the construction phase and who are hired during the preceding contracting phase should have direct contracts with the client. Such contracts should include clauses covering the duties of the construction manager as the manager, controller and expeditor of the construction process even though there is no direct contractual relationship and only an indirect entrepreneurial relationship between the construction manager and each of these trade/subcontractors.

There are a number of reasons for choosing to have the construction trade/subcontractors in direct contract with the client. Probably, the primary reason is that by so doing the construction manager remains a pure agency advisor to the client throughout the whole procurement process. That advice to the client will be untrammelled by the potential that part way through the process the construction manager will become a contractor to the client with potential income from cost savings suggested or made in that later period. Thus the client can be assured that the quality of advice will remain unsullied throughout the whole procurement process and that all benefits from the advice will flow to the client.

By having the trade/subcontractors under contract to the client there will exist the legal, contractual clarity in the situation and minds of all parties involved. The construction manager remains an advisory agent of the client throughout all procurement phases. The parties, i.e. the trade/subcontractors, carrying out the construction work for the client, are under contract directly with the client, albeit defined in their contracts as being managed by the construction manager whose name and duties are stated in their contract upon which each priced their bid to the client.

There will be continuity of agency advice and a continuing build up of a data base of design alternatives, decisions, and reasons for this building's procurement being as it is which has been maintained and managed by the same construction management agent from procurement phase to procurement phase. The richness of alternatives discussed during design is carried forward into contracting and construction and so if fast changes are needed to meet unexpected circumstances it is probable that earlier reviewed alternatives can be brought out of the data base rather than have to be researched and created under pressure of time.

By being the continuous pure advisory agent of the client, the construction manager does not face entrepreneurial risk from advice given thus the construction manager will tend to provide the best, most accurate advice that can be mustered. This is especially crucial with accuracy of cost estimates for each trade and design alternatives. It is interesting to note that private clients desire cost estimates to be as accurate as possible upon which to make design and contracting choices which can affect both construction costs and rental income as well as economic feasibility of the whole building project.

In the pure construction management approach the construction work known as general items work of site support services (but not those of management of the building process which is carried out by the construction manager) should be packaged as a separate trade/subcontract and bid for just the same as the normal trade packages.

By careful and thorough use of prequalifying all trade/subcontractors (plus being willing to exclude questionable performers) the need for bonding of each winning trade/subcontractor becomes a variable rather than an absolute ingredient of contracts. The combination of careful selection of the construction manager plus pre-qualification of all trade/subcontractors by the construction manager could be seen as subprocesses making bonding redundant and the client can save paying the premium indirectly in the bids of such contractors. If the prevailing rules of the client's organization require all contractors to be bonded regardless of pre bid qualification or post bid qualification then so be it. However, care should be taken that double bonding does not take place by having each trade/subcontractor bonded as well as having the construction manager bonded.

2. Contracts Under Quasi General Contractor Construction Management

Under the quasi general contractor approach, the contracts with the various parties, especially with the construction manager are more complex. The contracts for actual construction work are different from those under the pure construction management approach.

The contracts between the client and the architect will remain constant during design and contracting during the construction phase. In fact, the work of the architect may increase during the construction phase as the architect is then the only advisory agent of the client because the construction manager has then changed into being the contractor and the construction manager no longer exists. Then the architect's contract should tend towards the traditional procurement approach contractual work of the architect for quality inspection during construction but will include relating to the inputs of the construction manager during design.

From the beginning of their work it should be known to all parties to the building's procurement e.g. the architect and other designers, that the executant who is the construction manager in the design phase will become a contractor with a guaranteed maximum contract to the client later in the whole process.

The contract between the client and the construction manager should spell out the duties and responsibilities of the construction manager during design work and may refer to work

required during contracting and construction. These two types of work, are while working as an advisory agent and then while working as a contractor with a guaranteed maximum contract with the client. The process of changing from one to the other should also be clearly stated in the contract between the client and the construction manager. This should include the rights of the client to call for the guaranteed maximum bid when the client wishes to receive such a bid, that there may be post bid negotiations and that the client has the clear right to contract with another party for the guaranteed maximum contract to manage the construction process under whatever situations the client deems appropriate.

Clearly, if cost savings are to be shared between the client and former construction manager who is now a construction contractor, the method and accounting for such savings and the process of sharing should be clearly stated in the contract. In this contracting approach the client should realize that it is highly probable that the cost estimate for each trade/subcontract and all other work in the construction process will be a crucial datum factor from which savings will be measured. Therefore, the validity and accuracy of the estimate made by the construction manager who will become the contractor are of vital importance to the client.

Public clients with an already fixed maximum budget for the future building from their legislators tend to desire or at least be willing to tolerate cost estimates which may be a little high. The objective of these public clients is satisfied provided the estimates and building actually procured is within the already set legislative budget. They will have achieved one of their major objectives of having procured a building and not having to seek more funding from a legislative body. Clearly under the quasi general contractor approach, the construction manager giving cost estimates for the whole building and for design alternatives in the design phase knows that there could be benefits to his later role as a contractor if the earlier estimates are somewhat inflated (but within the legislative budget) rather than try to maximize the accuracy of such early estimates in the context of the building desired to clothe the clients needs. This is because the savings between the estimate which becomes the guaranteed maximum bid and the sum of the buyouts of the trade contracts is usually shared between the client and the then general contractor. Thus apparent savings to be shared could be derived not from lower trade bids but from estimates which were higher than the reality of the building's construction and the client will receive only a share of the apparent savings. Furthermore, these slightly high estimates by the construction manager can hold down the scope of the building designed for the budget.

In addition to desiring to have a guaranteed maximum cost construction contract prior to beginning construction there are other reasons for the client to wish to have the construction manager "hold" the trade/subcontracts rather than have each trade/subcontractor in contract directly with the client.

For the sake of simplicity of management of his own affairs, the client may not wish to have to deal with all trade/subcontractors in the construction process. In this situation the construction manager/general contractor provides a construction knowledgeable shield for the client as well as a single source of responsibility, communication and money flow between the client and the construction process. Another reason may be that the client may want to have the contractual linkages follow the same pattern as the most desirable communication linkages described above for the whole construction management process.

This quasi general contract approach provides a primary benefit to the client in that there will be someone i.e. the former construction manager, as a general contractor contractually responsible for the whole of the construction process. This includes cover to the risks from overlaps and omissions among the individual trade/subcontracts and for the general work items required to expedite the construction work on and off the site. Put another way, the client who wants to shed much of the entrepreneurial risk and hassle in the construction process from his own shoulders to those of the manager of construction should use this quasi general contractor approach for the construction of his building. In such a situation the client will have to pay more for such managerial services than under a situation where the client carries the entrepreneurial risks of construction. However, as the quasi general contractor construction manager is carrying

that risk burden on a contractual basis, the client should not expect to receive or be careful in weighing advice from a former agent who has now changed into a general contractor. Also, the client may have to be more cautious in evaluating advice in the design phase from a construction manager who knows he can become the sole source bidder for the subsequent construction work under a guaranteed maximum bid which implies potential cost savings which will be shared between the client and the general contractor.

3. Conclusion on Contract Network

In summary, the choice of contractual linkages in the construction team of contractors (not the design team) seems to depend on the client's desires on three major issues. These are the desired degree of compatibility between communication linkages and contractual linkages, the potential losses and risks to the client from the construction manager changing roles during procurement from an agency advisor to a contractor with entrepreneurial interests in the building construction efficiency (which also causes the client to not have a construction management advice during the construction phase) and the desire of the client to have or not have at least a guaranteed maximum price contract for construction before tolerating the letting of any construction trade contract for a part of the building.

The pure construction management format would seem most appropriate where the client has considerable knowledge of building procurement, can handle diversity of communication linkages from contractual linkages, desires continuity of agency advice to augment the client's large or small knowledge through the whole procurement process and has confidence in the validity of trade cost estimates along with confidence in the probability of their summed accuracy which eliminates the need for a guaranteed maximum bid prior to beginning to let trade contracts for construction work. In addition, the client should have a temperament or willingness to carry entrepreneurial risks from knowledge of building procurement and the advice of the construction manager advisory agent.

The quasi general contractor plus guaranteed maximum bid price from the former construction manager approach would seem most appropriate when the client wants or can only handle the simplicity of similarity of communications network and contractual networks,. wants a construction knowledgeable shield from the array of construction trade/subcontractors, is not concerned about the replacement of agency advice with a guaranteed maximum construction contract due to the construction manager becoming his contractor, the willingness to be without a construction manager agent during construction and its contract settlement or the preceding limited advice during the design phase and the desire to have a guaranteed maximum bid for the whole of construction prior to letting any one trade/subcontractor or contracts.

Put in a polar way for simplicity, the most likely type of client for the pure construction management approach would be the client who either knows little of building procurement or who has considerable knowledge of building procurement but who wants to benefit primarily in design and contracting phases. Such a client can benefit also from expediting of the whole process or from both general construction procurement expertise and special expertise such as knowledge of the local construction industry.

At the other extreme of the polarity the most likely client for the quasi general contractor approach would be the client who has a normal level of building procurement knowledge but who has some bureaucratic constraints to be avoided and some to be accommodated. Clearly, the satisfying of a preset legislated budget for construction cost by having a guaranteed maximum price contract for the whole of construction prior to starting construction would be such a major feature. Also, such a client is likely to be less interested in the space use efficiency and competitive attraction of a building to the marketplace and therefore, is less interested in maximizing the effectiveness, efficiency and attractiveness of the design than having a building comfortably within a reasonable closeness of his preset budget and which can house the activities of his organization. Provided the guaranteed maximum bid figure is below the legislated budget

for the building, such a client is content and may not be too interested in the difference between the guaranteed maximum bid and the actual final cost of construction.

VII CHARACTERISTICS OF A CONSTRUCTION MANAGER

A. CRITERIA FOR SELECTING A CONSTRUCTION MANAGER
   1. Generally
   2. Specific Parameters
      a. Abilities of Major People in the Construction Management Organization and Key People To Be Placed On A Particular Project
      b. Approach of the Construction Management Organization To Interactions With Other Roles
      c. Interpersonal Communications
      d. Past and Future Performances By the Construction Manager
      e. Knowledge of the Local Construction Market
      f. Constituents of the Contract Between the Client and the Construction Manager

B. PAYMENT FOR SERVICES OF THE CONSTRUCTION MANAGER
   1. Preconstruction Phases
   2. Construction and Later Phases

C. LICENSING OF CONSTRUCTION MANAGERS

VII CHARACTERISTICS OF A CONSTRUCTION MANAGER

A. CRITERIA FOR SELECTING A CONSTRUCTION MANAGER

1. Generally

A construction manager will be an agent who will provide advice to and participate in the triumvirate team of the client, the architect and the construction manager. Jointly, they will guide, manage and drive the building through the procurement process mainly comprising the phases of design, contracting and construction. They all may be involved in the preceding phases of establishing building needs and feasibility study as well as the early decision making on the features to be incorporated into the procurement process and the later phase of commissioning the building.

In considering all of the above, the needs of each future building's procurement process is likely to have its own specific emphases on types of advice needed from the construction manager depending on the particular tight constraints and unique features of that specific building and its procurement process at that time.

The point in time in the procurement process when the construction manager is hired will influence the size of the potential benefits to the client. Obviously, the construction manager can only provide service to the client after being selected and hired, so that leaves only the subsequent phases of procurement to be influenced by the construction manager. While this is obvious when written down, it appears that some clients are misled by the name construction manager into thinking that his primary function is to mange the construction process. This is not so. The primary potential from construction management for the client is to receive construction related advice in the design phase and the contracting phase and additionally, to a lesser extent, have the whole procurement process managed as expeditiously as possible by the construction manager. To select and hire a construction manager to only manage the construction process might well be detrimental to the client. Not only will the client then have an agent managing the construction process which increases the client's activity and risks in the construction process but the client will also have to forego the use of the competitive forces of the marketplace to competitively hire a general contractor with a lump sum bid for the whole building. Notwithstanding the above, if the construction manager is selected and hired just prior to construction then all he can do is manage the construction process which has been defined in the design and contracting phases. If the construction manager is selected and hired after or in the late subphases of design and before the phase of contracting for the trade/subcontractor work, then the client can receive advice on and manage the contracting phase and the following construction phase. Also, the already completed design may be critiqued but that may provide only marginal improvements in cost, quality and speed of construction if a good architect has been hired. Such changes may not provide better value in the building commensurate with what the client is paying in money and time for it. Post design criticism may reduce building value to an extent greater than the cost reduction. Also, criticism of the design under these circumstances will cause difficulties for the construction manager and the architect to cooperate fully as members of the client's team.

For the client to maximize the potential benefits from construction management, the construction manager should be hired and hence selected before the design process begins and about the same time as the architect is hired. The hiring and hence selection of the architect and construction manager should be seen as the bringing into the client's procurement team of the two other major members of a three member team i.e. the client, the architect and the construction manager. Each agent should be not only very competent in their own expertise but be trusting of the other and of the client and be capable of working in such an ad hoc triumvirate. Without trust and cooperation between the three major roles in construction management its whole approach to procurement of a building is in jeopardy and may provide only limited benefits from the potential benefits. It is within the above context that the selection criteria of a construction manager should be considered.

Construction management appears to require a number of specific parameters by which to select an exponent but of equal importance the construction manager is more likely to be successful if there is the capability to be a provider of other required forms of advice which may not be clearly definable before work starts. Also, for the team, the construction manager should be able to provide a participatory management process among the group of different, required experts. They should coordinate as a team if maximum benefits are to accrue to the client. The construction manager must be capable of beneficially participating in the team primarily in the design process and the contracting process as well as being able to manage the construction process which follows. This above best state does not always occur but is the objective to strive towards for construction managers. It is not sufficient for the construction manager to operate as a general contractor who has been asked to give ad hoc advice to a friendly client and architect occasionally during design and contracting.

2. Specific Parameters

What follows is a set of more specific parameters by which to evaluate and select construction managers. In evaluating prospective construction managers against these specific parameters the client should also be trying to reach conclusions on each prospective construction manager's capabilities regarding the above general parameters.

a. Abilities of Major People in the Construction Management Organization and Key People to be Place on a Particular Project

The nature of construction management is the provision of expertise which invariably exists in the brains of individual people. That expertise is in the fields of building construction and its management as well as the ability to appropriately input such expertise into the design process and consider its ramifications in setting up and carrying out the contracting for trade/subcontractors as well as managing the complexities of the actual construction process. It follows that the most important parameter by which to evaluate a potential construction manager is the quality of the expertise of key individuals in that organization.

Such key individuals usually exist in two groups of people. One group is those people who manage the whole construction management company of whatever size, locally, nationally or internationally and the other group of people is those who will be responsible for construction management services for the client's particular building procurement. Put simply, the former group will set the attitudes to management, integrity and service and philosophy within which the latter group will work. The latter group will be the specific people whose technological construction management expertise will be servicing whatever is needed by the client, the architect, the building project and all other participants in the procurement of that building.

A company which specializes in construction management may have evolved to the state of producing a guide book or manual to its staff on how to carry out all facets of what may be the required of them in carrying out construction management. While this can be a reinforcement to the knowledge base of individuals in their organization, especially people who are learning to be construction managers, it is the expertise or knowledge base in the people's brains and their ability to think with appropriate innovation for the specific building that comprise the strengths and weaknesses of the construction management organization. Thus the client wishing to hire a construction manager should probe the range and depth of expertise of both major groups of people in the construction management organization. It is most important that such a probe should be made of the specific people who are being proposed to work on the client's project as the basis for evaluating the knowledge and executing capability of each construction management organization. The client should be considering what types of advice this project will need and then compare that to the knowledge base such people can provide.

When the construction manager is being selected prior to design the nature of the tight constraints and unique features required of the procurement process may not be fully known. If the client lacks knowledge of building procurement there will be greater difficulty of knowing

what to look for by that building knowledgeable client. In this situation the client should pay less attention to glossy brochures, fancy charts, numbers of dollars volume of work done and marketing image but should concentrate on the characteristics of knowledge, integrity, trustfulness and innovativeness of the staff being proposed by each prospective construction manager for his project. Even though some such people may appear clumsy in a marketing or selection meeting they should be probed in an interactive, discussion format about their capabilities in the various types of advice stated in other parts of this report as being the mainstays of construction management. What previous types of buildings they have worked on, what types of advice they see as appropriate to potential situations to be faced, what accuracy of advice they gave on previous projects, and even their degree of willingness to humorously face changed situations and maintain willingness to suggest alternative solutions and participate with other people of different disciplines etc., should be evaluated. As not all of the tight constraints and unique features will be known at time of selection of the construction manager and these might change during the evolution of design and contracting, the ability of the construction manager's staff people to be flexible, innovative but realistic in moving the building forward through procurement is also worth checking. How such people respond to challenges and how they will operate in unexperienced or changing situations should be considered in selecting construction managers. A construction manager or construction management company which deterministically or militaristically lays out the specifics of what they will do, step by step in a mechanistic manner, could be incapable of wisely handling the interactive, changing, evolving, contributory, participatory nature of what can provide the best building for the client under whatever circumstances prevail at that time.

The selection of the construction manager's staff should be seen by the client as a negotiation for the best set of people for this building procurement rather than evaluating the people being presented in a "take them or don't hire us" basis. Also, because these people have not built a building exactly of the nature of the one being contemplated does not rule them out. It should be borne in mind that human experts usually like to grow and develop more expertise. Hence work that has some unknowns and challenges could well stimulate better performance on the clients building than if these staff people have built a large number of this type of building before. Care should be taken that such a "new experience" quotient should not be greater than about one fifth or one quarter of the expertise they already have.

The client must, at the very least, meet and interview the principal project manager and site superintendent proposed for this building by each prospective construction manager. These two people must be evaluated as to their construction knowledge, ability to operate in the design and contracting phases as the agent of the client and as human beings operating in a crucial group of diverse expert human beings. These people should be able to show that they understand the needs of this future building's procurement and how it could be built efficiently. Before hiring a construction management organization, the client must be satisfied with their above abilities and if not satisfied either seek replacements from within that construction management organization or select another more satisfactory construction management organization to serve him.

b. Approach of the Construction Management Organization to Managing and to Interactions with Other Roles

The second major parameter to consider in evaluating potential construction managers comprise their approach to managing and their approach to interactions with other roles in the clients project team and outside it but necessary for the procurement of the building.

The client, the architect and the construction manager and their staffs should work together as a team with each role contributing their inputs to further the building through the procurement process so the approach of the construction manager should be just that. Thus the client should interview all potential construction managers and some of their previous clients as well as architects and trade/subcontractors they have worked with previously to find out their

performances regarding their approaches to management. The agenda of the construction manager on this building project should be the agenda of the triumvirate team and should not be something that suits the operations of only the construction manager. A construction manager who makes promises to the client and then forces the other parties e.g. trade/subcontractors to perform work of whatever nature at their own cost to satisfy the construction manager's promise to the client will not serve the client well in the procurement work for the building. The construction manager who has the reputation of forcing performance from trade/subcontractors by such behavior as withholding or slowing rightly due payments to them will have great difficulty in continuing to have such roles performed correctly in the construction process. The client will be ill served by hiring an agent who brings such a reputation to his service.
The construction manager must be fair in dealing with all other parties in the building procurement and must honor his commitments to all of them. If he is not fair the client will suffer through his building for all of these forms of improper behavior of the construction manager.

c. Interpersonal Communications

As the essence of construction management is expertise to assist others, the construction manager's staff should have considerable capability in interpersonal communications, both written and verbal. Furthermore, as communications will take place among required experts in many disciplines, it will encompass the ability to listen and understand what others are communicating to the construction manager. Also, being able to dissolve miscommunications between two or more other parties is a valuable feature of handling communications in an expert group situation. Thus the construction managers should be able to give clear written and spoken communications, to receive complex written and spoken communications and relate these to many participants and also be able to spot miscommunications among people and have the courage to clarify all communications among the whole group of participants.

d. Past and Future Performances by the Construction Manager

In selecting a construction manager who has carried out similar building procurement previously the client has some assurance of ability for the same to occur on his building. This similarity of buildings can be in their size or complexity or both. In examining this feature of a construction manager, the client should take care that the people who will be working on the building have that previous similar experience. It is not much use to the client if the previous performances on similar buildings were carried out by individual people in the construction management organization who will not be working on this building's procurement.

The client's building will be in a specific location in a specific local construction marketplace. Hence the knowledge of the construction manager's staff people on that local marketplace and its participants are important to producing a top performance in the construction phase and more especially in the preceding contracting phase of procurement of buildings by construction management. Again, it will be the capability of the specific staff people for the client's buildings procurement that should be probed for their local knowledge.

The reputation of the construction management company and even of its specific staff people in the minds of all participants in the local marketplace should be probed by the client. All local construction marketplace participants will tend to behave and relate initially to the construction manager based on his reputation derived from his past performances in that local marketplace. While the construction management staff on a particular building may be different from the norm expected of that construction management company, the participants in the local marketplace will be working under the assumption that the staff will operate as the norm for that construction management company.

A specific feature of the construction management company to be probed in its past, is its history of frequency of generating litigation on its projects. While some litigation is almost unavoidable in such complex circumstances, a record of litigation on a long series of building projects could be a warning light to the client. Alternatively, it may be that such a construction

manager is less willing to sell out his client to the other local parties working on the client's project.

e. Knowledge of the Local Construction Market

All of the above assumes that the construction manager has worked for some time in the local marketplace and this may or may not be so. If it is so, then the past performance can be probed as above. If the construction manager is new to the local marketplace then he will be at an initial disadvantage compared to others who do have that local knowledge. While his national reputation may be good, he will have to find out on the client's building who are the local players and who among them is good, bad and indifferent. If this is not done early in the procurement process, it may be too late to serve the best interests of the client. Furthermore, if a construction manager is in a locality for one building procurement only, with little or no commitment to remain there in the future there may be a different work attitude than if the construction manager is committed to be in that marketplace into the long term future. It is perceived that without such a long term commitment the construction manager may not provide as good services as compared to one with local commitment for the long term. Under such circumstances, the construction manager will probably have to expend more energy to provide the perceived same services as a long term locally based construction manager. However, it could be that other major features of such a construction manager's expertise will outweigh his lower local knowledge quotient. It must also be borne in mind that a construction manager who is fully localized may be so tied in to relationships locally with suppliers and trade/subcontractors that he may not be as fully committed to the agency services of the client as would be a construction management expert from outside the locality in which the building will be built.

f. Constituents of the Contract Between The Client and The Construction Manager

Another major parameter of evaluating construction managers for selection is to examine the clauses of the contract each proposes with the client. Alternatively, the client can probe each construction manager on the clauses each thinks important for inclusion in the contract between them. As an alternative probe of this parameter the client may suggest certain clauses for the contract that he considers vital and then appraise the response of each prospective construction manager.

A major feature of the actual contract which should be suggested and insisted upon by the client as well as a probe at the approach of the construction manager, is that the project manager and site superintendent and other key players of the construction manager be named in the contract. These specific people, along with other senior experts required for this building, should be named after they have been interviewed and found to be acceptable by the client for his building's procurement. Furthermore, and of great importance, the contract should give to the client the right to end the construction manager's contract if any one of these named key expert people is moved off the client's procurement process before the work is completed to the satisfaction of the client. It is not good enough for senior high quality experts be named by the construction manager prior to winning the contract and then other people on his staff are put on the client's project to do the work. It is both a fundamental feature of construction management and a marque of good faith that this clause be adhered to by the construction manager. If, such a key person is moved off the client's project during procurement, then the client should move to have him put back or the client should exercise his right to end the contract with the construction manager. The essence of construction management is expert service by human experts and the client should have the contractual right to insist on the services agreed to in the contract. At the time of selection of the construction manager, this feature of the contract is a major test of the attitude of each potential construction manager. While there may be ameliorating features regarding the duration or schedule timing of the services of particular support or second tier experts of the construction manager on the project, the above principle should hold. The project manager of the construction manager should be full time for the whole duration of procurement

and the site superintendent should be involved for at least the duration of contracting and construction phases.

In more general terms, it is very important that the construction management contract should define all expected services as fully as possible. Such definition should be as specific as possible as to nature and scope of the services on that building. These services should be defined per phase of the procurement process and should cover all features mentioned in this report. While not all services will be needed as defined and others may be unforseen at the time of writing the contract, the willingness of the potential construction manager to be specific and precise and even suggest possible service needs because of the nature of the building proposed is desirable and worth probing by the client at this selection phase of the project. Ameliorating between the rigor of such contract clauses and the need for flexibility can be achieved by setting up the mode of payment to the construction manager at rates per hour or day for each level or category of staff that is required to work on the project. In the selection process, the client should be very wary of the type of construction manager who leans to the opposite polarity of contractual vagueness by suggesting that the client sign a simple contract with him and they will "work things out as they go along". The client should see such a suggestion as a negative in the selection of a construction manager.

The construction management contract should also define the duties, responsibilities and relationships of all the other major participants to the project including the client and the architect and interactions with local government agencies. Reciprocal definitions of duties should be in the contracts between the client and other major participating roles on the project and should express the same meanings as those in the contract between the client and the construction manager. While there can be overlapping areas in the duties and responsibilities of the architect and construction manager it is seen as better to lean towards the polarity of specificity rather than vagueness. In the selection process for appointing the construction manager, these contract clause contents can be fertile parameters to choose a better construction manager by examining the responses to these contractual matters by all prospective construction managers.

Further contractual matters that can be used in the selection process are the contracts to be let to trade/subcontractors. The same principles of equity in the contract for the trade/subcontractors can be used to establish the attitude of the potential construction manager. Also, the constituents of such contracts should reflect the nature and constituents of the contract between the client and the construction manager.

B. PAYMENT FOR SERVICES OF THE CONSTRUCTION MANAGER

Payment for services rendered by the construction manager tend to fall into two time segments of the building procurement process. These two segments are (a) the earlier phases of procurement in which the construction manager is providing advice during all the subphases of the design process and in the phase of contracting (i.e. writing all contract documents, and selecting, bidding and negotiating contracts) with the trade/subcontractors who will carry out the construction work and (b) the later major phase of managing the actual construction process. This may also include the commissioning phase i.e. moving of tenants or users into the building and ensuring that the building operates as it should.

Each of these two time segments of construction management can be considered either of the two approaches to construction management known as (i) pure construction management under which the construction manager is an advisory agent of the client throughout the whole procurement process or (ii) quasi general contractor construction management under which there is usually a guaranteed maximum lump sum bid for the construction process by the former construction manager advisory agent of the client who becomes a contractor to the client under the guaranteed maximum contract.

The negative risky aspects to all the above are that at the time when the construction manager is to be selected and contracted by the client, the nature, volume and duration of agency services needed may not be sufficiently known to be priced clearly and simply without

considerable performance and pecuniary risk to both the client and the construction manager. If, at that time, the construction management agency advice services were already known by type and volume to enable for lump sum pricing, then, the whole building and building procurement processes are so well defined that a more normal, traditional type of building procurement may be more suitable.

1. Pre Construction Phases

In the early phases of the building procurement process, the work of the construction manager is that of a consultant advisory agent to the client. Due to the initial vagueness of what services in nature, volume and duration, might be required of the construction manager, it is extremely difficult to establish a lump sum or even a guaranteed maximum price for such services without jeopardizing the quality of agency services the client may need on that building or the future economic viability of the construction manager by him being committed to an unknown scope of services for an already fixed sum of money. Thus the most appropriate mode of payment to the construction manager in these early phases is either a professional fee per day or week or month based on an agreed schedule of rates per level of skill or service or cost plus a percentage for the duration of use of resources e.g. managers, advisors, consumed in such work.

The simplest, most appropriate mode of payment to the construction manager for advisory services should be in the same format as would be for any professional advisor e.g. architect or lawyer. In each contract between a client and a construction manager there should be an agreed dollar fee scale per hour or per day for each type of advisory skill or service from strategic procurement advice to basic office support procedures. Also each type of expected expense may be listed with a price rate or the contract states that expenses other than human services will be billed at cost and state the cost rate.

During the design phase under both the pure construction management approach and the quasi general contractor approach all savings from the advice of the construction manager belong to the client (who is also carrying all of the entrepreneurial risks of that situation). The construction manager is paid a fee for advisory agent services regardless of the volume of savings or costs provided to the client. This is an element of the advisor being purely an advisor and not an entrepreneurial risk carrier for the client. It also behooves such a construction manager to operate as a pure advisor bringing all required professional expertise to the elbow and potential benefit of his client.

The construction manager should compile his request for payment monthly or for whatever duration and timing matches the client's accounting processes and submit that bill to the client with supporting documentation. The client should be cautious that the construction manager is not over applying staff simply to increase income but such caution should be weighed against the value of the advice being received by the client from the construction manager. To assist controlling this, a guaranteed maximum dollar figure could be incorporated into the contract which can be renegotiated by mutual consent of the parties.

The above payments for services in the contract should be the mode of payment during the early advisory agent part of the procurement process for both the pure construction management approach and the quasi general contractor approach.

2. Construction and Later Phases

Under the pure construction management approach the payment process set up for the early phases of procurement and described above will continue throughout all later phases of the building procurement process i.e. for the whole process.

The form of payment to the former construction manager for the management of the construction process by the quasi general contractor approach should be that there is a constituent part of the guaranteed maximum lump sum bid attributable to the process of managing the construction process. This can be a fixed or variable lump sum depending on the degree of clarity and completeness of the contract documents upon which the guaranteed

maximum bid was made. Such work could be calculated by and paid for by a rate per week or month of such management of construction service. Clearly, the services included in such management should be spelled out in the guaranteed maximum contract.

Payments to the trade/subcontractors hired by the general contractor under a guaranteed maximum contract will be incorporated in the usual (monthly) interim payments from the client to the general contractor under the conditions of that contract regarding such payments.

All of the above is comparatively clear and simple if the quasi general contractor approach is to be used and if fast tracking is not to be part of the construction management approach used. Under this circumstance there will be a specified date at which the mode of payment to the construction manager/general contractor will change from the fee basis for advisory work to the contractual basis under the guaranteed maximum bid.

If fast tracking is to be used inside the quasi general contractor approach there can be a period of time during which the one role may be both advising on and carrying out of the contracting of trade subcontractors while also managing the construction work of trade packages already contracted. Such a situation does not preclude such services but does mean that a very careful accounting process should be used in compiling the fee portion of the monies due to the legally compound role of the construction manager/quasi general contractor. Here, the payment process can be handled but the client should be aware of the legal complexities and risks faced by having one party simultaneously acting as agent and contractor.

Under any guaranteed maximum contract there may or may not be clauses covering the concept of shared savings as the trade/subcontracts are let. The contractual clauses defining the sharing of savings between the client and the construction manager is a major issue to be considered carefully.

Under the quasi general contractor approach to construction management, the guaranteed maximum lump sum bid contract should include clauses clearly stating how any savings should be allocated to the client, the general contractor and the trade/subcontractors in the construction process. This should include how to handle the cost increases in some trades' work which may be needed to enable the basic larger saving in one trade to be made to enable the net saving to be achieved. Here also should be stated in the contract how the general contractor will be reimbursed for the work of arranging the change orders to take place across the array of trade/subcontractors involved by it. Also, the effect of costs and savings of change orders, in the construction process upon the fundamental guaranteed maximum price bid of the general contractor should be spelled out in the contract. This issue is whether or not the guaranteed maximum sum includes or excludes the cost of change orders. If it excludes the cost of change orders then the contract should be seen as a quasi guaranteed maximum contract and that violates the basic concept of a guaranteed maximum contract for the client.

All of the above contractual clauses for handling cost savings under the guaranteed maximum contract should be spelled out in the contract with each trade subcontractor.

Where there occurs the confluence between (i) the quasi general contractor approach using a guaranteed maximum contract and (ii) fast tracking and (iii) the sharing of savings, a particularly complex payment system will exist. Under this situation each saving should be evaluated as to its source. Is the saving coming from advice on the design or contracting of future work or is it coming from the construction process under the guaranteed maximum contract? If the saving comes from the former, all benefits of the saving go to the client and if from the latter, the benefits are shared as stated in the guaranteed maximum contract. This complexity could become more byzantine because such a situation also may be the source of, or expressed as, construction change orders. In order to not consume tomes describing the alternatives here, the client should consider in selecting a construction manager, the level of integrity thought appropriate. Then when such situations as above arise each should be evaluated on its own. Put simply, if the client thinks a prospective construction manager will not behave with propriety under such circumstances then that construction manager should not be hired. These payment issues and integrity issues should be considered when selecting between the pure construction

management approach or the quasi general contractor approach, and which organization will be selected as the construction manager.

C. LICENSING OF CONSTRUCTION MANAGERS

Licensing by the State of Florida is directed at protecting the health and safety of the public. Safety could include the safety of business persons in the handling of their business and public or private organizations from improper agency advice or behavior of construction managers. However, such parties are not seen as normal members of the public. Individual people in Florida could hire the services of a construction manager but that is rather rare.

Construction management is still, despite its existence in the U.S. for a couple of decades, a somewhat unclearly defined form of agency. Hence it is very difficult to state what is the common expectations from a construction manager in the marketplace. This continues to keep the construction manager in the context of a "special agent" rather than having evolved into the format of a "common agent" whose duties are commonly understood by the law and the public. Many knowledgeable experts considered that the flexibility in setting the scope of duties of the construction manager to satisfy the needs of each particular building and its procurement situation is a major strength of construction management. Furthermore, the full array of services actually required on a procurement of a building may not be fully known at the time when it is best to hire a construction manager i.e. before design begins. This further underscores the position of a construction manager as a special agent rather than a common agent.

The range of expertise which may be required by a construction manager on a particular project may span across and even beyond real estate, finance, economics, law, architecture, general contracting, building construction and a variety of construction trade work. Also the construction manager should be knowledgeable and capable in many facets of cooperative management of humans in complex organizations. He should also be capable of clear thinking on making decisions blending whatever is required from all of the above. Also, all of the above should be linked together by an entrepreneurial sense within the agency advice on each different building project on behalf of the client. Again, such variety of services with different emphases on different projects goes against the regularization of a set of expected services to a common grouping of services which would be required as a base from which to license agents as construction managers.

The common conclusion is that construction managers should not be licensed as such in Florida. It was concluded that if a license was felt to be necessary for the construction manager he should hold a Florida general contractor's license. Tempering that conclusion, it was considered that the construction manager should have capabilities beyond that of a general contractor and such additional increments of expertise span the above stated range of expertise related to the procurement of building projects. Thus if consideration was to be made to license construction managers in Florida, the above scope of expertise would be appropriate as an additional component to the license of a general contractor.

VIII NORMAL SERVICES OF A CONSTRUCTION MANAGER

A. GENERALLY
B. ABNORMAL SERVICES
C. NORMAL SERVICES
    1. Client Parameters and Values
    2. Team Concepts and Approaches
    3. Early Major Decisions
        a. Hiring the Architect and Construction Manager
        b. Clients Capability to Handle Entrepreneurial Risk
        c. Pure Construction Management or Quasi General Contractor Construction Management
        d. Fast Track or No Fast Track
    4. Plan the Best Procurement Process
    5. Execute and Expedite That Best Procurement Process
    6. Schedule the Procurement and Construction Processes
        a. The Whole Procurement Process
        b. The Construction Process
    7. Advice on Building Costs
        a. Estimate of Overall Building Costs
        b. Comparative Costs Estimates
        c. Cost Control of Procurement
    8. Knowledge of Local Building Marketplace
        a. Local Building Costs
        b. Local Volume and Nature of Building Work
    9. Constructability of the Building's Design
    10. Quality of the Building
    11. Trade Contract Packages
    12. Contracts for Long Lead Materials and Work
    13. Finding Qualified Trade/Subcontractors
    14. Managing the Bidding and Contracting Process
    15. Managing the Construction Process
    16. Handling the Money Flows for the Construction Process
D. INTERACTIVITY OF ALL OF THE ABOVE SERVICES

VIII NORMAL SERVICES OF THE CONSTRUCTION MANAGER

A. GENERALLY

The construction manager's services in general terms, are to provide advice, participate in discussions and decision making and then where appropriate, execute the results of these preceding activities.

The advice will be of expertise and knowledge of buildings and their construction as a physical entity and entrepreneurial process, the management of that process and the interactions of such a process with local construction market place characteristics and government requirements. That advice should be directed to the benefit of the client, as should that of any agent. That advice should be given mainly to the client in the context of the client, the architect and the construction manager being the core triumvirate of the client's procurement team for a future building. Such advice has the greatest potential benefits to the client in the design and contracting phases of the building procurement process. Such advice will be directed mostly as input to many complex, interactive decisions to be made by the core triumvirate team of the client, architect and construction manager in those two procurement phases. Clearly, advice from the construction manager can be proffered, sought and utilized outside these two phases, especially in the later construction phase but by then most of the major decisions about the building and its procurement will have been made and many will have been put into effect. The client and the architect will also be inputting expertise and information into the core triumvirate for its decision making.

Once team decisions are made, the resulting action will be the responsibility, wholly or partly, of each of the client, architect and construction manager. Hence, the construction manager will be responsible for carrying out actions subsequent to team decision making and especially for those actions related to the contracting and construction processes. Such actions will tend to be managing and controlling these later activities to achieve the result desired to match the decisions made earlier.

It may also be reasonably normal in the construction management approach to the building's procurement process for particular buildings or clients that the construction manager carries the role of manager or secretary to the core triumvirate of the construction management approach. This will entail maintaining the data base of all decisions and input information and conveying required information to and from participants in and adjacent to the procurement of that building to expedite work for completion of the building ready for use.

Care must be taken that each of the following normal services which should be available for provision by a construction manager should be provided on a coordinated basis. Each service tends to be interactive with all other services and all of these role players, inputs, decision and outputs have to be considered interactive. Thus to provide a valid overall service to his client the construction manager should provide a carefully considered and orchestrated coordination across all the individual services he could and is providing on each procurement process for a building.

B. ABNORMAL SERVICES

At this juncture it must be realized that the term normal construction manager is somewhat oxymoronic in that, if a building or its procurement can be described as normal then the use of the construction management approach may well be too sophisticated than is needed by that normality in construction procurement. Even if a type of building and its procurement, however unique, has been carried out a few times then it should become a more programmed and specified form of building procurement than that which requires construction management.

What follows, more specifically describes the normal services which could be provided by a construction manager but it must always be borne in mind that the construction manager (and the client and architect) must seek out and provide whatever input information and services are required to create the best building and its procurement process given the needs of the client.

Thus, there should be a constant perception of doing what may be abnormal in procurement of buildings to satisfy the needs of a particular building and its procurement whatever may be such needs. Put another way, a construction manager who has a cookie cutter way of carrying out construction management and insists on following it on every building's procurement will very probably provide below optimum service to his client for all building projects.

The origins of such abnormalities may be the nature of the building, the required constraints put on its procurement by the client, the state of the local construction industry and marketplace, the physical location for the building or even some constraints and peccadillos by which the client must or desires to approach doing business.

The client may desire a circumscribed set of services from the construction manager for whatever reasons considered appropriate. Also, the scope of expertise and knowledge of the client on procurement of buildings may cause the client to operate in a particular way regarding procurement of buildings. It can be construed that very building-knowledgeable clients may want the full array of services from a construction manager to creatively interact with the client's inhouse staff to maximize benefits to the client. It can also be construed that a client who is comparatively lacking in knowledge of building procurement has limitations which may lead to making somewhat suboptimal selection of services from the construction manager. Also, such a client may succumb to marketing blandishments of potential construction managers and select a somewhat suboptimal construction manager for the project. There will be many positions between these polarities which have to be satisfied in particular building's processes.

C. NORMAL SERVICES

Not only should the following services be available from a construction manager but each has its own characteristics of integration into the whole flow of the procurement of buildings. For a particular building some of these services are best provided as sequential, some should be in parallel and some should be cyclic.

Sequential services, or more exactly, the sequence of providing different services can affect the quality of each and the quality of the sum of the services provided. If not carefully thought out to the most appropriate sequence, each service may be somewhat suboptimal and may require some such services to be done cyclically to satisfy the best coordination across all services. Parallel services are those which can provide most to the client by occurring simultaneously and usually interactively with other services. Cyclic services are those which best serve the client by occurring repeatedly through the procurement process usually as checks on what has occurred in the procurement process since the last time the service was provided.

Each of the following normal services should be available from a construction manager. Some are sequential, some are parallel and some are cyclic. From this array of services a selection should be made as to which are needed on each particular building's procurement. Then those appropriate to that building's procurement should be blended to each other and to the work of the other roles in the core triumvirate and its peripheral players on that particular building's procurement.

To the extent possible these normal services will be presented in groups, in sequence of the beginning of their use by the client under the construction management process of building procurement.

1. Client's Parameters and Values

The client's parameters desired in and which will set the boundary conditions for the building and its procurement should be established. Also, the relative weighting of these parameters one to another should be extracted from the mind of the client and set down in writing. The purpose of these parameters and their values is to guide all decisions major and minor, abstract or concrete, during designing and contracting and constructing, to procure a building that is harmonious with the needs of the client across all complex decisions which have to be made during the procurement process. The decisions and choices to be made by the core

triumvirate of the client, architect and construction manager as they guide the evolving building through the procurement process will be easier to make, more objective and more valid with the explicit existence of these parameters and values. Many inputs to such decisions will conflict with each other but the existence of the agreed client parameters and their relative values provides a common datum from which to make these decisions and choices.

Put simply, these parameters and their relative values are the client's needs for the building and its procurement, abstract as well as concrete, and constitute the lodestar for its general and detailed features and procurement process. The major parameters for any building's procurement are its scope, its cost, its quality and its duration of procurement. For each individual building these and many others should be fleshed out by discussion of the core triumvirate and decided upon prior to beginning the procurement process.

2. Team Concepts and Approach

For construction management to provide even a reasonable procurement process requires the setting up and maintenance of a team spirit among those who will manager and participate in the procurement process. The core of this team is the client, the architect and the construction manager. While each must be capable in his own field and be willing and able to work with the other two as an interactive team, to achieve maximum benefit from this requires the maintenance by continuous nurturing of this team spirit. To provide that climate requires capabilities in human management of a participative, democratic, creative management approach and the use of these human managerial team building characteristics towards all participants drawn into the procurement process.

Complementary to the above human team spirit needs to be the more formal expression of role duties. This should be in contracts expressed clearly and without conflict of overlapping or omission across these roles in an integrated team. The appropriate lines of communication between all these roles have to be thought out, clearly expressed and conveyed to all participants. So much of the success of construction management depends on so many people that a very high premium should be placed on achieving valid, clear and fast communication flows of information among all participants. As well as information flows there should also be a data base to preserve all information which has been communicated and decisions made. This is for reference purposes later in the procurement process and even after completion of the building in the event of litigation.

3. Early Major Decisions

A number of early major decisions have to be made by the core triumvirate prior to formatting the procurement process most suitable for the building at hand. Each of these decisions should be derived from the clients parameters and their values to provide harmony throughout procurement.

a. Hiring the Architect and Construction Manager

Firstly, the construction manager and the architect have to be hired as agents of the client and their contracts set up to provide the array of services required but probably not yet fully known explicitly and without overlap or omission between them. More importantly, while each may be very capable as a professional, the client must ensure that there will be compatibility and working comfort between them. Also, this desired interaction between them should exist between their staffs who will work together on the procurement as well as between the principals. Compatibility should be in their approach to their work and in their business philosophies. Usually the nature and philosophy of the client to business and work will tend to be a datum by which to measure and select a compatible architect and construction manager. However, the client should be aware of the human issue that too much compatibility may be as bad as too little compatibility. There should be a relationship between the members of the core triumvirate in which creative conflict can exist, be tolerated and used for the benefit of the future building. From

this state there can be enough energy released by the parties to creatively solve the complex, interactive issues facing the triumvirate. The construction manager should be a player thrusting required expertise forward to the same extent as the architect and client. The construction manager who merely carries out what the client and architect decide is not fully carrying out what is expected. These hirings, while not part of the activities of the construction manager do have a considerable influence on how the construction manager is expected to operate throughout the procurement process. Both of these hirings should take place as early in the procurement as possible and should have been completed prior to the beginning of the design phase.

b. Client's Capability to Handle Entrepreneurial Risk

To quite an extent construction management requires the client to make decisions and commit to actions which could be costly for his organization based upon only the advice of his construction manager and architect. It follows that if the client has a strong capability to live comfortably while in situations of entrepreneurial risk then he can fully utilize the potential of construction management. Alternatively, if the client has a low tolerance of operating under entrepreneurial risk he should use construction management in a more circumscribed mode than exists at its full potential. Thus, a very early major decision to be made by the core triumvirate of client, architect and construction manager is the level of entrepreneurial risk that is comfortable for the client regarding procurement of this building. The range of that tolerance could be from minimally different from the traditional approach to procuring buildings to the opposite pole that any risk is tolerable because unless this building is procured and in place and being used within a limited duration the client will be out of business.

c. Pure Construction Management or Quasi General Contractor Construction Management

There are these two main types of construction management and there can be other hybrids for specific situations between these two polarities. This major decision should be made very early in the procurement process because it will have a major impact on all subsequent aspects of procurement. In fact, the client should probably consider this matter and to a large extent decide on it with sufficient time to use it in the selection of the construction manager.

Pure construction management is where the construction manager acts as an advisory agent of the client throughout the whole building procurement process. Also, the client will be contractually committing his organization to major procurement activities, costs, and risks based on the advice of the construction manager and to a lesser extent on the advice of the architect.

Quasi general contractor construction management is where the client hires by contract an advisory agent who at a later point in time in the procurement process will stop being an advisory agent and submit a sole source guaranteed maximum lump sum bid for the whole construction process. Thus in the later stages of procurement the client will be without the agency advice of the construction manager but will have in hand a guaranteed maximum lump sum bid from a contractor intimately knowledgeable of the design and desires of the client but made from the situation of being the sole bidder.

The point in time at which this change will take place will be when the client and the triumvirate consider the design and contracting features have been sufficiently crystallized to enable the creation of a guaranteed maximum bid for construction of the building with only an acceptable number or scope of changes in relation to the clients capacity to handle entrepreneurial risk and their costs.

d. Fast Track or No Fast Track

Fast. Track is the overlapping of the design process, the contracting process and the construction process. The objective is to reduce the calendar duration of the whole procurement process. To successfully do so while maintaining normal costs of construction and professional services requires very high capabilities in the client, the architect, and the construction manager and that they all can work together with mutual trust. Anything less may induce so much

confusion in all aspects of procurement that fast tracking may result in the equivalent of normal building procurement or may increase costs or reduce the quality of the design and of the building quality or may even extend the calendar duration of procurement and increase the potential for litigation.

The potential from fast tracking is further reduced because early contracting for construction work packages cannot begin until at least after the end of the sub phase of conceptual design work. Even then fast track potential is further reduced and such trade work contracts may be put in further jeopardy of subsequent change, increased costs and litigation, if working drawings must be complete for final design approval for building permits and approvals from government agencies such as the Fire Marshall etc. and those who issue environmental impact clearances , permits etc.

However, for clients willing to face the risks and their costs to achieve very fast procurement there is the potential to be harvested from fast tracking to achieve earlier calendar finish of the building but costs may be higher than normal for that benefit and the client must participate fully with his architect and construction manager.

In the early days of construction management it was considered inherent to this approach that fast tracking would be used. However, now, fast tracking should be seen as an early yes/no major decision to be made by the core triumvirate depending on the parameters and values of the client, the entrepreneurial situation faced by the client and his willingness to handle entrepreneurial risk.

Thus, now, to fast track or not to fast track constitutes a construction management variable upon which the construction manager will have to advise. If the decision to use fast track is made then the work of the construction manager will be cast in a more complex mode.

4. Plan the Best Procurement Process

After completion of the preliminary activities of hiring an architect and construction manager compatible with each other and with the client, establishing the client's parameters and their values and making the early major decisions, etc, the construction management triumvirate should plan out the most appropriate procurement process for that building given all the circumstances surroundings its situation.

All of the services required at each phase of the procurement process and between phases should be listed. Then which of these services should occur in what sequence should be established. Those which are required to occur in a cyclic manner and those which best serve the client in parallel with others should be so planned. The result of all of this planning will be a procurement process plan of all required services and inputs and outputs by all members of the triumvirate which are connected into the best overall sequence for this building's procurement given mainly its nature and the constraints and topics in the client's parameters and values.

Of course the plan may be changed during the process but such changes can be minimized by having a wisely and carefully thought out plan of procurement before beginning to execute the procurement process. Quite often the desire for flexible potential in such a plan is used as a cover for poor quality planning which may also tend to be sketchy rather than thorough. Both of these negative attributes lead to poor procurement and should not slip into place under the guise of creating flexibility in the plan. The plan should be the best guide by which to coordinate the complex work of many expert professionals. By having a wise plan available to all participants the complex, interactive and intuitive work of building procurement can be carried out as expeditiously as possible.

5. Execute and Expedite that Best Procurement Process

The construction manager, either within the role scope of services or as a member of the core triumvirate, or by default of no one being appointed to do so, usually may be called upon to carry out the management of the procurement plan. This will require gathering information ahead of time which is needed to carry out each individual service process, set up meetings of all

professions involved as beneficial to that services success and execution of the work involved in that service.

To a large extent this is a people management process. These people will be bringing their professional expertise to interact with the professional expertise of others to reach the most satisfying conclusions for the clients building and its procurement. However, these professionals are human beings and tend to be at the polarities of being intelligent and predominantly interested in their own field of expertise. This creates more intractable and complex human management needs than with people of less specialized expertise. The construction manager should be able to provide the human management skills needed to carry out this management work. The construction manager will have to allow sufficient time for all of the professionals to input their expertise, consider the inputs of others, then all of them reach the best common solution for the client and then pass the results of that decision or choice to all parties who need to know it for their own future work. While allowing reasonable duration for the above in the circumstances it is probable that the construction manager will have to continuously expedite such services and interactions so that each does not consume more time than has been allotted to it.

6. Scheduling the Procurement and Construction Process

a. The Whole Procurement Process

The above best procurement process should be scheduled within the duration available for the procurement process as laid out by the client's parameters. Thus, the whole procurement process should be put into a time frame so that durations of individual services and points in time between sequential services in the procurement process can be clearly related to calendar duration. On the one hand there is the complexity of the interactions among interactive and iterative required services and on the other hand the managerial need for duration control and expediting of the procurement process. It appears that a fair balance for such a schedule for the procurement process would be to establish calendar dates by which each phase of procurement and each sub phase of design and contracting should end and this should form the time framework of the procurement process. Within each such phase and sub phase should be a list of all services to be performed by each participating role. From this balance between fixed calendar dates and lists of individual services which relate to each other in complex interactions there should be sufficient information for the schedule to be used as a guide and coordinating tool by the construction manager while allowing flexibility of interaction among the many participants groping forward to create the design in general and harmonious detail and relate its parts to the contracting phase.

A major input to this scheduling will be the decision to fast track or not to fast track. If fast tracking is not to be used, the schedule and the procurement process to be managed will be at its simplest albeit still complex. If the decision is to use fast track then the schedule will have to be more detailed in its list of services per phase and in clearly expressing the linkages between the different sub parts of design, contracting and construction caused by fast tracking.

b. The Construction Process

The construction process should be expressed as a network schedule which expresses both the desired strategic approach to construction of this building and the required detailed sequence of work tasks required by that strategy. Also, the detailed work tasks should be of a size and nature that they can be grouped under each contractual work package which it is anticipated will be let by bidding in the contracting phase. This can greatly facilitate both contracting and management of the subsequent construction process as well as the linking of estimates with the schedule. Clearly the whole construction process should fit inside the overall duration appropriate for construction in the whole procurement process. Here consideration of maximizing parallelism

in the work tasks of the construction schedule may be made while trading off such a choice with the likely increased cost of construction of that parallelism.

If fast tracking is to be used, its effect on the construction process and the early execution of material delivery contracts prior to the beginning of construction work should be included in the schedule for the construction process.

Regardless of whether the procurement will be fast tracked or not, under the construction management approach it is important that the construction schedule be created and ready for use at the latest, prior to the beginning of contracting for the construction work packages. By so doing, the details of when each prospective trade contractor will be required to execute the different parts of his work can be presented as part of the trade contract package upon which each trade sub contractor will bid.

7. Advice on Building Costs

The construction manager is called upon to provide a number of services within building costs. Those tend to be in three major groups (i) an estimate of overall building cost, (ii) comparative cost estimates and (iii) cost control of procurement.

a. An Estimate of Overall Building Cost

Quite often the construction manager is called upon to provide an estimate of the expected total cost of the building very early in the procurement process. Once this estimate has been finalized by discussion of the core triumvirate and accepted by the client it should become a major force or datum for control of all costs and decisions throughout the remainder of the procurement process. Such an estimate is usually made from sketchy information from the client and maybe from the architect's information in a pre design phase or very early in the design process. It will also be derived from the construction manager's knowledge of building construction costs in that locality and for that type of building. While the client may have only vague ideas on what type of building is desired at this early stage there may or may not be a vague idea of total budget that can be spent for it. This early total estimate and discussions about it should firm up ideas on the building and its total cost for the procurement. If the client's organization has already fixed a total budget for the building prior to appointing the construction manager, this estimate should take that total and incorporate within it a breakdown which can relate to the work of the architect in design and to the trade packages for contracting for construction of the future building in that locality. The resulting budget amount for the future building should also be tolerable to maintaining feasibility in the sense of real estate economics.

This initial estimated budget will be the ceiling price tolerable to the client. The construction manager and architect should use their expertise to procure i.e. design, contract and construct a building within that early set estimate/budget produced by either the client or by this very early overall estimate produced by the construction manager.

b. Comparative Cost Estimates

Throughout the design process the construction manager will be called upon to provide comparative cost estimates between design alternatives. At one polarity these alternatives can be of different total designs concepts for the whole building or at the other polarity can be comparisons of different details within one design or even between different choices of materials or equipment to carry out the same function in the building. Also, comparative estimates can be required of mixtures of building features and also of any important or desired design feature of the building.

Comparative cost estimates may also be required from the construction manager on the grouping of the required total construction work to different alternative contractual work packages prior to the contracting phase of procurement. These packages should come from the interaction between the desired design and the capability and availability of trade contractors in the local

marketplace as a way of gaining lower costs for the client and a more efficient construction process.

During the construction process itself, if change orders are to be issued the construction manager should first produce a comparative estimate of each so that the construction management triumvirate of client, architect and construction manager can evaluate both the cost of the proposed change and its effect on the agreed total estimate for the building or the running/changing total budget prior to issue of the change order. Similar estimates should be made for addenda.

c. Cost Control of Procurement

The construction manager at all phases and sub phases of the procurement process should be advising on the controlling of cost of the building and its procurement.

Once the initial overall estimate of building cost is made and accepted by the core triumvirate, the construction manager should use it as a ceiling beyond which the building scope and design should not be allowed to expand without the express approval of the client. Thus, at the end of each design sub phase and within such sub phases at important decision points, an estimate of that current design scope should be made. This estimate should be compared to the initially set estimate datum and any overrun of the datum should be brought to the attention of the client and discussed by the client, architect and construction manager.

As a preparation for the contracting phase and its hiring of trade contracts, a budget should be made up from the overall estimate total showing the expected bid price for each trade/subcontractor contract package. The construction manager should be prepared to make every effort to buy out that trade/subcontractor package at a price at or below the budget set for that trade/subcontract as a constituent of cost controlling the whole procurement of the building.

At an absolute minimum the viability of the total budget for the whole building should be maintained across the purchase of all trade contracts. This may require changing the contents of some trade contracts to lower their cost to the client. However, to achieve this usually requires making design changes and issuing change orders and addenda. The problem here is that there is less potential to save value and costs if such design and contract scope changes are made only to the contracts let later in the series. Hence, it is more important to carry out cost control of letting contracts early in the series compared to controlling those let later in the series.

During construction, within each trade contract and especially across all trade contracts the construction manager should exercise cost control. This should be directed at least towards two objectives, firstly maintaining the viability of the total cost estimate for the building and secondly in the conventional subcontractor cost control of labor in construction work to maintain a level of productivity within each trade contract that is needed to meet both cost targets but more importantly to meet time objectives for the whole construction process.

8. Knowledge of Local Building Marketplace

This local knowledge appears in two major parts (i) local construction costs and (ii) volume and nature of construction work ongoing now and in the future in that marketplace. Each is related to the other and both influence and are inputs to the above services under building cost advice.

a. Local Building Costs

The construction manager should have or rapidly develop considerable information on local building costs. Knowing the cost control dollar figures from ongoing local construction projects can provide detailed productivity figures which can be used as realistic data for cost rates in estimates for building costing work. The viability of these building cost services is quite dependent on the viability of the cost data available to the construction manager. The client, who is a repetitive client may be able to provide such data. The construction manager who has worked in the locality before should have such information in his data base. For the construction manager

who has not worked the locality before, an early task should be to gather such data from the local industry in whatever manner is considered appropriate.

b. Local Volume and Nature of Building Work

The construction manager should be aware of or find out the capacity of the local building industry as to its size and current and future work load in relation to its size. This information can enable gauging the probability of change in current building costs from the time of giving such advice during the design phase to the time of receiving bids from contractors during the contracting phase.

The nature of strengths and weaknesses in the local building industry, the variances in availability of skilled tradesmen in some trades and not in others should be established by the construction manager. Usually such inherent local resource allocations will reflect the vernacular capabilities of the local marketplace and the buildings it has produced. This information can provide considerable economic benefits and cost savings to the client if their effect are included the design and contracting of the building to be procured. Also, the opposite will be true if local resources will be required to carry out building work which is foreign to their capabilities. Knowing these aspects of the local marketplace can assist the construction manager to provide both good cost and good time advice to the client and architect as well as influencing the viability of other advice on constructability and quality of the building to be procured.

If the nature of the desired and designed building does not harness the strengths of the local building marketplace, building resources for such work have to be brought from outside the local marketplace. This may increase costs of building for all trades due to them all working together but not knowing each other prior to this building as well as the transportation costs for such non local resources. In this case, such resulting higher costs should be built into the estimates for the building, especially if such estimates are to be realistic.

Basically, by the construction manager being knowledgeable of the local costs of building types and of building work and the strengths and weaknesses of the local building industry provides an extremely sound basis from which to give building cost, time, constructability and building quality input advice to design and contracting phases under construction management.

9. Constructability of the Building Design

The construction manager should be able to provide advice on constructability of any building in any location. Also the construction manager should be able to evaluate physical site conditions upon which the building will be placed and the effect of the surrounding neighborhood, whatever it may be, on the efficiency of the construction process of whatever type of building is being contemplated.

Considering the major features as well as the details of the design, the construction manager should be providing advice on simplifying them to simplify the construction process. This can be achieved by creating features and details in the design which minimize interaction between trade contract packages and maximize continuity of work within each trade contract package and each of which should be harmonized with the local construction industry. These details and major features in the design which could increase speed of construction by each trade contractor should be brought to the discussions of the client, architect and construction manager during the design phase. By bringing these matters to triumvirate discussions can simplify the construction process and thus reduce its costs and durations thus simplifying the construction process and minimize the amount of capital investment to be made by the client for the building. Care should be taken to not press such constructability and component quality matters to the extent of reducing capital costs but which increase subsequent operating and maintenance costs of the building over its lifespan. Of course, this is dependent on the bias between capital and functioning costs along with the planned economic life of the building desired by the client and the purpose to which it is to be put. However, the client, architect and construction manager discussing these design and constructability features and their life cycle cost implications along

with their effect of reducing capital costs bring to the client a clearer and more objective framework to his decision making regarding his future building. At such discussions the parameters and their values set earlier by the client could well play a decisive role in making such decisions compatible to all decision being made during the procurement of the building.

10. Quality of the Building

It is mainly the architect's input that creates the design of the building and its aesthetic quality. However, a construction manager who is knowledgeable of building materials can and should provide valid advice on building quality. The construction manager could suggest materials of equal quality to those suggested by the architect but which have a lower construction cost or may suggest a different layout of features of the building which provide equal design performance but cause less inhibitions on the construction process.

The construction manager should be able to input advice on various degrees of quality of materials which will be either exposed to the building user or hidden from the eyes of the user of the building. In both cases there may be materials available either locally or nationally which can perform equally well as those suggested by the architect but which may be of lower costs etc., and hence of benefits to the client. It can be that some materials have a low cost delivered to the site but require such special handling that their cost in place in considerably different from that suggest by the manufacturer of the material. These matters have to checked and validated.

In the crucial situation of reconciling the designed building cope with the control datum of the overall estimate for the whole building there are times when the most desirable materials may be too expensive to be included in the building. Then the issue is of establishing what materials and even design features should be modified and to what degree to maintain the viability of the whole building's already agreed estimate/budget. Here the discussion is more delicate than the polarity of the most desirable or the cheapest. It is one of what is most appropriate in this situation for this building. Here the construction manager should not be suggesting the cheapest material substitute or total elimination of the feature. Here the construction manager is advising on what material quality or extent of the feature could be incorporated in the design within the controlling budget for the whole building. In such situations the construction manager is advising on the best material etc., to be acceptable within the given budget. Again, all these matters and issues should be handled and decided during design discussion of the client, architect, and construction manager operating as the core triumvirate of the construction management team. This type of discussion and decision making is a major strength of the construction management approach and should not be shied away from.

11. Trade Contract Packages

The construction manager should be the major role creating both the scope and detailed documents for each trade/sub contract for each work package.

Each such package of construction work should be set up to best match between the construction work needed for the building and the capabilities of the local construction marketplace under the circumstances faced by procuring that building. All such contract packages taken together should cover the construction work needed to construct the building to be procured.

If pure construction management is being used, the general items work package should be let as a single trade package to a local general contractor. This will require careful definition of scope and nature of the duties required and payment process as it is nontraditional. Also, the interface between its executant and the construction manager should be carefully spelled out.

If the quasi general contractor approach to construction management is being used there is the choice of letting the general items package to a local general contractor as above or the general items work can be a work package or contract to be carried out by the contractor who submits the guaranteed maximum contract bid to the client, i.e. the former construction manager.

There should be similarity in as many of the contract clauses as possible for all of these trade packages so that there can be a similarity in the management of all these contracts which comprise the whole construction process.

The construction manager should be capable of and most likely be the party from the construction management triumvirate to be the primary writer of all of these contract documents for construction work, especially in coordinating their work scopes and detailed interactions. At the very least, the construction manager and the architect should jointly write and produce these contract documents to meet the needs of the client in the procurement process.

Decisions about scope of required bonding, insurances, substantial completion of work, warranties and schedules of values should also be addressed in these contract documents. These matters should be discussed and decided by the core triumvirate and then put in to the contracts by the construction manager depending on the nature of the work involved.

Considerable care should be taken in the writing of these contract documents to match the specific needs of each building's procurement to reflect the needs of the client's parameters and values set up to guide decision making in the procurement process. It is very probable that merely taking generally available contract conditions from an existing source in the construction industry and using them will cause problems during contracting and construction phases because they have not been adapted to the needs of the specific building being procured by these contracts.

12. Contracts for Long Lead Materials and Work

If there is a need to carry out the procurement of the building with great speed or even at a speed greater than normal, it is very probable that the core triumvirate will expedite that faster construction by placing orders for materials (and work) that requires a long lead time prior to the selection of a trade contractor for the work involved. It will usually be the construction manager who will prepare and may carry out such contracting for the long lead materials for the building. The contents of such contracts should be compatible with the work package/trade contracts to be used for contracting the building work to which such long lead contracts will be assigned at a later date and vice versa.

The construction manager should be examining the design and the construction marketplace at early stages to evaluate what, if any, of the work should be handled this way. After finding and reaching conclusions on what materials would be advantageously procured this way, the construction manager should discuss such proposals with the client and architect for joint decisions. Then the construction manager should seek out appropriate material suppliers for questioning on the most expeditious terms for contracting such materials prior to carrying out competitive bidding or sole source bidding and placing the contracts. Delivery dates for such materials which match the proposed construction schedule for the construction of the building should be included in such long lead material and work contracts.

Depending on the nature of the client it may be best to have such contracts directly with the client or it could be that the construction manager is the party to such contracts. In all such contracts it should be clearly stated that such contracts will be assigned to the appropriate trade contract when it is let at a later date.

13. Finding Qualified Trade/Subcontractors

Once the array of trade/subcontract packages has been set up for the whole building and usually simultaneously with the setting up of the scope of work of each such work package, the construction manager should be seeking out qualified trade/subcontractors in the local construction industry and beyond as prospective bidders and contractors for each trade package contract.

These potential contractors should be evaluated as to their quality as constructors and as having managerial and financial capabilities to handle the appropriate contract packages for which they are being considered. The reputation of each within their local construction

marketplace should be sought, noted and evaluated. Then short lists of contractors for each trade/subcontract package should be prepared. The construction manager should gather enough bidders, qualified as above, for each contract package to receive sufficient competition when it is put out to bid. This enables the client to harness the competitive forces in the marketplace while being reasonably sure that each competing bidder is capable of doing the required work in the context of the needs of the whole procurement process.

The inclusion or exclusion of bonding of such trade/subcontractors in these contracts should be a variable to be discussed and decided by the core triumvirate and depending on the nature of the client's requirements for procurement and the desired degree of quality of the winning bidder.

14. Managing the Bidding and Contracting Processes

The construction manager should be capable of setting up, managing, and completing the bidding and contracting for all trade/subcontracts for the required construction work. The schedule set up for the construction process will be a major controlling feature for this bidding and contracting work. The bidding for each trade package should be timed to enable the start of such work to match the desired and already created construction schedule.

Inputs to these processes will be the contract documents for each trade/subcontract work package and the lists of qualified bidders for each trade found from the local marketplace or elsewhere.

The contract documents packages of contract conditions and drawings and specifications should be checked for compatibility both inside each package and across all packages before these documents have to be produced and issued to bidders. Prebid meetings to clarify any questions have to be arranged and carried out and subsequent addenda have to be issued to all bidders.

The receipt of bids for each trade package has to be arranged and handled in the context of the client's requirements. The construction manager should check each bid for completeness and then compare all bids for each trade package to the already estimated cost for that package. All variable features of each bid should be evaluated and considered. After discussing the various bids for each trade package with the core triumvirate as to the effects of each bid on the total estimated cost and construction schedule etc for the building, the construction manager should be prepared to carry out post bid negotiations on behalf of the client to achieve a clear contract for each trade package and within or at the dollar amount in the estimate for the whole building for each trade package. He should also arrange the assignment of any long lead contracts to the trade/subcontractors who will carry out the onsite work with such materials.

The construction manager should finalize the contract for each trade package from the contractor to be receive all the necessary information requested in the bid package. Then the parties to the contract should sign all papers required to formalize that contract. Then the contractor can mobilize resources to begin and carry out construction work harmoniously with the desired and scheduled construction process.

15. Managing the Construction Process

Within the context of the early decisions made for the procurement of each building usually the management of the whole construction process will be one of the major services of the construction manager. Also, the construction process should be set up, managed and controlled to occur within the context of all earlier services and features within the building procurement process.

Major inputs to this process will include the construction schedule created earlier to express the needs of the clients and the procurement of this building. Clearly, at the various phases within the construction process more detailed schedules are likely to be needed to express in construction terms the overall construction schedule already thought out and in place. These detailed sub schedules should be created by the construction manager who should use them to guide the actual construction work for that time segment or geographic part of the building.

The other major input to the construction process are the trade/subcontractors hired in the contracting phase of procurement. Under construction management it is probable that each such contractor will be hired at a different point in time during construction so that the contracting phase should be scheduled to run in parallel with most of the construction phase and to suit the needs of that construction process. The construction manager should manage the whole construction process by simultaneously managing all the trade/subcontractors as would be done on a normal construction process. The construction manager should also be monitoring the trade/subcontractor's quality control work with the architect so that these two members of the construction management triumvirate do not conflict or overlap or omit their interests and work in this respect.

Care and attention should be paid to expediting both the work and the flows of resources to the site by all participants in the construction process. This means that the construction manager should have staff on site capable of and willing to expedite communications to and from all participants in the construction process to enable them to speedily execute their work. This should be comparatively easy provided the construction manager's site staff have participated in most of the discussions and decisions in the design phase and contracting phase and are now managing the construction phase. The construction manager should also have attitude and desire to expedite the construction work as well as have the ability to do so.

The handling of onsite disputes of any type and the arranging for change orders and having them carried out should be done as expeditiously as possible by the construction manager with backup discussions with the architect and client to assist producing what is best for the overall procurement of the building.

It should be remembered in this service by the construction manager that all of the participating contractors and professional advisors and members of the construction management team are people. Each has expertise and all have to be blended into a cohesive ad hoc work force to construct the building. The circumstances surrounding their work are extremely complex and many situations are overlapped with design work and contracting work. Also, the process of managing the diversity of people, contracts, interactions, flows of many resources and information is more complex and dynamic than on a normal construction process. This implies the need for a higher quality of participative management skills from the construction manager to keep the whole management process flowing as smoothly as possible under the above circumstances.

Usually the construction manager also should be responsible for closing out the construction process through substantial completion, occupancy move in and handling all warranties for constituents of the building on behalf of the client.

During the whole of the construction process the construction manager should be providing reports of the actual construction progress and problems to the regular meetings of the core triumvirate of client, architect, and construction manager. Also, to be brought to each of such meetings should be construction process issues which have to be decided in the near future in order not to hinder future parts of the construction process. In this work the construction manager should explain and coordinate such matters with the other two members of the triumvirate as each can be a valuable resource to the construction management team in its management of the construction process.

The construction manager should be careful in his handling of all trade/subcontractors during the construction phase. This caution is especially valid under the pure construction management approach described below. The construction manager's handling of trade/subcontractors should not include any element of coercion such as simple, nasty human behavior e.g. shouting, bullying etc or withholding payments contractually due to a trade/subcontractor. However, warnings that performance should be as contractually agreed, along with reminders of contractually allowed sanctions could be used. On the other hand, attempting to induce more, better, or faster performance by promises of future work from the client or construction manager or threatening to preclude the trade/subcontractor from future consideration for work are seen as reprehensible. The construction manager should manage the

trade/subcontractor fairly and correctly by their contractual agreements with the client or construction manager. Failure to behave correctly by the construction manager on this project will simply build up prices for future projects of the client and construction manager.

16. Handling of Money Flows for the Construction Process

The construction process is when the client will have the greatest amounts of cash outflow per unit of time. Hence, it should be carefully managed and usually the construction manager is the role to handle these matters.

This can begin by rearranging the preconstruction total estimate to a cash flow per unit of time estimate based on the construction schedule produced before the contracting phase begins. This will enable the client to not only arrange for the appropriate total amount of financing needed for construction but also enable the planning of cash flow per month then can be expected to be paid out during the construction process.

Next, at each month or contractual time interval of the construction process, there will be the handling of all the interim payments to all the trade/subcontractors by whichever mechanism has been set up in their contracts for such payments from the client. In addition to interim payments, there will be the handling of the money effect of the change orders which are to be issued and work carried out. These change orders and their costs will cause adjustments to planned estimates and cash flows and maybe the logic of construction schedules. These may affect the volume and makeup of construction work which, in turn, affects the amount of interim payments and trade contract amounts. This, in turn, can affect the total cost of the building to the client. All of these interactive money matters have to be discussed, decided, and monitored and acted upon by the construction manager and the client and architect.

Major payments to contractors at the substantial completion stage of work and end of warranty periods and final paying off of each trade contractor have to be carried out properly and expeditiously according to the contracts under which this work is to be carried out.

D. INTERACTIVITY OF ALL OF THE ABOVE SERVICES

Each of the above normally available services to be expected from a construction manager has been briefly sketched individually for clarity. However, it is imperative to realize that on the procurement of a particular building that virtually all of these services are interactive. A change inside one of them will most likely cause changes in at least another of them and most likely cause changes in many of them. Furthermore, it should be realized that the services briefly sketched above may have to be augmented by abnormal services required by the particular building and the particular procurement process perceived as best for the needs of that particular client's needs at that time.

The construction manager should be capable of recognizing the effects of individual changes inside any one service upon all other services. This perception and attitude by the construction manager is very important in providing the client with an agency service derived from a complete network of services under the construction management approach.

The construction manager, while giving advice and participating in discussions in the procurement process should constantly be thinking of the effect of that advice on the work in the later phases of procurement. The construction manager should be constantly watching for inconsistencies across all services provided by himself and others so that future disputes from such inconsistencies will not arise or be minimized. All of these matters deal with providing a complete network of service made up from the above normal services, abnormal services and services of others brought to the client so that the building can be procured as simply and as well as possible under whatever circumstances are faced by the client at that time and place.

- THE END -

APPENDIX A

GUIDE TO SPECIFIC REQUESTED SUB TOPICS

TO BE RESEARCHED UNDER THIS RESEARCH CONTRACT

The main objective of this piece of research was to produce a report on the consensus of building industry experts from a variety of disciplines on Construction Management. The whole report does this.

In addition, the research was to report on an array of specific sub topic questions within Construction Management. These are presented below with the content topic in the report which presents the essence of the results dealing with each sub topic question. Usually, additional, fuller information is provided on each sub topic elsewhere in the report. Where the sub topic questions are only indirectly answered in the text is where the thrust of the responses from the experts in the industry differed from the thrust of the sub topic question.

Sub Topics

A. What is the definition of a Construction Manager?
   See especially pages introducing the conceptual and literal objectives of construction management. [III A and III B]

B. How many different structures or organizations are there under Construction Management?
   See pages dealing with the organizational structure of construction management, especially those dealing with communications. [VI A, VI B, VI B(1) and VI B(2)]

C. What are the normal services/responsibilities of the Construction Manager?
   See especially pages introducing the normal and abnormal services of a construction manager. [VIII A and VIII B and VIII C]

D. What are the criteria for selecting a Construction Manager?
   See pages introducing the criteria for selecting a construction manager. [VII A, VII A(1), VII A(2a), and VII A(2b)]

E. Which different fee structures are used?
   See pages dealing with payment for services of the construction manager. [VII B(1) and VII B(2)]

F. Which state license, if any, should be used?
   See pages dealing with licensing of construction managers. [VII C]

G. What is the threshold price for Construction Management to be economical?
   See pages, generally introducing the threshold for use of a construction manager [V A and V C(2)]

H. How successful is Construction Management today?
   See pages describing the degree of success of construction management in the past [II D]