

PROJECT MANAGEMENT

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This manual is part of the Construction Managers' Library – a set of books related to the wide area of management in construction. The books were created within the Leonardo da Vinci (LdV) project No: PL/06/B/F/PP/174014, entitled: “COMMON LEARNING OUTCOME FOR EUROPEAN MANAGERS IN CONSTRUCTION”. Warsaw University of Technology, Civil Engineering Faculty, Department of Construction Engineering and Management was the Promoter of the Project.

The following organisations were Partners in the Project:

- Association of Building Surveyors and Construction Experts (BE)
- Universidad Politécnica de Valencia (ES)
- Chartered Institute of Building Ireland (IE)
- Polish Association of Building Managers (PL)
- Polish British Construction Partnership Sp. z o.o. (PL)
- University of Salford (UK)
- Chartered Institute of Building (UK)

The objective of this project was to create seven manuals conveying all the information necessary to develop civil engineering skills in the field of construction management. The scope of knowledge presented in the manuals is meant to be the basis for assessing the managerial qualifications of civil engineers by the Association of European Building Surveyors and Construction Experts for the purposes of the European engineering professional card - EngCard.

The following manuals have been developed (in the brackets you will find an estimate of didactic hours necessary for mastering the contents of a given manual):

- M1: PROJECT MANAGEMENT IN CONSTRUCTION (100)
- M2: HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION (100)
- M3: PARTNERING IN CONSTRUCTION (100)
- M4: BUSINESS MANAGEMENT IN CONSTRUCTION ENTERPRISE (100)
- M5: REAL ESTATE MANAGEMENT (100)
- M6: ECONOMY AND FINANCIAL MANAGEMENT IN CONSTRUCTION (240)
- M7: CONSTRUCTION MANAGEMENT (100)

The manuals created for the purposes of the library are available in three languages: Polish, Spanish and English. The manuals may be used as didactic materials for students of postgraduate courses and regular studies in all three languages.

Graduates from the courses will receive a certificate, which is recognized by all organizations – members of the AEEBC, association of construction managers from over a dozen European countries. Polish representative in the AEEBC is the Polish Association of Building Managers, in Warsaw.

More information about the LdV project see:

www.leonardo.il.pw.edu.pl

This manual is part of a prescribed set of learning manuals. Although the material is largely self-contained it should be read in the context of the

entire suite. Major linkage points to other manuals are indicated in the text.

The manual begins by examining the links between the different professionals engaged in the process of construction and the relative sizes of project in which they can be involved.

Study Time

This module will require approximately 100 hours of study to complete.

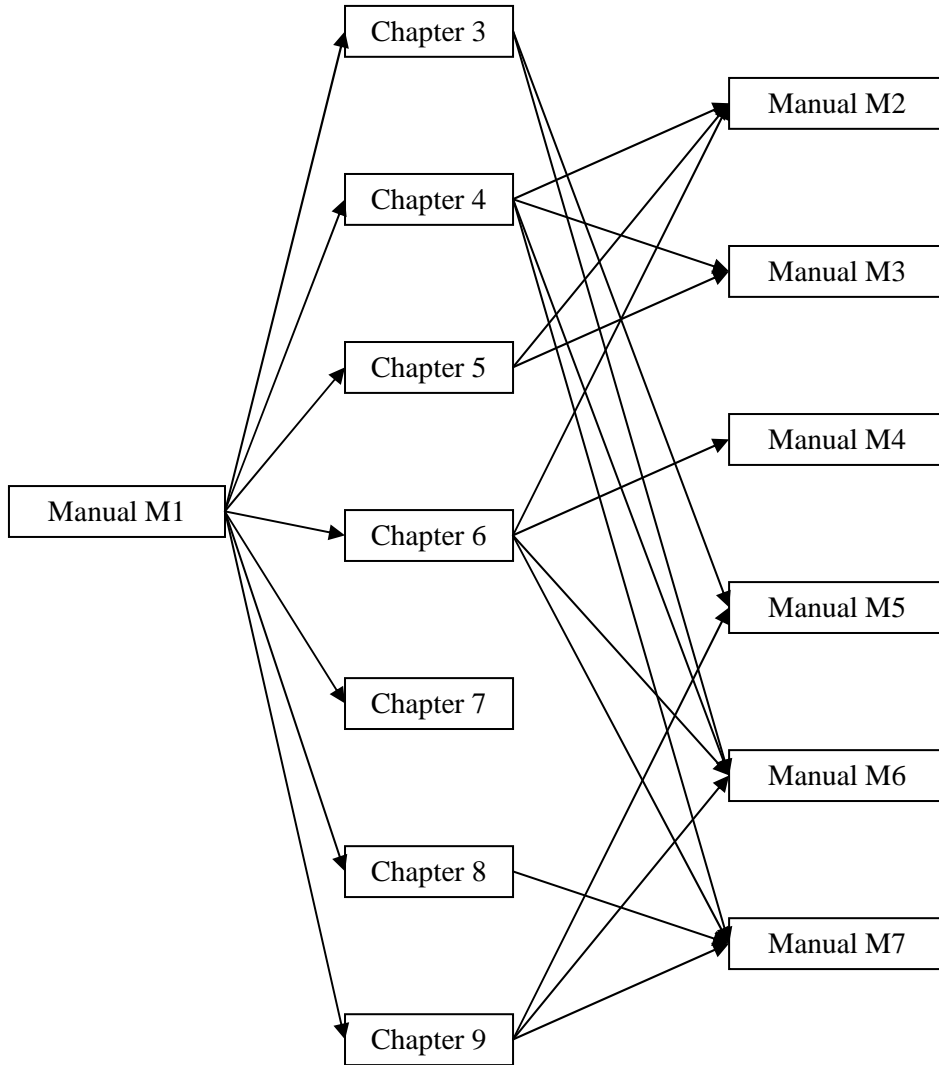
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Inter-relationship Between each Chapter in Manual M1 and other Manuals in this Series

CHAPTER 1

LEARNING OUTCOMES

After studying this section within the context of your workplace, you should be able to:

- Describe the business context of Project Management including the key Stages of the process and their inter-relationships;
- Recognise the linkages between Construction Project Management and other professionals engaged in the construction process;
- Appreciate the strategic importance of Construction Project Management both internationally and within the national industry market place.

1.1 INTRODUCTION

Project management is the professional discipline, separating the management function of a project from the design and execution functions. Management and design may still be combined on smaller projects and be performed by the leader of the design team but for larger or more complex projects the need for separate management resulted in the evolution of project management.

Project management has a long history but in its modern form its use for construction only extends back for as little as 45–50 years. Much of the earlier codification of the principles and practices of project management was developed in the United States, although in the United Kingdom the Chartered Institute of Building (CIOB) published a seminal work on the subject in 1979.

Project management may be defined as ‘the overall planning, co-ordination and control of a project from inception to completion aimed at meeting a Client’s

requirements in order to produce a functionally and financially viable project that will be completed on time within authorised cost and to the required quality standards.'

Other definitions exist e.g.

Project Management Body of Knowledge (PMBOK) from the Project Management Institute (PMI): "Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements".

Projects in Controlled Environments (PRINCE) defines Project Management as follows: *"The planning, monitoring and control of all aspects of the project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance."*

DIN 69901 defines it thus: "Project management is the complete set of tasks, techniques, tools applied during project execution"

In November 2007 work began with the British Standards Institute in the United Kingdom on new international standards for Project Management (ISO 21500), taking BS6079-1 as the base standard for the new research.

1.2 ROLE

Project management has a strong tradition in the construction industry and is widely used on projects of all sizes and complexity. Even so, many projects do not meet their required performance standards or are delivered late or over budget. These issues can be directly addressed by raising the standards of project management within the construction industry and more specifically improving the skills of project managers.

1.3 PURPOSE OF CONSTRUCTION PROJECT MANAGEMENT

The purpose of project management in the construction industry is to add significant and specific value to the process of delivering construction projects. This is achieved by the systematic application of a set of generic project-orientated management principles throughout the life of a project. Some of these techniques have been tailored to the sector requirements unique to the construction industry.

The function of project management is applicable to all construction projects. However, on smaller or less complex projects the role may well be combined with another discipline e.g. leader of the design team. The value added to the project by project management is unique: no other process or method can add similar value, either qualitatively or quantitatively.

1.4 THE STRUCTURE OF PROJECT MANAGEMENT

Construction and development projects involve the coordinated actions of many different professionals and specialists to achieve defined objectives. The task of project management is to bring the professionals and specialists into the project team at the right time to enable them to make their best possible contribution, efficiently.

The professionals and specialists bring knowledge and experience that contributes to decisions embodied in the project information. The different bodies of knowledge and experience all have the potential to make important contributions to decisions at every stage of projects. In construction and development projects there are far too many professionals and specialists involved for it to be practical to bring them all together at every stage. This creates a dilemma because ignoring key bodies of knowledge and experience at any stage may lead to major problems and additional costs for everyone.

The practical way to resolve this dilemma is to carefully structure the way the professionals and specialists bring their knowledge and experience into the

project team. The most effective general structure is formed by the eight project stages used in this description of project management. In many projects there is a body of knowledge and experience in the Client organization. This also has to be tapped at the right time and blended with the professional and specialists' expertise.

Each stage in the project process is dominated by the broad body of knowledge and experience that is reflected in the stage name. As described above, essential features of that knowledge and experience need to be taken into account in earlier stages if the best overall outcome is to be achieved. The way that professionals and specialists who own knowledge and experience are brought into the project team at these earlier stages is one issue that needs to be decided during the **Strategy Stage**.

The results of each stage influence later stages and it may be necessary to involve the professionals and specialists who undertook earlier stages to explain or review their decisions. Again the way they are employed should be decided in principle during the Strategy Stage.

Each stage relates to specific **Key Decisions**. Consequently many project teams hold a key decision meeting at the end of each stage to confirm that the necessary actions and decisions have been taken and the project can therefore begin the next stage. There is a virtue in producing a consolidated document at the end of each stage that is approved by the Client Body before proceeding to the next stage. This acts as a reference or peg in the sand as well as acting as a vehicle for widespread ownership.

Projects begin with the **Inception Stage** resulting from business decisions by the client that suggest a new construction or development project may be required. Essentially the Inception Stage consists of commissioning a project manager to undertake the next stage - which is to test the feasibility of the project.

The **Feasibility Stage** is a crucial stage in which all kinds of professionals and specialists may be required to bring many kinds of knowledge and experience into a broad ranging evaluation of feasibility. It establishes the broad objectives for the project and so exerts an influence throughout subsequent stages.

The next stage is the **Strategy Stage** which begins when the project manager is commissioned to lead the project team to undertake the project. This stage requires the project's objectives, an overall strategy and the selection of key team members to be considered in a highly interactive manner. It draws on

many different bodies of knowledge and experience and is crucial in determining the success of the project. In addition to selecting an overall strategy and key team members to achieve the project's objectives, it determines the overall procurement approach and sets up the control systems that guide the project through to the final **Post -Completion Review** and **Project Close-Out Report Stage**. In particular the Strategy Stage establishes the objectives for the control systems. These deal with much more than quality, time and cost. They provide agreed means of controlling value from the client's point of view, monitoring financial matters that influence the project's success, managing risk, making decisions, holding meetings, maintaining the project's information systems, and all the other control systems necessary for the project to be undertaken efficiently.

At the completion of the Strategy Stage, everything is in place for the **Pre-Construction Stage**. This is when the design decisions are made. This stage includes statutory approvals and consents, and bringing manufacturers, contractors and their supply chains into the project team. Like the earlier stages, the Pre-Construction Stage often requires many different professionals and specialists working in creative and highly interactive ways. It is therefore important that this stage is carefully managed using the control systems established during the Strategy Stage to provide everyone involved with relevant, timely and accurate feedback about their decisions. Completion of this stage provides all the information needed for construction to begin.

The **Construction Stage** is when the actual building or other facility that the client needs is produced. In modern practice this is a rapid and efficient assembly process delivering high quality facilities. It makes considerable demands on the control systems, especially those concerned with time and quality. The complex nature of modern buildings and other facilities and their unique interaction with a specific site means that problems will arise and have to be resolved rapidly. Information systems are tested to the full, design changes have to be managed, construction and fitting out teams have to be brought into the team and empowered to work efficiently. Costs have to be controlled and disputes resolved without compromising the value and quality delivered to the client.

The Construction Stage leads seamlessly into a key stage in modern construction and development projects, the **Engineering Services Commissioning Stage**. The complexity and sophistication of modern engineering services makes it essential that time is set aside to test and fine tune each system. Therefore these activities form a distinct and separate stage which should be finished before beginning the **Completion, Handover and**

Occupation Stage which is when the client takes over the completed building or other facility.

The client's occupational commissioning needs to be managed as carefully as all the other stages because it can have a decisive influence on the project's overall success. New users always have much to learn about what a new building or facility provides. They need training and help in making the best use of their new building or facility. It is good practice for their interests and concerns to be considered during the earlier stages and preparation for their move into the new facility should be begun early so there are no surprises when the client's organization moves in.

The final stage is the **Post-Completion Review** and **Project Close-Out Report Stage**. This provides the opportunity for the project team to consider how well the project's objectives have been met and what lessons should be taken from the project. A formal report describing these matters provides a potentially important contribution to knowledge. For clients who have regular programmes of projects and for project teams that stay together over several projects, such reports provide directly relevant feedback. Even where this is not the case, everyone involved in a project team, including the client, is likely to learn from looking back at their joint performance in a careful objective review.

CHAPTER 2

INCEPTION STAGE

2.1 INTRODUCTION

Capital projects are usually complex, requiring significant management skills, coordination of a wide range of people with different expertise and ensuring completion within the parameters of time, value and necessary specifications.

The inception stage of any construction and development project requires the decision from the client that a potential project represents the best way of meeting a defined need.

In assessing the need for construction, key questions should include:

- Why is the project needed?
- How best is the need to be fulfilled? (For example, a new building, or refurbishment, or extension of existing structure etc.)
- What benefits are expected as a result of the project?
- What are the investment/funding options?
- What risks related to the development can be foreseen at this stage?

2.2 CLIENT'S OBJECTIVES

The main objective at this stage for the client is to make the decision to invest in a construction or development project. The Client should have a business case prepared (capital expenditure programme) involving careful analysis of its business, organisation, present facilities and future needs. Experienced clients

may have the necessary expertise to prepare their business case in-house. Less experienced clients, may need help. Many project managers are able to contribute to this process. This process will result in a project-specific statement of need. The Client's objective will be to obtain a totally functional facility, which satisfies this need and must not be confused with the project objectives, which will be developed later from the statement of need.

A sound business case prepared at this stage will:

- Be driven by needs
- Be based on sound information and reasonable estimation
- Contain rational processes
- Be aware of associated risks
- Inherit flexibility
- Maximize the scope of obtaining best value from resources
- Utilise previous experiences

2.3 CLIENT'S INTERNAL TEAM

Investment decision maker: this is typically a corporate team of senior managers/directors who review the potential project and monitor the progress. However, they are seldom directly involved in the project process.

Project sponsor: typically a senior person in the client's organisation, acting as the focal point for key decisions about progress and variations. The project sponsor has to possess the skills to lead and manage the client role, have the authority to take day-to day decisions and have access to people who are making key decisions.

Client's advisor: The project sponsor can appoint an independent client advisor (also referred to as construction advisor or project advisor) who will provide professional advice in determining the necessity of construction and means or procurement, if necessary. If the client does not have the necessary skills in-house, an external consultant should be appointed. If advice is taken from a Consultant or a Contractor, those organizations have a vested interest not only in confirming the Client's need, but also in selling their services and products.

The client advisor should understand the objectives and requirements of the client but should not have a vested interest in any of the project options beyond

the provision of expert advice to clients. The advisor should not form part of any team but instead should provide advice directly to the client. The areas where the client may seek independent advice may include: –
accounting, tax and legal issues, market research, Town Planning, surveying, investment banking.

- Business Case Development
- Investment Appraisal
- Understanding the need for a project
- Deciding the type of project that meets the need
- Generating and Appraising Options
- Selecting an appropriate Option
- Risk Assessment
- Advising the Client on the choice of procurement route
- Selecting and appointing the project team
- Measuring and monitoring performance

2.4 PROJECT MANAGER

Project managers can come from a variety of backgrounds but will need to have the necessary skills and competencies to manage all aspects of a project from inception to occupation. This role may be fulfilled by a member of the client's organisation or by an external appointment.

2.5 PROJECT MANAGER'S OBJECTIVES

The project manager, both acting on behalf of, and representing the Client has the duty of *'...providing a cost-effective and independent service, selecting, correlating, integrating and managing different disciplines and expertise, to satisfy the objectives and provisions of the project brief from inception to completion. The service provided must be to the Client's satisfaction, safeguard*

his interests at all times, and, where possible, give consideration to the needs of the eventual user of the facility...'

The key role of the project manager is to motivate, manage, co-ordinate and maintain the morale of the whole project team. This leadership function is essentially about managing people and its importance cannot be overstated. A familiarity with all the other tools and techniques of project management will not compensate for shortcomings in this vital area.

In its dealings with the Project Team the project manager has an obligation to recognise and respect the professional codes of the other disciplines and, in particular, the responsibilities of all disciplines to society, the environment and each other.

There are differences in the levels of responsibility, authority and job title of the individual responsible for the project, and the terms project manager, project co-ordinator and project administrator are all used.

It is essential that, in ensuring an effective and cost-conscious service, the project should be under the direction and control of a competent practitioner with a proven project management track record usually developed from a construction industry related professional discipline. This person is designated the project manager and is to be appointed by the Client with full responsibility for the project. Having delegated powers at inception, the project manager will exercise, in the closest association with the Project Team, an executive role throughout the project.

2.6 PROJECT MANAGER'S DUTIES

The duties of a project manager will vary depending on the Client's expertise and requirements, the nature of the project, the timing of the appointment and similar factors. If the Client is inexperienced in construction the project manager may be required to develop his own brief. Whatever the project manager's specific duties in relation to the various stages of a project are, there is the continuous duty of exercising control of project time, cost and performance. Such control is achieved through forward thinking and the provision of good information as the basis for decisions for both the project manager and the Client. A matrix correlating suggested project management duties and Client's requirements is given in Table. 2.1.

Table 2.1**Suggested duties of project manager**

Duties*	Client's requirements			
	In-house project management		Independent project management	
	Project management	Project coordination	Project management	Project coordination
Be part to the contract	√		X	
Assist in preparing the project brief	√		√	
Develop project managers brief	√		√	
Advise on budget/funding arrangements	√		X	
Advise on site acquisition, grants and town planning	√		X	
Arrange feasibility study and report	√	X	√	X
Develop project strategy	√	X	√	X
Prepare project handbook	√	X	√	X
Develop consultants brief	√	X	√	X
Devise project programme	√	X	√	X
Select project team members	√	X	X	X
Establish management structure	√	X	√	X
Co-ordinate design processes	√	X	√	X
Appoint consultants	√		√	X
Arrange insurance and warranties	√	√	√	X
Select procurement system	√	√	√	X
Arrange tender documentation	√	√	√	X
Organise contractor pre-qualification	√	√	√	X
Evaluate tenders	√	√	√	X
Participate in contractor selection	√	√	√	X
Participate in contractor appointment	√	√	√	X
Organise control systems	√	√	√	√
Monitor progress	√	√	√	√
Arrange meetings	√	√	√	√
Authorise payments	√	√	√	X
Organise communication/reporting systems	√	√	√	√

Provide total co-ordination	√	√	√	√
Issue safety/health procedures	√	√	√	√
Address environmental aspects	√	√	√	√
Co-ordinate statutory authorities	√	√	√	√
Monitor budget and variation orders	√	√	√	√
Develop final account	√	√	√	√
Arrange pre-commissioning/commissioning	√	√	√	√
Organise handover/occupation	√	√	√	√
Advise on marketing/disposal	√		√	X
Organise maintenance manuals	√	√	√	X
Plan for maintenance period	√	√	√	X
Develop maintenance programme/staff training	√	√	√	X
Plan facilities management	√	√	√	X
Arrange feedback monitoring	√	√	√	X
* Duties vary by project and relevant responsibility and authority Symbols: (x) = possible additional duties (√) = suggested duties				

Typical terms of engagement for a project manager will be subject to modifications to reflect the Client's objectives, the nature of the project and contractual requirements.

A *supervising officer* and/or *contract administrator* may be appointed for the construction and subsequent stages of the project. This post is often taken by a member of the Project Team who will have a direct contractual responsibility to the Client, subject to consultation with the project manager.

The term **project coordinator** is applied where the responsibility and authority embrace only part of the project, e.g. pre-construction, construction and handover/migration stages. (For professional indemnity insurance purposes a distinction is made between project management and project co-ordination. If the project manager appoints other consultants the service is defined as project management. If the Client appoints other consultants the service is defined as project co-ordination.)

2.7 APPOINTMENT OF PROJECT MANAGER

To ensure professional, competent management coordination, monitoring and controlling of the project right from the inception stage, and its satisfactory completion in accordance with the brief, it is advisable to appoint the project manager at a very early stage; possibly at the inception. However, depending upon the nature and type of project and the client's in-house expertise, the project manager can be appointed at a later stage, at the feasibility or perhaps at the beginning of strategy stages. In selecting and appointing the project manager, the Client may follow the procedure for selecting and appointing consultants.

2.8 MANAGING PEOPLE

Project management, though strongly associated with change management and systems, is above all about managing people. It is about motivating the project team, middle management and the workforce and of gaining their commitment. It is also about achieving an effective form of relationship, which will enable an atmosphere of mutual co-operation to exist.

2.9 PEOPLE – THE MOST IMPORTANT RESOURCE

Although it is important to exploit new technology in order to achieve technological leadership and thus a competitive advantage, it is feasible that all firms could ultimately have access to similar technology. It is, therefore, the

human resource that will make the difference and ultimately create the competitive advantage. Even computer-based systems are only as good as their designers and operators. People are the construction industry's most important resource.

It requires special skills to be successful at organizing, motivating and negotiating with people. Although some people have a greater natural talent for this than others, everyone can improve their natural ability through appropriate education and training.

The skills the project manager will need to consider when assessing an individual may include the following.

- What a person can do: skills, competencies.
- What a person can achieve: output, performance.
- How a person behaves: personality, attitudes, intellect.
- What a person knows: knowledge, experience.

The skills the project manager will use during the course of a project will include:

- Communication: using all means, the foremost skill.
- Organising: using systems and good management techniques.
- Planning: via accurate forecasting and a scheduling.
- Co-ordination: by liaising, harmonising and understanding.
- Controlling: via monitoring and response techniques.
- Leadership: by example.
- Delegation: through trust.
- Negotiation: by reason.
- Motivation: through appropriate incentives.
- Initiative: by performance.
- Judgement: through experience and intellect.

2.10 ESTABLISHING OBJECTIVES

The recognition that members of the Project Team have differing and sometimes conflicting objectives is the first step in ensuring that the team operates as an effective unit.

With the Client's project objectives in sharp focus, attention is directed towards overcoming any conflict in the aims of team members. Presentation of objectives, team selection, choice of working environment, definition of levels of responsibility, authority and communication procedures; all are influential in ensuring that team members meet their personal objectives as part of the successful execution of the project.

The project manager should aim to create an environment in which the Client and all his team members can achieve their personal, as well as project, goals.

There is no doubt that team performance is optimised when members are encouraged to identify and tackle problems early in the process. This will only occur when the benefits of revealing mistakes and omissions outweigh any penalties imposed by the Client. Promotion of an open, 'blame free' culture, where the project manager leads by example, will also help in breaking down communication barriers.

CHAPTER 3

FEASIBILITY STAGE

CLIENT'S OBJECTIVES

The objectives for the client at this stage include specifying project objectives, outlining possible options and selecting the most suitable option through value and risk assessment. Establishing the Project Execution Plan (PEP) for the selected option should be the key output at this stage.

3.1 OUTLINE PROJECT BRIEF

For most Clients a building is not an end in itself, but merely the means to an end – i.e. the Client's objectives. The Client's objectives may be as complex as the introduction and accommodation of some new technology into a manufacturing facility or the creation of a new corporate headquarters; or they may be as simple as obtaining the optimum return on resources available for investment in a speculative office building.

The Client's objectives are usually formulated by the organisation's board or policy-making body (the investment decision maker) and may include certain constraints – usually related to time, cost, performance and location. The client's objectives must cover the function and quality of the building or other facility.

If it is considered that the objectives are of a complexity or size to merit the engagement of a project manager, the appointment should ideally be made as early as possible, preferably after approving the project requirements at the inception stage. This will ensure the benefit of the special expertise of the

project manager in helping to define the objectives and in devising and assessing options for the achievement of the objectives.

The project manager should be provided with or assist in preparing a clear statement of the Client's objectives and any known constraints. This is the initial outline project brief to which the project manager will then work.

A typical example of a template for an outline project brief is shown in Figure 3.1 below:

<p>Project Title: Project Reference number: Customer (Internal/External): Project Sponsor: Project Manager:</p>
<p>GOAL: Be specific: Include a specification for the project (It should spell out WHAT will be done and WHEN it will be done by.)</p>
<p>OBJECTIVES: Cover the 'OUTCOMES': Specific – i.e. clear and relevant Measurable: so that it is feasible to see what is happening Achievable : use positive language Realistic: i.e depends upon resources/time/outcome (or aim) Time Bound: set a time limit – (otherwise they are just wishes)</p>
<p>APPROACH The project plan should include the key milestones for the review, i.e. set a target date for agreeing the project brief and target dates for each of the project milestones</p>
<p>SCOPE This sets the project boundaries and will be useful if the project changes in due course</p>
<p>CONSTRAINTS Add 'Start' and 'End' dates here</p>
<p>DEPENDANCIES Factors outside the control of the Project manager Supply of information Decisions being taken at the right time Other supporting projects</p>
<p>RESOURCE REQUIREMENTS Include estimates of project days and costs</p>

AGREED: Signature: _____ Project Manager: Project Sponsor:	Date: _____
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Fig. 3.1 Outline Project Brief Template

3.2 FEASIBILITY STUDIES (see also Manual M6)

There is seldom if ever a single route available for the achievement of the Client's objectives, so the project manager's task is to work under the Client's direction to help establish a route which will best meet the Client's objectives within the constraints that are set. In liaison with the Client, the project manager will discuss the available options and initiate feasibility studies to determine the one to be adopted. In order that the feasibility studies are effective, the information used should be as full and accurate as possible.

Much of that information will need to be provided by specialists and experts. Some of these experts may be available within the Client's own organisation or be regularly retained by the Client – lawyers, financial advisers, insurance consultants and the like. Others, such as architects, engineers, planning supervisors, town planning consultants, land surveyors and geotechnical engineers may need to be specially commissioned.

Feasibility study reports should include:

- Scope of investigation (from outline project brief) including establishing service objectives and financial objectives
- Studies on requirements and risks
- Public consultation (if applicable)
- Geo-technical studies (if applicable)
- Environmental Impact Assessment
- Sustainability Appraisal
- Health and Safety Study

- Legal/Statutory/Planning requirements or constraints
- Estimates of capital and operating costs (demolition costs, if applicable)
- Assessment of potential funding
- Potential site assessments (if applicable)

The Client will commission feasibility studies and establish that the project is both **deliverable and financially viable**. The Client **should have already instructed** the Project Manager at this stage and if so, his input will be made alongside the reports and views of the various consultants.

The Client may ask the Project Manager to engage and brief the various specialists for the feasibility studies, co-ordinate the information, assess the various options and report his conclusions and recommendations to the Client. The feasibility report should include a '**risk assessment**' for each option and will usually also determine the contractual procurement route to be adopted and a draft master programme applicable to each. The Client may also require comparative 'life cycle costings' to be included for each option.

It is at this stage that the end value or outputs of the Development must be assessed. Accurate and well informed assessments of revenue streams and prospective capital values must be made with the expert help of specialist consultants and valuers. If the proposed project does not pass these tests, then changes will have to be made. At this point the Project Manager plays a crucial and pivotal role in advising the non-cognate Client that proper attention should be paid to Specialist Advice provided on the value side of the cost/value equation. Where organisations have their own "in-house" assessment team, it is assumed that they can take their own decisions on the financial feasibility of a project.

During the progress of the feasibility studies the project manager will convene and minute meetings of the feasibility team, report progress to the client and advise the client if the agreed budget is likely to be exceeded. Feasibility studies are the most crucial, but also the least certain, phase of a project. Time and money expended at this stage will be repaid in the overall success of the project. The specialists engaged for the feasibility studies are most commonly reimbursed on a time-charge basis and without commitment to engage the specialist beyond the completion of the feasibility study, although often some or all members of the feasibility team will be invited to participate in the selection process to become design team members.

The project manager will obtain from the Client a decision on which option to adopt for the project and this option is designated the outline project brief. The process of developing the project brief from the Client's objectives is shown in Figure 3.2.

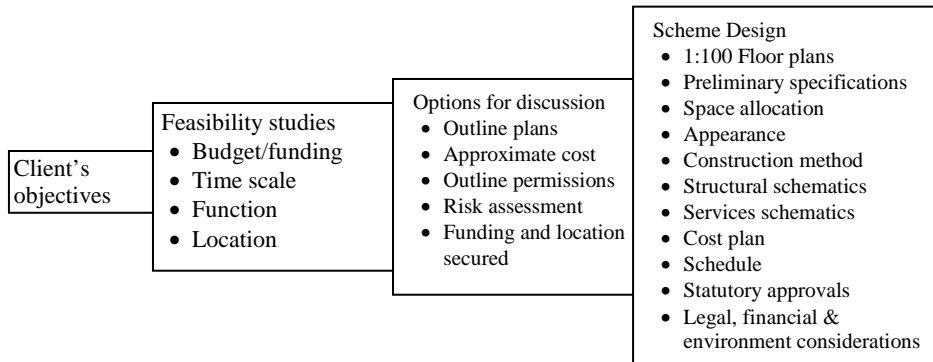


Fig. 3.2 Development of project brief from objectives

3.3 SITE SELECTION AND ACQUISITION (see also Manual M5)

Site selection and acquisition is an important stage in the project cycle in the situation where the Client does not own the site to be developed. It should be effected as early as possible and, ideally, in parallel with the feasibility study. The work is carried out by a specialist consultant and monitored by the project manager.

The objectives are to ensure that the requirements for the site are defined in terms of the facility to be constructed, that the selected site meets these requirements and that it is acquired within the constraints of the project programme and with minimal risk to the Client.

To achieve these objectives the following tasks need to be carried out:

- Preparing a statement of objectives/requirements for the site and facility/buildings and agreeing this with the Client.
- Preparing a specification for site selection and criteria for evaluating sites based on the objectives/requirements.
- Establishing the outline funding arrangements.
- Determining responsibilities within the Project Team (Client/project manager/commercial property agent).
- Appointing/briefing members of the team and developing a schedule for site selection and acquisition; monitoring and controlling progress against the schedule.
- Actioning site searches and collecting data on sites, including local planning requirements, for evaluation against established criteria.
- Evaluating sites against criteria and producing a short list of three or four; agreeing weightings with the Client.
- Establishing initial outline designs and developing costs.
- Discussing short-listed sites with relevant planning authorities.
- Obtaining advice on approximate open-market value of short-listed sites.
- Selecting the site from a short list.
- Appointing agents for price negotiation and separate agents for independent valuation.
- Appointing lawyers as appropriate.
- Determining specific financial arrangements.
- Exchanging contracts for site acquisition once terms are agreed, conditional upon relevant matters, e.g. ground investigation, planning consent.

3.4 DETAILED PROJECT BRIEF

The formulation of the detailed brief for the project is an interactive process involving most members of the design team and appropriate representatives of the Client organisation. It is for the project manager to manage the process, resolving conflicts, obtaining Client's decisions, recording the brief and obtaining the Client's approval.

Table 3.1 Suggested contents for detailed project brief:

Background
<ul style="list-style-type: none"> • Project definition; explain what the project needs to achieve e.g. <ul style="list-style-type: none"> ○ Project objectives ○ Project scope ○ Outline project deliverables ○ Exclusions ○ Constraints ○ Interfaces
<ul style="list-style-type: none"> • Outline business case <ul style="list-style-type: none"> ○ Describe how this project supports the business strategy ○ The reason for selection of this solution
<ul style="list-style-type: none"> • Customers quality expectation
<ul style="list-style-type: none"> • Acceptance criteria
<ul style="list-style-type: none"> • Risk assessment

If earlier work has been done, the Project Brief may refer to the document(s) containing useful information, such as the Outline Project brief, rather than include copies of them.

It is not unusual during this phase for the Client to modify his thinking on various aspects of the proposals, and there is certainly the opportunity and scope for change during this phase. Figure 3.4 demonstrates graphically the relationship between 'scope for change' and the 'cost of change' set against the time-scale of a development. It will be seen that the crossover point occurs at the completion of the strategy stage. The Client's attention should always be drawn to this relationship and to the benefits of brief and design freezes.

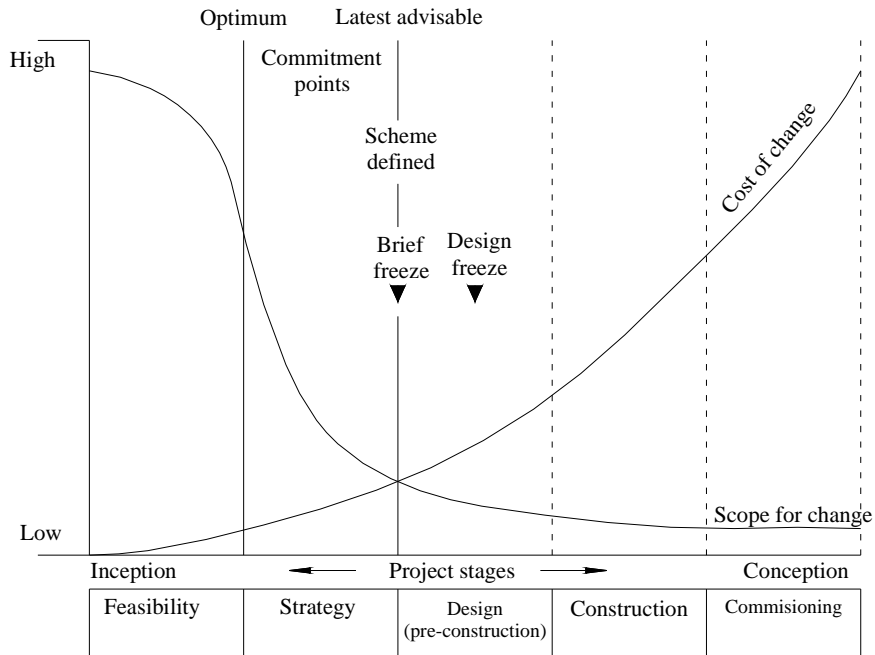


Fig. 3.3 Relationship between scope for change and cost of change

The key emphasis for the client should be to understand and establish enough information about the end requirements and objectives for developing the project. This point cannot be overemphasised. It is essential for the project manager to identify the Client's needs and objectives through careful and tactful examination, in order to minimise potential future changes to the project brief. Many clients who are unfamiliar with the development process are not perhaps fully aware of the benefit of getting the design right as far as possible at the start of the project, and therefore the importance of making sure the brief fully reflects the client's requirements, before materials are ordered and construction commences. The project manager should do his utmost, therefore, to familiarise the Client with the potential cost and time implications of design changes and identify as clearly as possible the precise requirements of the Client.

3.5 DETAILED DESIGN BRIEF

Within the detailed project brief, the assembly of the detailed design brief will normally be the responsibility of the lead design consultant along with the project manager and, where appropriate, the Client.

The project manager will monitor the assembly of the detailed design brief to ensure compliance with the outline project brief, the project budget and the master programme.

Depending upon the procurement method adopted and the master schedule, the assembly of the detailed design brief may occur in parallel with other activities, such as the development of the final scheme design and site preparation. A decision on some elements of the detailed design brief may be deferred by the Client even until after construction has commenced. This is risky and should be allowed only when time is of over-riding concern to the client. It means that the design of the first elements to be constructed have to be over-designed to allow for any possible subsequent client requirements. It is much better and usually possible (except in extreme emergencies) to complete the brief and the design before construction begins. It just needs good project management.

The project manager will advise the Client of the implications for cost, time and risk in the deferment of any elements of the detailed design brief.

The project manager will monitor the progress of the assembly of the detailed design brief and notify the Client of the effects on cost, time, quality, function and financial viability of any changes from the outline design brief. The detailed design brief, or such part of it that has not been deferred, having been tested against these criteria, should be presented to the Client as a formal document for his approval. The lead design consultant and the project manager should normally make the presentation jointly.

3.6 SCHEME DESIGN

Once approved by the Client, the detailed design brief becomes the control document for the design and will be issued by the project manager to all

members of the design team. The project manager, with the approval of the Client, will instruct the design team to complete the scheme design.

In order to make informed decisions on deliverability of a project and also its financial viability, it will be necessary to instruct the architect (the cost consultant and other experts as appropriate) to prepare site layouts, floor plans, elevations and other drawings in sufficient detail for the cost consultant to prepare preliminary cost plans.

The project manager will monitor the completion of the scheme design, arrange for cost checks bench marking against the cost plan and obtain confirmation that the design meets the detailed design brief and all external constraints.

3.7 FUNDING AND INVESTMENT APPRAISAL (see also Manual M6)

In all development projects, a balance between cost and value must be established. The Financial Appraisal of the project can either be assessed by calculating the total cost and then assessing the value or alternatively, calculating the value of the end product and working out the project costs with an eye to value. In either case, the Client will expect value to exceed cost and in the case of Developer led projects, the Client will at inception stage, have decided upon the level of profit he will require for the amount of risk involved. A thorough risk analysis, particularly analysing the market conditions on the potential revenue generation, interest rate changes, potential impact of programme delay and outcomes of similar historical precedents (which may be incorporated within the business plan or development appraisal for the project) is usually performed to assist in decision making. Developers and many Clients experienced in construction procurement may not require specific help from the project manager in these areas but should keep him well informed of the financial arrangements so that they can be taken into account in any project decisions. On the other hand, Clients unfamiliar with construction may require an input by the project manager or from an independent construction advisor. In any case, although the project manager may have knowledge of project finance, it is unlikely that he will be expected to advise in this area. Specialist advisors

or the Client himself will arrange bank finance; take tax and legal advice in all those areas relating to the acquisition of the site and the financing of the development project. The project manager should be able to advise on certain matters relating to VAT, budgetary systems, cost and cash flow. The project manager should also know when and where to go for specialist advice to augment his own expertise or his Client's expertise in such matters.

3.8 PROJECT/MARKET SUITABILITY

The key to a successful project is to try to bring together all the various elements into a workable and viable whole. In building for the commercial occupational market, good market awareness and the ability to judge not only occupiers' requirements but also trends in the investment market are absolutely vital and a key issue at this stage is to ensure site selection, appropriate to those demands.

This test should apply whether the project is a shopping centre, office block, hospital, library, stadium or business and industrial park. In buildings for overtly commercial use, relatively simple tests can be made to assess the project's suitability for the target market and thence the project's overall viability. In other cases such as buildings for public or leisure uses, different and more complex tests must be applied to ensure that the revenues and outputs offer a satisfactory return on costs. Independent advice on these revenue/value issues is important and the Client should look to the Project Manager to point him in the right direction. This will enable a valid Assessment of the Risk Analysis.

Project suitability also encompasses impact analysis on a company's financial performance, whether it impacts the Balance Sheet, Profit and Loss account or cash-flow, and an informed assessment of these matters needs to be carried out by the in-house team with proper support from the Project Manager.

At this stage, the Project Manager will also be ensuring that the Brief ties in with the business assumption of the Client and where it does not, to point the Client in the right direction.

3.9 DECISION TO GO AHEAD

The client, reviewing the documents generated throughout this phase, has to reaffirm the decision to proceed with the project, in order to:

- Provide the authorisation of financial management and control throughout the project.
- Ensure that no commitment is made to large expenditure on the project before verifying that it has been authorised as required.

At the early stages of a project it is unlikely that the actual costs will be known. It is important to check that the need for financial provision has been recognised by all the parties. The actual project cost, which perhaps will almost certainly be higher than the original estimate, requires the question of affordability to be revisited at that stage to be sure that adequate funds will be available.

3.10 PROJECT EXECUTION PLAN (PEP)

The PEP is the core document for the management of a project. It is a statement of policies and procedures defined by the project sponsor, although usually developed by the project manager for the project sponsor's approval. It sets out in a structured format the project scope, objectives and relative priorities.

This is a live document that enforces discipline and planning having a wider circulation than the project design team. It forms a basis for:

- Sign off by the client body at the end of the feasibility and strategy phases;
- A prospectus for funding
- An information and “catch up” document for prospective contractors.

Some of the confidential information in the client version will be taken out of the published version to other parties.

3.11 CHECKLIST FOR THE PEP

Does the PEP:

- include plans, procedures and control processes for project implementation and for monitoring and reporting progress?
- define the role and responsibilities of all project participants, and is it a means of ensuring that everyone understands, accepts and carries out their responsibilities?
- set out the mechanisms for audit, review and feedback, by defining the reporting and meetings requirements, and, where appropriate, the criteria for independent external review?

3.12 ESSENTIAL CONTENTS

Much of PEP will be standardised, but the standard will need to be modified to meet the particular circumstances of each project. A typical PEP might cover the items listed below, although some may appear under a number of headings with a cross reference system employed to avoid duplication:

- Project definition and brief;
- Statement of objective;
- The Business Plan with costs, revenues and cash flow projections including borrowings interest and tax calculations;
- Market predictions and assumptions in respect of revenue and returns;
- Functional and aesthetic brief;
- Client management and limits of authority including the project manager;
- Financial procedures and delegated authority to place orders;
- Development strategy and procurement route;
- Risk assessment;
- Schedule and phasing;
- The scope content of each consultant appointment;
- Reconciled scheme design and budget;
- Detailed design

- Package design and tendering
- Construction
- Commissioning and handover
- Operation
- Safety and environmental issues, such as the construction design and management regulations;
- Quality assurance; and
- Post project evaluation.

The PEP will change as a project progresses through its design and construction stages. It should be a dynamic document regularly updated and referred to as a communication tool, as well as a control reference.

CHAPTER 4

STRATEGY STAGE

CLIENT'S OBJECTIVES

The main aims for the client at this stage include setting up the project organisation, establishing the procurement strategy and commissioning/occupation issues through identifying project targets, assessing and managing risks and establishing the project plan.

INTERLINKING WITH FEASIBILITY

Distinction between the tasks and activities of the feasibility and strategy stages is not always clear, as each is influenced to a certain extent by the considerations and findings of the other. The two tasks and activities need to relate to each other in order to achieve effective outcomes for both. Feedback is essential in order to establish for the Client a sound basis for decision making at the conceptual phases of the project and, subsequently, for its effective execution. The order in which the activities are set out here is not significant and will vary for specific projects.

4.1 PROJECT TEAM STRUCTURE (see also Manual M2)

Projects are usually carried out by a Project Team under the overall direction and supervision of a project manager. The Team normally comprises:

- Client's internal team (appropriate representatives)
- Project Manager (either within the Client's own organisation or independently appointed)

- Design team: architects, structural/civil/mechanical and electrical (M&E) engineers and technology specialists
- Consultants covering quantity surveying, development surveying, planning, legal issues, valuation, finance/leasing, insurances, design audit, health & safety and environmental protection, access issues, facilities management, highways/traffic planning, construction management and other specialisms
- Contractors and subcontractors

The Project Team structure for project management is shown in Figure 4.1. This structure is idealised and in practice there will be many variants, depending on the nature of the project, the contractual arrangements, type of project management (external or in-house) involved, and above all, the Client's requirements. It should be one of the duties of the Project Manager to advise the client on the most appropriate Project Team structure for a particular project.

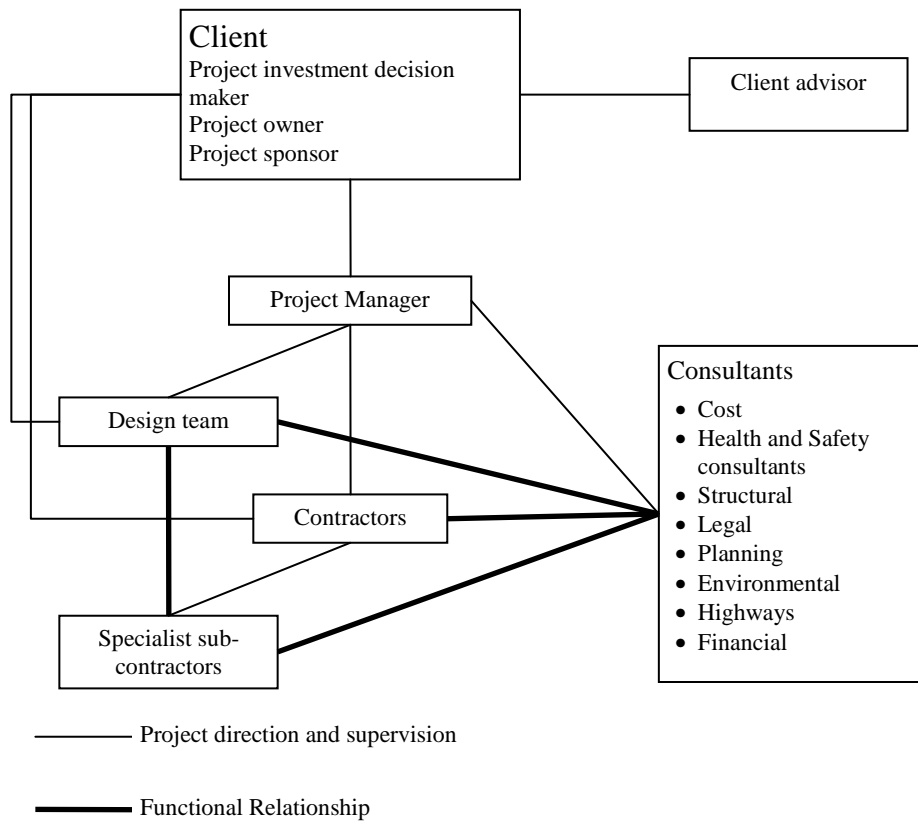


Fig. 4.1 Project Team structure

Effective project management must, at all times, fully embrace all provisions for quality assurance, financial control, health and safety, access provision and environmental protection. These aspects are always to be considered as incorporated and implied in all relevant project activities.

4.2 SELECTING THE PROJECT TEAM (see also Manual M2)

When establishing a Project Team, many skills will be needed. During selection the project manager should consider the following factors:

- A commitment by the Project Team to clearly defined and measurable project objectives.
- Firm duties of teamwork, with shared financial motivation to pursue those objectives. These should involve a general presumption to achieve 'win-win' solutions to problems which may arise during the course of the project (further guidance towards a co-operative mutually beneficial team working arrangement is available in various industry and governmental regulatory bodies).
- The production of satisfactory evidence from each team member, to show that they can contribute effectively to the project objectives. This evidence may include a realistic schedule, a financial plan and a demonstration of adequate resources,
- When choosing each team member, as suggested in Chapter 2, special attention is to be paid to their:
 - relevant experience
 - technical qualifications
 - appreciation of project objectives
 - level of available supporting resources
 - creative/innovative ability
 - enthusiasm and commitment
 - positive team attitude
 - communication skills
- Financial strength and core resource strength can also be important. In choosing contractors it is wise to avoid placing orders with companies if the order is greater than 20% of annual turnover.
- Defining clear lines of communication between the respective Project Team members.
- Promoting a working environment which encourages an interchange of ideas by rewarding initiatives which ultimately benefit the project.
- Undertaking regular performance appraisals for all Project Team members.
- Ensuring that Project Team members are suitably located and that communication protocols have been established (particularly for

electronic sharing of information) so as to facilitate regular contact with each other, as well as with their own organisations.

- Defining clear areas of responsibility and lines of authority for each Project Team member, and communicating these within the team.
- Identifying a suitable deputy for each team member, who will be sufficiently familiar with the project to be able to act as their replacement should the need arise.
- Making provision for members of the Project Team to meet informally and socially, outside the work environment, on a regular basis, in team building activities.

4.3 STRATEGY OUTLINE AND DEVELOPMENT

The project manager performs several principal activities at this stage which may include all, or most of the following:.

- Reviewing, and in some cases developing, the detail project brief with the Client and any existing members of the Project Team to ascertain that the Client's objectives will be met. Preparing a final version in written form with supplementary appendices where these add to the general understanding of the issues that support the brief itself.
- Establishing, in consultation with the Client and other consultants, a project management structure (organisation) and the participants' roles and responsibilities, including access to Client and related communication routes, and 'decision required' points (see Part Two for details). This should be developed and presented in the Project documents for the reference of all parties.
- Ensuring, in liaison with the Client, the planning supervisor, design consultants and the principal contractor when appointed, that appropriate arrangements have been made to meet the requirements of the Health and Safety Regulations in force in the EU Member Country at the time.
- Establishing that 'value management' is applied effectively from the earliest stages of the preparation of the design brief until the design is

complete. The emphasis should be on providing value for money and in producing a building/facility that can be constructed and operated at the lowest cost without reducing quality, scope or specification. The design team and consultants should be encouraged not to accept conventional wisdom on what buildings/facilities cost, but consciously seek to reduce cost by better design and construction methods. An approach where the whole team 'designs in quality and drives out cost' at all stages in the design process should be encouraged –emphasis on overall value should be encouraged. Further guidance on Value Management is included Chapter 6.

- Advising the Client on the recruitment and appointment of additional consultants and design team members, i.e.
 - preparation of appropriate definition of roles and responsibilities
 - preparation and issue of selection/tender documentation
 - evaluation, reporting and making recommendations
 - assisting the Client in the preparation of agreements and in selection and appointment
- Drawing the Client's attention to the benefits of project insurance for the whole project and works and providing assistance to him in assessing the risks on the project and including an appropriate contingency sum in the project budget. Putting in place procedures for managing risk as a continuous project activity. A project risk assessment checklist may be used or adapted as part of such a procedure. (These risks are not to be confused with risks covered by Health and Safety Regulations although they will form a subset of an overall risk management regime.)
- Selection , or development, and agreement of the most appropriate form of contract relative to the project objectives and the parameters of cost, time, quality, function and financial viability.
- Assisting the Client in completing site selection/evaluation, investigation and acquisition.
- Advising on whether certain activities, such as fitting out and occupation/migration, constitute separate projects and should be treated as such.
- Making the Client aware of relevant Statutory submissions and other consultations that may be required in the delivery of the project.

4.4 PROJECT ORGANISATION AND CONTROL

A project management organisation structure sets out unambiguously and in detail how the parties to the project are to perform their functions in relation to each other in contributing to the overall scheme. This should be recorded in the Project Handbook. It also identifies arrangements and procedures for monitoring and controlling the relevant administrative details. It is updated as circumstances dictate during the lifetime of the project, and should allow project objectives and success criteria to be communicated and agreed by all concerned and help promote effective teamwork.

Procedures covering the relationships and arrangements for monitoring, control and administration of the project should be developed, with the assistance of parties involved, for all stages of the project and cover time, costs, quality and reporting/decision-making arrangements.

The organisation structure should clearly identify the involvement and obligations of the Client and his organisational backup.

4.5 INFORMATION TECHNOLOGY

It is usual for extensive use to be made of computer applications as tools to assist most project management functions. It is essential for project managers to keep abreast of developments in this area in order to select and recommend appropriate packages and communication protocols for use on a project. It is particularly important to make sure that systems used by Project Team members are compatible to facilitate electronic exchange of data. E-mail, project specific web-sites, integrated project data applications and teleconferencing are examples of tools which may be required and the project manager will need to be able to define the ways in which these tools are used and how the transfer of information is managed and monitored.

4.6 PROJECT PLANNING (See also Manual M7)

The project master schedule should be developed and agreed with the Client and the consultants concerned, and detailed programmes for each stage of the project should be prepared as soon as the necessary parameters are established.

While preparing the master schedule necessary allowances should be incorporated to provide for potential delays (including possible impact on initial revenue generation) in activities such as applying and obtaining statutory approvals, external consultations and enquiries, legal and funding negotiations and any other third party agreements.

It is the project manager's responsibility to monitor the progress of the project against the master and stage schedule, identify risks to progress and to initiate necessary action to rectify potential or actual non-compliance.

4.7 COST PLANNING (See also Manual M6)

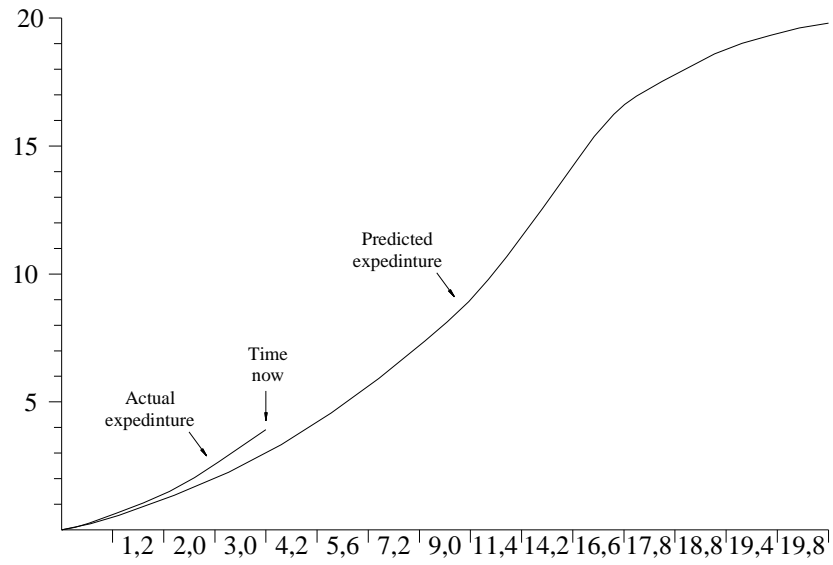
A development budget study is undertaken to determine the total costs and returns expected from the project. A cost plan is prepared to include all construction costs, all other items of project cost including professional fees and contingency. All costs included in the cost plan will also be included in the development budget in addition to the developer's returns and other extraneous items such as project insurance, surveys and his agent's or other specialist advisers' fees.

The objective of the cost plan is to allocate the budget to the main elements of the project to provide a basis for cost control. The terms *budget* and *cost plan* are often regarded as synonymous. However, the difference is that the *budget* is the limit of expenditure defined for the project, whereas the *cost plan* is the definition of what the money will be spent on and when. The cost plan should, therefore, include the best possible estimate of the cash flow for the project and should also set targets for the future running costs of the facility. The cost plan

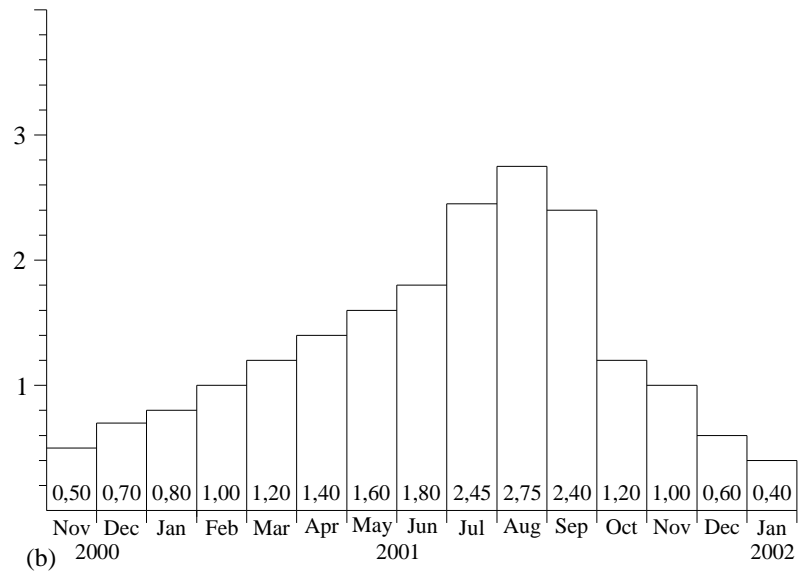
should cover all stages of the project and will be the essential reference against which the project costs are managed.

The method used to determine the budget will vary at different stages of the project, although the degree of certainty should increase as more project elements become better defined. The budget should be based on the client's business case and should change only if the business case changes. The aim of cost control is to produce the best possible building within the budget

The cost plan provides the basis for a cash flow plan, based upon the master schedule, allocating expenditure and income to each period of the Client's financial year. The expenditures should be given at a stated base-date level and at out-turn levels based upon a stated forecast of inflation. A cash flow histogram and cumulative expenditure graph are shown in Figure 4.4.



(a)



(b)

Fig. 4.2 Examples of: (a) construction expenditure graph; (b) cash flow histogram

Operational cost targets should be established for the various categories of running costs associated with the facility. This should accompany the capital cost plan and be included in the brief to consultants. Revenue, grants and tax planning for capital allowances must also be taken into consideration.

When the cost plan is in place it serves as the reference point for the monitoring and control of costs throughout a project. The list which follows should be used as an aid in setting up detailed cost control procedures for all stages of a project.

4.8 COST CONTROL (See also Manual M6)

The objective of cost control is to manage the delivery of the project within the approved budget. Regular cost reporting will facilitate, at all times, the best possible estimate of:

- established project cost to date
- anticipated final cost of the project
- future cash flow

In addition cost reporting may include assessments of:

- ongoing risks to costs
- costs in the use of the completed facility
- potential savings

Monitoring of expenditure to any particular date does not exert any control over future expenditure and, therefore, the final cost of the project. Effective cost control is effectively achieved when the whole of the Project Team has the correct attitude to cost control, i.e. one which will enable fulfilment of the Client's objectives.

Effective cost control will require the following actions to be taken:

- Establishing that all decisions taken during design and construction are based on a forecast of the cost implications of the alternatives being considered, and that no decisions are taken whose cost implications would cause the total budget to be exceeded.

- Encouraging the Project Team to design within the cost plan, at all stages, and adopt the variation/change and design development control procedures for the project. It is generally acknowledged that 80% of cost is determined by design and 20% by construction. It is important that the Project Team is aware that no member of the team has the authority to increase costs on its section or element of the work. Increased costs on one item must always be balanced by savings on another.
- Regularly updating and reissuing the cost plan and variation orders causing any alterations to the brief.
- Adjusting the cash flow plan resulting from alterations in the target cost, the master schedule or the forecast of inflation.
- Developing the cost plan in liaison with the Project Team as design and construction progress. At all times it should comprise the best possible estimate of the final cost of the project and of the future cash flow. Adherence to design freezes will aid cost control. (Development also means adding detail as more information about the work is assembled, replacing cost forecasts with more accurate ones or actual costs whenever better information can be obtained.)
- As part of risk management reviewing contingency and risk allowances at intervals and reporting the assessments is essential. Development of the cost plan should not involve increasing the total cost.
- Checking that the agreed change management process is strictly followed at all stages of the project is very important. The procedure should only be carried out retrospectively handed then only during the construction phase of the project, when it can be demonstrated that otherwise significant delay, cost or danger would have been incurred by awaiting responses.
- Arranging that the contractor is given the correct information at the correct time in order to minimise claims. Any anticipated or expected claims should be reported to the Client and included in the regular cost reports.
- Contingency money based on a thorough evaluation of the risks is available to pay for events which are unforeseen and unforeseeable. It should not be used to cover changes in the specification or in the Client's requirements or for variations resulting from errors or omissions. Should the consultants consider that there is no alternative but to exceed the budget, a written request to the Client must be submitted and correct authorisation received. This must include the following:

- details of variations leading to the request
- confirmation that the variations are essential
- confirmation that compensating savings are not possible without having an unacceptable effect on the quality or function of the completed project
- Submitting regular, up-to-date and accurate cost reports to keep the Client well informed of the current budgetary and cost situation.
- Establishing that all parties are clear about the meaning of each entry in the cost report. No data should be incorrectly entered into the budget report or any incorrect deductions made from it.
- Ensuring that the project costs are always reported back against the original approved budget. Any subsequent variations to the budget must be clearly indicated in the cost reports.
- Plotting actual expenditure against predicted to give an indication of the project's progress

4.9 PROCUREMENT (See also Manual M3)

In the context of this code of practice, procurement should be considered to be the process of identification, selection and commissioning of the contributions required for the construction phase of the project. The alternative methods of procurement referred to reflect the different organisational and contractual arrangements which can be made to ensure that the appropriate contributions are properly commissioned and that the interests of the client are safeguarded.

The various procurement options available reflect fundamental differences in the allocation of risk and responsibility to match the characteristics of different projects; therefore selection of the procurement option must be given strategic consideration. The project manager should advise on the relative benefits and disadvantages of each option, related to the particular circumstances of the project, for the benefit of the client.

The final choice of procurement method should be made on the basis of the characteristics of the project, the Client and his requirements. The selection of method should be made when consideration is being given to the appointment

of design and other specialist consultants because each option can have a different impact on the terms of appointment of the members of the Project Team.

The various procurement methods which may be pursued can be broadly classified under four headings:

- traditional
- design and build
- management contracting
- construction management

Each method has its own variations. No method is best in all circumstances. They bring different degrees of certainty and risk towards the project construction and development.

4.10 TRADITIONAL

The contractor builds to a defined scope of work for a fixed price lump sum regardless of his costs. The client, however, remains responsible for the design and the performance of his consultants under the building contract. The Client appoints a design team, including a Cost Consultant responsible for financial and contractual advice. A building contractor is appointed, usually after a tender process, and usually based on one of the standard forms of contract, to carry out the construction. The tender process can be based on complete design information or partial design information plus provisional guidance if an early construction start is required.

4.11 DESIGN AND BUILD

The Client appoints a building contractor, usually on a standard form of contract to provide the completed building to agreed cost and programme. The contractor is responsible for design and construction as defined in formal documentation known as the Client's Requirements. The appointment may be made after a tendering process incorporating variations on the method, or through negotiation. The Client may appoint a consultant to oversee matters on his behalf. This arrangement transfers maximum risk to the contractor and generally has a good reputation for controlling programme and the Client's cost. The design, however, will be the most commercial response that a contractor can produce to satisfy the contract conditions.

The Design and Build Contractor may be appointed when part of the design has been completed, and in these circumstances, the appointments of the Design Team may be formally passed on (contractually novated) to the D&B contractor. However, research has shown that this practice usually leads to potential conflict and poor quality and thus is not advisable.

4.12 PRIME CONTRACTING

PRIME CONTRACTING - is an extension of the Design and Build concept. The Prime Contractor will be expected to have a well-established relationship with a supply chain of reliable suppliers. The Prime Contractor coordinates and project manages throughout the design and construction period to provide a facility, which is fit for the specified purpose, and meets its predicted through-life costs. The prime contractor is paid all actual costs plus profit incurred in respect of measured work and design fees; it is only at risk in respect of its staff and preliminaries.

4.13 MANAGEMENT CONTRACTING

The Client appoints a design team with responsibilities as in the traditional method and augmented by a management contractor whose expertise and advice is available throughout the design development and procurement processes. Specialist works subcontractors, who are contracted to the management contractor on terms approved by the contract administrator who may be the Architect, the Cost Consultant or the project manager, carry out the construction. The appointments of the management contractor and the trade subcontractors are usually made on standard contract forms. The management contractor is reimbursed all his costs and paid a percentage on project costs in the form of a guaranteed profit or fee.

4.14 CONSTRUCTION MANAGEMENT

Construction management requires that the specialist works contractors are contracted to the Client directly, involving the construction manager as a member of the project team acting as an agent and not a principal, to concentrate on the organisation and management of the construction operations. The project team, including the construction manager, are responsible for all financial administration associated with the works. The construction manager is paid an agreed fee to cover the costs of its staff and overheads. This is generally considered to be the least adversarial form of contract and is often invoked when design needs to run in parallel with construction.

RELEVANT ISSUES

Variations from the formats described above can be a potential source of confusion and compromise the intended philosophies. Before a contractual or organisational variation is introduced the choice of procurement option should be made against the most important criteria. Only then should essential variations be introduced and these must be dealt with by specific contractual arrangements and documentation within the framework of the overall procurement method adopted.

It is important to recognise that the actual process by which construction projects are implemented remains identical whichever procurement route is followed. This process involves four stages:

- Development of a detailed definition of the requirements for the producer (the detail project brief).
- Preparation of designs, working drawings and specifications identifying every component and detailing the construction method.
- Procurement of every component required for the product, and the specialised skills necessary for its construction.
- Management of the activities of the many participants and contributors involved in the project.

Construction components comprise those prefabricated or manufactured wholly or partially off-site, as well as those which are constructed on-site. There is an ongoing trend towards more use of components manufactured off-site, and towards the use of more proprietary components, which means that significant elements of design are carried out by the suppliers of the components, rather than by the design team directly responsible to the Client. The implications of this on the design and the build responsibilities of the project as a whole must be carefully thought through and incorporated in the project handbook.

Table 4.1

Characteristics of alternative procurement options

Characteristic	Traditional	Design & Build	Management Contracting	Construction Management
Diversity of responsibility	Moderate	Limited	Large	Large
Size of market	Moderate	Limited	Moderate	Large
Timing of cost certainty	Moderate			
Need for early precise definition of client requirements	No	Yes	No	No
Availability of independent assistance in developing design brief	Yes	No	Yes	Yes
Speed of mobilization	Slow	Fast	Fast	Fast
Flexibility in implementing changes	Reasonable	Limited	Reasonable	Good
Availability of recognized standard documentation	Yes	Yes	Yes	Limited

Ability to develop proposals progressively	Reasonable	Limited	Reasonable	Good
Cost monitoring provision	Good	Poor	Reasonable	Good
Construction expertise input to design	Moderate	Good	Good	Good
Management of design production programme	Poor	Good	Good	Good
Influence in selection of trade contractors	Limited	None	Good	Good
Provision for monitoring quality of workmanship/materials	Moderate	Moderate	Moderate	Good
Opportunity for contractor to exploit cash flow	Yes	Yes	Yes	No
Financial incentive for contractor to manage effectively	Strong	Strong	Weak	Minimal
Propensity for confrontation	High	Moderate	Moderate	Minimal

Table 4.1 provides a comparison of the features of the four basic procurement options available.

4.15 APPOINTMENT OF PROJECT TEAM (See also Manual M2)

The project manager in consultation with the Client will decide on and implement a selection procedure for the members of the Project Team and may then appoint the Project Team on behalf of the Client. Alternative methods of procurement will affect the selection procedure.

There are two main arrangements for a Project Team appointment:

- Separate appointment of independent service providers
- Single appointment of a team of service providers or a lead organisation for the provision of all services.

It is important that the members of the Project Team should be as compatible as possible both in temperament and in working methods, if the project is to have the greatest likelihood of success.

The Project Team may be selected and appointed through a process of short-listing and structured interviews or through a competitive tendering procedure. This may be through EU procurement procedures, which may be mandatory for publicly funded projects (dependent on size of project). The project manager needs to be fully informed on all issues related to the procurement process and advise the client accordingly.

The Client should be consulted on the formulation of short-lists and should be invited to attend any interviews.

The project manager should formulate the short lists, convene and chair the interviews, record and assess the results and present a report and recommendation to the Client for final decision.

Most professional firms are members of organisations that publish standard terms of appointment and codes of conduct. It is usual to appoint the Project Team members on the standard terms which are designed to provide a proper balance of risk and responsibility between the parties. Standard terms are capable of amendment by agreement but the project manager should advise against terms which impose uninsurable risks or unquantifiable costs on the consultants or are in conflict with their professional responsibilities or codes of conduct.

The project manager will issue to the appointed Project Team the project handbook, the outline project brief and the master schedule together with the budget or cost plan. It is advisable that these elements are referred to in as much detail as is available at the time of the Project Team's appointment.

4.16 PARTNERING (See also Manual 3)

Partnering was identified as a set of actions by project teams by which conflict could be minimised. The intention is to provide a 'win-win' situation for the partners. It is put into practice by having regular partnering workshops where all the key members of the project team work to establish and foster cooperative ways of working aimed at improving performance. In broad terms partnering teams agree mutual objectives that take account of the interests of all the parties; establish cooperative methods of decision making including procedures for resolving problems quickly; and identify actions to achieve specific improvements to normal performance. The workshops take place throughout the project initially under the guidance of an independent partnering facilitator.

It has already been shown that partnering can bring benefits in the form of reduced costs, improved quality and shortened timetables. It should be considered particularly for clients with rolling programmes or phased projects but it can provide benefits for every project. Ideally, partnering includes the supply chains that produce key elements

4.17 PFI AND PPP SCHEMES OF PROJECT PROCUREMENT (See also Manuals M6)

The current propensity to engage in procurement contracts organized on Private Finance Initiative (PFI) principles or Public Private Partnerships (PPP) delivers to governments the ability to satisfy public demands for expensive services without recourse to the use of sensitive public funds. Current initiatives see the 'bundling' of small projects into larger projects, or the counter initiative of 'unbundling' to create smaller projects, which companies other than the existing experienced PFI operators can compete for. This has the effect of increasing the competitive pool for future projects. Value for money is a prime consideration with this procurement vehicle as is the need to better manage risk and obtain

greater certainty that public sector services will be delivered to the specified standard. It is generally accepted that the risks are borne by the party that can best manage them.

CHAPTER 5

PRE-CONSTRUCTION STAGE

CLIENT'S OBJECTIVES

At this stage the Client expects to finalise the project brief for the project team, identify and agree the solution that gives optimum value, and to ensure a detailed design which can be efficiently delivered with predictability of cost, time & quality.

INTERLINKING WITH PREVIOUS STAGES

After the client has made a commitment to the project, accepted the feasibility report and approved the scheme design, the process will then move into the next phase or stage which we call Pre-Construction.

However, it should be appreciated that many of the stages overlap and it is only to identify the full scope of activities involved in the development process and to enable some sort of chronology to be established, that we have separated the activities into stages.

'Pre-Construction' involves establishing the detailed design, the preparation of tender documents and the tendering process (including negotiated tendering). However, the precise sequence of activities will depend very much on the choice of procurement system, and the type and form of contract selected.

It is worth noting at this stage, that we are moving into an ever increasing legislative environment, with greater controls in the form of statutory requirements, national and European legislation and guidelines, minority stakeholder pressures, demand for greater sustainability and growing restrictions on disposal of unused material, to name but a few.

Therefore, by the start of this Pre-Construction stage, a significant number of key activities will have been addressed and action taken. These include the following:

- The client's project brief detailing his objectives for the project, will have been established and the associated scheme design fundamentally completed. However, whilst it would be expected that the detailed project brief would remain substantially unchanged for the remainder of the project, it is likely that unforeseen factors will have some effect upon the brief during the project period, although hopefully these will be minimal e.g.
 - A suitable site and the scope of any treatments required will have been identified and made available.
 - Environmental and energy audits will have been undertaken.
 - Risk register prepared incorporating data from risk analysis
 - Surveys to cover: geology, topography, hazardous materials (COMAH), landfill and re-cycling will have been carried out.
 - Obligatory reports concerning sustainability, disability discrimination, etc., will have been prepared and approved by the appropriate authorities.
 - Statutory requirements concerning the possible Housing Grants, and Health and Safety regulations will have been accommodated.
 - Statutory authorities, public bodies and utilities will have been approached for information regarding all mains services, highways and related infrastructure items, which are likely to influence site development.
 - A master project schedule will have been prepared.
 - A cost plan will have been prepared
 - A cost allowance will have been allocated to cover on-site development including pre main construction works, infrastructure, buildings, fitting-out and equipment.
 - Local planning authorities will have been contacted regarding the planning status of the site, which has been deemed acceptable for the intended purpose. 'Outline' planning consent will have been obtained.
 - The Project Team will have been appointed together with their associated consultants. This Team will include the Client, the project manager and, as soon as possible, representatives from the main contractor and associated key sub-contractors/work packages. These will all contribute to the strategic decision making process.
 - Project Execution Plan (PEP) drafted during the feasibility stage, may be enhanced during this stage. It is a live document

which governs the strategy, organisation, control procedures, respective responsibilities for the project and much more:

- client brief: functional and aesthetic; business plan
- constraints and risk assessment; revenue assumption/criteria
- funding cost controls: budget; drawdown procedures; reserves;
- schedule : deadlines, milestones;
- organisation and resources: responsibilities, delegated authority;
- project strategy and procurement details;
- roles, and responsibilities of project team members;
- occupation plan: commissioning; facilities management/maintenance strategy

The Project Handbook would have been prepared under the guidance of the project manager and submitted to the Client and any other interested party, for comment, discussion and agreement. Its review and update will be the responsibility of the project manager, unlike the 'Health and Safety File' which is the responsibility of the Health and Safety Supervisor. This Project Handbook differs from the Project Execution Plan, in that the 'Handbook' sets out the process and procedures for administration purposes, whereas the PEP covers detail as shown in Chapter 2 and in the preceding bullet points.

The Client will have authorised the project to proceed and should be aware that considerable costs will be incurred. Adequate cash flow provision must be provided for regular monthly expenditures. These will include professional services fees, e.g. for the project manager, architect, Cost Consultant, structural and ME engineers, together with planning fees and on-site investigations, demolition, site clearance and disposal, etc.

The Pre-Construction stage is about final preparation for the construction stage. The success of which will depend, to a great extent, on the amount of planning and preparation that has taken place during this and earlier stages.

5.1 DESIGN MANAGEMENT

The project manager will need to convene a meeting of the design team and any other consultants/advisers to review all aspects of the project to date. A dossier of relevant information should be circulated in advance. The object of the meeting will be to formulate a design management plan.

The plan should at least cover:

- who does what by when
- the size and format of drawing types
- schedules of drawings to be produced by each discipline/specialist
- relationships of interdependent CAD (computer-aided design) systems
- transfer of data by information technology
- estimates of staff hours to be spent by designers on each element or drawing
- monitoring of design resources expended compared to planned estimates
- schedules of information required/release dates
- initiating procedures for design changes
- incorporation within the design schedule of key dates for review of design performance to check:
 - compliance with brief
 - cost acceptance
 - value engineering analysis
 - health and safety issues
 - completeness for tender

The project manager, as a basis for monitoring and controlling the design process, will use the agreed design management plan. While the project manager may convene a meeting of the design team, responsibility for the co-ordination and integration of the work of other consultant and specialists lies with the design team leader. For certain elements of the project different lead consultants will be nominated. However these roles will always come under the direction of the design team leader for co-ordination.

SUGGESTED TASK LIST FOR DESIGN TEAM LEADER

- Establishing the overall design style, quality, etc.
- Establishing a grid/reference system for the base scheme

- Reviewing the design schedule
- Directing the design process
- Liaising with the Client about significant design issues
- Preparing sufficient production information for consultants and specialists to develop their proposals, co-coordinating these and integrating them into the overall scheme
- Advise on the need for and appointment of other consultant and specialists.
- Establish system for information transfer, check compatibility of system and software
- Co-ordinate the Briefing document
- Establish a system of design reviews and validation
- Agree basis for the cost plan to be developed and subsequent monitoring
- Advise the Client of his role and duties under the Health and Safety regulations

5.2 DUTIES OF PROJECT MANAGER AT THIS STAGE (See also Manual M2)

- Organise within the Client organisation appropriate groups of people, who will contribute to the detail of the brief and champion relevant aspects of the design prepared by the design team for signing off.
- Assist in the preparation or finalisation of the Detailed Project Brief
- Prepare the Design Management Plan
- Arrange the appointment of other consultants and specialists
- Organising the communication and information systems
- Produce co-coordinated design schedule and monitor progress
- Ensure that various technical specialists appointed by the Client such as IT, acoustics, catering, landscaping and artists are brought into the design process at the appropriate times.

5.3 PROJECT CO-ORDINATION AND PROGRESS MEETINGS

To aid control of the design process the project manager will arrange and convene project progress meetings at relevant intervals to review progress on all aspects of the project and initiate action by appropriate parties to ensure that the design management plan is adhered to. Distributing minutes of meetings to all concerned is an essential part of the follow-up action.

DESIGN TEAM MEETINGS

Design team meetings are convened, chaired and minuted by the design team leader. It is not essential for the project manager to attend all these meetings as a matter of course, although he normally has the right to do so. The project manager will receive minutes of all meetings and will report to the Client accordingly.

5.4 MANAGING CONSULTANTS' ACTIVITIES

The project manager has several responsibilities:

- Monitoring progress against the design management plan in association with the team. This is essential in view of their interrelationship. However, effective interrelationship cannot be finalised until the full team has been appointed and has had time to get to grips with the project and its complexities.
- Advising the design team leader of the requirement to agree the detail and integration of the Design Team activities and to submit an integrated design production schedule for co-ordination by the project manager.
- Incorporating, into the project schedule, dates for the submission of design reports and periods for their consideration and approval.

- Commissioning, as necessary, or arranging for the team to commission, specialist reports, e.g. relating to the site, legal opinions on easements and restrictions and similar matters.
- Ensure a competent consultant is appointed as Planning Supervisor as required by CDM regulations.
- Drawing to the attention of the Client and the designers their respective duties under the CDM Regulations and monitoring compliance.
- Arranging for the team to be provided with all the information they require from the Client in order to execute their duties. It is an important function of the project manager to co-ordinate the activities of the various (and sometimes numerous) participants in the total process. Planning supervisor, solicitors, accountants, tax advisers, development advisers, insurance brokers and others may all be involved in the pre-construction stage.
- Submitting, in conjunction with the Design Team leader, preliminary design proposals, reports and scheme design drawings to the Client for approval.

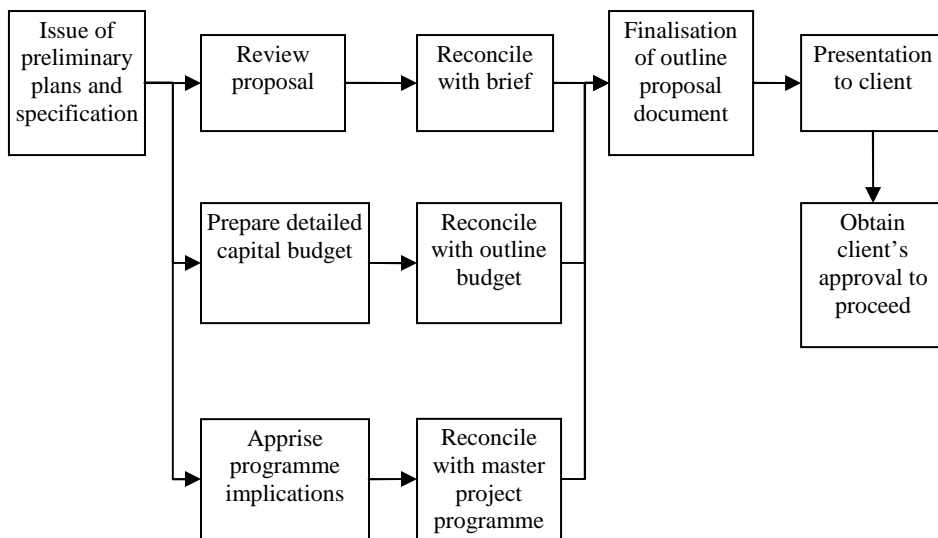


Fig. 5.1 Outline design proposals

- Conveying approvals to the team to proceed to subsequent stages of the project.

- Obtaining regular financial/cost reports and monitoring against budget/cost plans. Initiating remedial action within the agreed brief if the cost reports show that the budget is likely to be exceeded. Solutions to problems that cannot be resolved within the agreed brief, or likely substantial budget underspend, should be submitted to the Client with recommendations. The necessity to agree firm budgets at an early stage is most essential. It could, in certain cases, lead to the Client modifying the project brief.
- Preparing 'Schedule of Consents' with action dates submission documents, status etc, and monitor progress,
- Checking that professional indemnity insurance policies are in place and remain renewed on terms that accord with conditions of engagement.

5.5 STATUTORY CONSENTS

Although a great deal of the detailed work involved in obtaining statutory consents, such as planning permission and Building Regulations approval is carried out by the design team and other consultants, the project manager has a vital facilitating role to play in what can be critical project activities.

PLANNING APPROVAL

Legislation

Primary legislation governing the planning process is contained in Local Legislation relevant to each EU partner; in the UK the following Acts of Parliament cover this aspect:

- Town and Country Planning Act 1990.
- Planning (Listed Buildings and Conservation Areas) Act 1990
- Planning (Hazardous Substances) Act 1990
- Planning and Compensation Act 1991
- Town and Country Planning (General Permitted Development) Order 1995

- Town and Country Planning (General Development Procedure) Order 1995
- Town and Country Planning (Use Classes) Order 1987
- Town and Country Planning (Development Plan) Regulations 1991

The grant of planning permission does not remove the need to obtain any other consents (e.g. engineering and environmental approvals) that may be necessary, nor does it imply that such consents will necessarily be forthcoming.

Planning permission

Planning permission is normally required for any development of land in all EU States. 'Development' is defined as 'the carrying out of building, engineering, mining or other operations in, on, over or under land, or the making of any material change in the use of any buildings or other land'. The definition of building operations includes the demolition of buildings.

Some works may not be recognized as constituting development under Local planning laws. These may include, inter alia:

- works of maintenance, improvement or other alteration of any building which affect only the interior of a building or which so not materially affect its external appearance;
- the use of buildings or land within the curtilage of a dwelling house for any purpose incidental to the enjoyment of the dwelling house such as; the use of land for the purpose of agriculture or forestry; and
- change of use of land or buildings from one use to another within the same classification and use definitions

Moreover, there may be certain defined classes of development, mainly of a minor character. The most commonly used class permits a wide range of small extensions or alterations to dwelling houses.

Within Europe, schemes for 'Enterprise Zones' and 'Simplified Planning Zones' also grant planning permission for developments for types defined in the scheme concerned.

Timing

Planning permission cannot be guaranteed or assured in advance of the local planning authority decision and the project manager must recognise this in the master programme.

Negotiations

The project manager will normally assist the Design Team leader in negotiations with officers of the local authority and report to the Client upon the implications of any special conditions, or upon the need to provide *planning gain* through the appropriate statutory agreements. The Client's legal advisers are briefed to act for the Client accordingly.

Presentations

The project manager will arrange, should it be necessary, any presentations to be made to LPAs and local community groups. He will also organise meetings, including agreeing publicity and press releases with the Client.

Refusal

Should planning permission be refused, the advice of the relevant consultants should be obtained and action initiated, either to submit amended proposals or to 'appeal' against the decision.

Appeal

In the event of an 'appeal', arrangements are made for the appointment and briefing of specialists and lawyers, including managing the progress of the appeal. Applicants who are refused planning permission by a planning authorities, or who are granted permission subject to conditions which they find unacceptable, or who do not have their applications determined within the appropriate period, may have recourse to governmental officers

Enforcement powers

Most local authorities have enforcement powers e.g.

- to issue an enforcement notice, stating the required steps to remedy an alleged breach within a time limit (with a right to appeal)

- to serve a stop notice which can prohibit, almost immediately, any activity to which the accompanying enforcement notice relates
- to serve a breach condition notice if there is a failure to comply with a condition imposed on a grant of planning permission;
- to apply to the Courts for an injunction to restrain an actual or apprehended breach of planning control;
- to enter on privately owned land for enforcement purposes
- following the landowner's default, to enter land and carry out the remedial work required by an enforcement notice, and to charge the owner for the costs incurred in doing so.

OTHER STATUTORY CONSENTS

It is the duty of the design team to facilitate that the design complies with all other statutory controls, e.g. consents for Building Regulations/engineering operations, means of escape, the storage of hazardous materials, fumes and emissions, and pollutants. Generally, statutory controls make the owner or occupier responsible for the aspect of continuing duties in relation to the statute. The project manager obtains from the design team and/or other relevant sources, all consents and arranges for the Client to be advised of these continuing duties. Others such as specialist sub-contractors submit and obtain Building Regulations approval for their product/system.

5.6 DETAIL DESIGN AND PRODUCTION INFORMATION

The project manager's monitoring and co-coordinating role will entail extensive liaison with members of the Project Team and will include the tasks set out in more detail below.

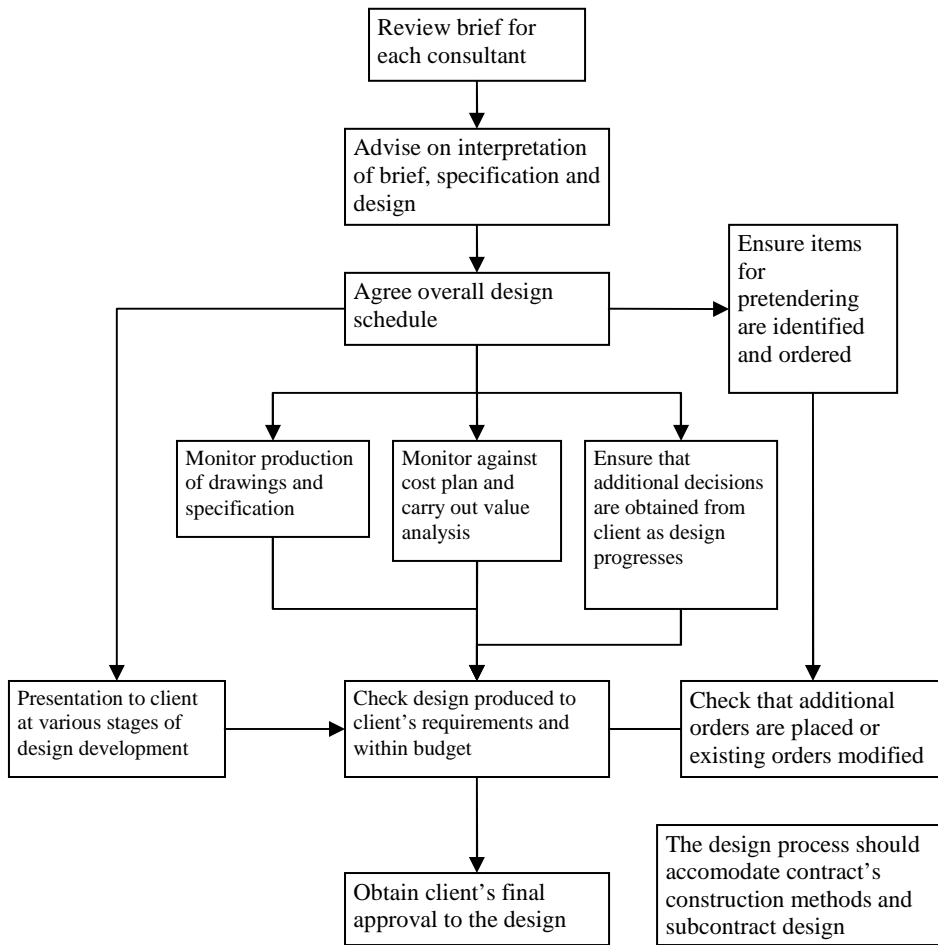


Fig. 5.2 Co-ordination of design work up to design freeze

- Controlling the extent to which the design will be produced by specialist contractors and/or component manufacturers, and establishing the division of responsibilities between them and the Design Team.
- Reviewing the project strategy, control systems, procedures and amending the project handbook, as required.
- Amplifying the design brief as necessary during design development.

- In conjunction with the Project Team preparing a detailed stage schedule for the detailed design and production information stage, defining tasks and allocating responsibilities.
- Preparing schedules to establish timely flow of information from the design team for
 - cost checking
 - Client's approval
 - tender preparations
 - construction processes
- Co-ordinating the activities of the Client and the Project Team in the management of the production of the design information.
- Formulating, in collaboration with the consultants, recommendations to the Client/owner in respect of the quality control system, including:
 - on-and off-site inspection of work for compliance with specifications, and testing of materials and workmanship
 - performance testing and the criteria to be used
 - preparation of schedules for required samples and mock-ups, their updating and monitoring progress of approvals; copies of schedules are included in the relevant monthly reports
- Listing the key criteria in terms of performance benchmarking that in all areas of design make clear how the design will be judged i.e. air changes or faults with current facilities.
- Monitoring the emerging detail design against the cost plan.
- Liaising with the Client/Project Team and the local authority/utilities and other statutory bodies to obtain permissions and approvals.
- Evaluating changes in Client's requirements for cost and time implications and incorporating approved items into the design process.
- Monitoring progress and providing regular reports incorporating information relating to:
 - project status
 - progress against schedule, together with exceptions report
 - cost against budget/cost plan, together with reconciliation statement
 - forecast of total cost and date of completion
 - critical areas
 - corrective action needed
- Obtaining the Client's approval to the detailed design and production information phase.

- Initiating arrangements for implementation of approved design and production information, to ensure that contractors' reasonable information requirements are fulfilled.

5.7 TENDER ACTION

The procurement schedule will indicate the time allowed for short listing suitable contractors or works packages (manufacturers/suppliers and installers of large tender items such as 'cladding' and early items such as ground-works and foundations). This schedule will also show activities such as tender interviews, tendering and selection. It will then lead to a design schedule which defines scope, release dates, approval periods, cost checking and consolidation into tender documentation.

- Checking that the various tender documents are produced at appropriate times, including those for enabling works (e.g. demolition, site clearance, access and hoarding) and ensuring that they contain any special terms required by the Client. In conjunction with the relevant consultants, preparing lists of firms to be invited to tender for the main and subcontract elements of the work (pre-qualifying process). Obtaining confirmation that the listed firms will be prepared to submit tenders at the specified dates, taking up references and/or interviewing prospective tenderers, together with the relevant consultants
- Ensuring that appropriate reference to the Health and safety is made in tender documentation where the contractor is to be appointed as 'principal contractor', including the health and safety plan.
- Checking, in liaison with other Project Team members, that all subcontract terms are compatible with the main contract terms, paying particular regard to contractor-designed elements and confirming that appropriate warranties are secured. Receiving reports on tenders, together with method statements. Interviewing successful tenderers, if necessary, to clarify any special conditions and to meet significant leading personnel. Arranging for formal acceptance of tender as appropriate and issuing relevant letters of intent.

- Selection should be based on balancing quality and price – (see CIB and CIRIA publications on selection process for further guidance on balancing quality and price in selection process).
- Initiating action if tenders are outside budget.
- Ensuring that the Client understands the nature and terms of the construction contract, particularly those in relation to possession and payment terms, and that possession of the site can be given to the contractor on the date set out in the tender.
- Arranging for formal signing and exchange of contracts.

In view of the EU directives on procurement, negotiated tendering is also being undertaken as an option to secure best value for money.

5.8 BRINGING THE CONTRACTOR ONBOARD

It is always advisable to ensure that the contractor is brought onto the design team and design stages from the earliest possible opportunity as is viable. This concept is of course dependant on the type of Contract under which the project is to be executed.

The benefits gained by early involvement of the Contractor are (the encouragement to ensure the acceptance and involvement of the Contractor is solely dependant on the positive management of the Project Manager):

- Resolution of Buildability issues at design stage
- Choice of the most efficient materials to be used
- Advice to the client as to costing (practical, rather than rates)
- Able to possibly involve specialist Subcontractors in the design process to streamline and pinpoint design issues.
- The Contractor can understand the client's needs in all areas, which will assist in the construction process leading to improved quality and other benefits for the client.

The contractor can highlight any Health & Safety issues which must be taken into account on the design.

5.9 PRE-START MEETING

The pre-start meeting with contractors and consultants (Project Team) is held to establish proper working arrangements, roles and responsibilities, lines of communication and agree procedures to be followed throughout the contract (project on site). If bonds are required they must be provided before possession of site is granted. The 'Principal Contractor's' health and safety plan must be in place before work starts on-site.

AGENDA ITEMS AT PRE-START MEETING

INTRODUCTION

- Introduce the representatives who will regularly attend progress meetings and clarify their roles and responsibilities. The client, contractor and consultants may wish to introduce themselves.
- Briefly describe the project and its priorities and objectives, and any separate contract that may be relevant (preliminary, clients own contractors, etc)
- Indicate any specialists appointed by the client, e.g. for quality control, commissioning, for this contract.

CONTRACT

- Describe the position with regard to preparation and signature of documents
- Hand over any outstanding Production Information, including nomination instructions, variation instructions. Review situation for issuing other important information.
- Request that insurance documents be available for inspection immediately, remind the contractor to check specialist sub-contractors' indemnities. Check if further instructions are needed for special cover.

- Confirm the existence, status and use of the Information Release Schedule, if used. Establish procedure for agreeing adjustments to the Schedule should they be necessary.

CONTRACTOR'S MATTERS

- Check that the contractors' master schedule is in the form required and that it satisfactorily accommodates the specialist sub-contractors. It must:
 - contain adequate separate work elements to measure their progress and integration with services installations;
 - allocate specific dates for specialist sub-contract works, including supply of information, site operations, testing and commissioning;
 - accommodate public utilities, etc
- Agree a procedure for the contractor to inform the architect of information required in addition to any shown on the Information Release Schedule. This is likely to involve contractors schedule of information required, which must relate to his works schedule and must be kept up to date and regularly reviewed. It should include information, data, drawings, etc to be supplied by the contractor/specialist sub-contractors to the architects/consultants.
- Review in detail the particular provisions in the contract concerning site access, organisation, facilities, restrictions, services, etc to ensure that no queries remain outstanding. Ensure the contractor has a copy of any conditions placed on the Client in respect of the planning consent. Also provide the contracts with legal drawings showing the curtilage of the site ownership.
- Quality control is the contractor's responsibility. Remind the contractor of the contractual duty to supervise, standards and quality of work during the execution of the works
- Numerous other matters may need special coverage, e.g.:
 - check whether immediate action may be needed by the contractor over specialist sub-contractors and suppliers
 - emphasise that drawings, data, etc received from contractor or specialist sub-contractors (not approved) will remain the responsibility of the originator;
 - review outstanding requirements for information to or from the contractor in connection with specialist works;
 - clarify that the contractor is responsible for co-ordinating the performance of specialist works and for their workmanship and materials, for providing specialists with working facilities, and for co-ordinating site dimensions and tolerances

- The contractor must also provide for competent testing and commissioning of services as set out in the contract documents, and should be reminded that the time allocated for commissioning is not a contingency period for the main contract works
- The contractor must obtain the architect's written consent before subletting any work.

RESIDENT ENGINEER/ARCHITECT/CLERK OF WORKS' MATTERS

- Clarify that architect's inspections are periodic visits to meet the contractor's supervisory staff, plus spot visits
- Explain the supportive nature of the various roles and the need for co-operation to enable them to carry out their duties
- Remind the contractor that the resident staff must be provided with adequate facilities and access, together with information about site staff, equipment and operations.
- Confirm procedures for checking quality control, e.g. through:
 - certificates, vouchers, etc as required;
 - sample material to be submitted;
 - samples of workmanship to be submitted prior to work commencing;
 - test procedures set out in the Bills of Materials
 - adequate protection and storage;
 - visits to suppliers/manufacturers works.

CONSULTANT'S MATTERS

- Emphasize that consultants will liaise with specialist sub-contractors only through the contractor. Instructions are to be issued only by the architect/contract administrator. The contractor is responsible for managing and co-ordinating specialist sub-contractors
- Establish working arrangements for specialists' drawings and data for evaluation (especially services) to suitable timetables. Aim to agree procedures which will speed up the process; this sector of work frequently causes serious delay or disruption.

COST CONSULTANT'S MATTERS

- Agree procedures for valuations; these may have to meet particular dates set by the client to ensure that certificates can be honoured.

Clarify:

- that dayworks will only be accepted on written instructions;
- that daywork sheets are required within a stated number of days from work being carried out;
- tax procedure concerning VAT and 'contractor' status;
- that the contractor should only order from drawings and specifications, not the Bills of Quantities.

COMMUNICATIONS AND PROCEDURES

- The supply and flow of information will depend upon schedule being established at the start and will proceed smoothly if:
 - there is regular monitoring of the information schedules
 - requests for further information are made specifically in writing, not by telephone
 - the design team responds quickly to queries;
 - technical queries are raised with the clerk of works (if appointed) in the first instance
 - policy queries are directed to the architect/contract administrator;
 - discrepancies are referred to the architect/contract administrator for resolution, .
- On receiving instructions, the contractor should check for discrepancies with existing documents; check that documents being used are current
- Information to or from specialist sub-contractors or suppliers must be via the contractor
- All information issued by the design team is to be via the appropriate forms, certificates, notifications etc. The contractor should be encouraged to use standard formats and classifications
- All forms must show the distribution intended; agree numbers of copies of drawings and instructions required by all recipients
- Clarify that no instructions from the client or consultants can be accepted by the contractor or any sub-contractor; only empowered written instructions by the architect/contract administrator are valid and all oral instructions must be confirmed in writing. Explain the relevant procedure under the

contract. The contractor should promptly notify the architect/contract administrator of any written confirmation outstanding.

- Procedures for notices, application or claims of any kind are to be strictly in accordance with the terms of the contract; all such events should be raised immediately the relevant conditions occur or become evident.

MEETINGS

Review format, procedures, timing, participants and objectives of the next stage:

- Meetings i.e. Site (progress) Meetings, Policy/Principals Meetings and Contractor's Production Information Meetings, and,
- Site Inspections

5.10 FEE PAYMENTS

The project manager is responsible, as required in his conditions of engagement, for receiving fee accounts and invoices from consultants and others concerned with the project, checking for correctness and arranging for payment within the terms of the various appointments or contracts.

5.11 QUALITY MANAGEMENT

It is the project manager's role to set up and implement an appropriate process to manage project quality. From the quality policy defined in the project brief, the development of a quality strategy should lead to a quality plan setting out the parameters for the designers and for the appointment of contractors. Quality control then becomes the responsibility of the contractor, subcontractors and suppliers operating within the agreed quality plan. The plan itself should establish the type and extent of independent quality auditing (particularly for

off-site production of components) and the timing of inspections and procedures for 'signing off' completed work.

It is the responsibility of the Design Team and other relevant consultants to specify the goods, materials and services to be incorporated in the project, using the relevant British Standards, codes of practice and Agreement Board criteria or other appropriate standard.

The achievement of these standards rests with the appointed main contractor. When interviewing contractors at pre-tender stage, the project manager will seek confirmation that each company has a positive policy towards the control of quality, a policy which will be reflected in all of its operations on site.

5.12 DISPUTE RESOLUTION

Although it is hoped that the non-adversarial approach advocated in the Latham Report and the increasing choice of alternative procurement options and partnering will lead to a reduction in disputes, nevertheless, the project manager should make every effort to pre-empt any dispute that may arise and endeavour to mitigate and resolve the problem.

Other options which may prove to be effective alternatives to arbitration, adjudication or litigation, subject to the conditions of the contract, is the application of alternative dispute resolution (ADR); it provides:

- a viable method of early resolution to avoid claims and likely high costs
- a conciliation service at short notice
- a third party free of any conflict or interest; this generally leads to a negotiated settlement

CHAPTER 6

CONSTRUCTION STAGE

CLIENT'S OBJECTIVES

At this stage the client should aim to ensure the safe completion of the construction/development within the targets set at previous stages.

INTERLINKING WITH PREVIOUS STAGES

The change from pre-construction to the construction stage is a watershed. It is the culmination of all the pre-construction effort that allows the actual work to commence on-site. With this change, the duties of the project manager also change and this section sets out his tasks on the premises that he then supervises the construction and final delivery of the project.

The move to construction must be managed as a seamless operation and must recognise and enact any key policy or strategy decisions that will have been taken during the earlier stages of the project cycle. Decisions will have been taken in such areas as client's main requirements, planning requirements, whole life cycle constraints, value engineering, procurement methods, early contractor or specialised subcontractor/supplier involvement, Health, Safety and Welfare, environmental issues, etc. The procedures and responsibilities for all these have been dealt with in the earlier sections of this Manual and now must be effectively implemented during this dynamic stage of the project.

This doesn't mean however, that there is no opportunity left for further initiative or development of the project. On the contrary, a very proactive input is needed from the project manager and all the members of the project team to search out and find further practical betterment that will enhance the end product.

It is the project manager's overriding role during this phase to provide the team with the necessary strong and proactive leadership. He/she has to steer the project to completion through continuous measurement of performance against time, quality and costs and to carry out all necessary actions to ensure the

team's successful delivery of a project that not only satisfies the client's satisfaction but that also exceeds his expectations.

6.1 RESPONSIBILITIES OF THE PROJECT MANAGER AT THIS STAGE

TO BE THE PRO-ACTIVE 'DRIVER' OF THE PROJECT

The project manager needs to demonstrate his soft skills as well as hard skills:

- Hard Skills generally include planning, programming, organisational ability, report writing, information assembly, cost control, innovation, decision making and prioritization,
- Soft skills include leadership, motivation, communication, interpersonal skills, personality, team building abilities, honesty, integrity, and sense of humour.

TO SET THE PROJECT OBJECTIVES

The project manager has responsibility for defining the primary objectives for the project. From these he/she has to develop individual objectives, team objectives and the project general objectives, in order to achieve the primary objectives. He/she has then to be able to effectively communicate with the team members and obtain their commitment to achieve them.

These should include:

- Meeting the clients objectives within the contract, i.e. not at all costs
- Fair treatment of all parties to the project
- Customer focus
- Ensuring a delighted Client.

TO ENSURE ACHIEVEMENT OF OBJECTIVES

The project manager must clearly adhere to the Project Success Criteria. He /she must maintain the measurement against the progress and then pro-actively manage the project to ensure success.

ACHIEVING CLIENT'S SATISFACTION

Must be the prime responsibility of the project manager.

6.2 ROLES OF PROJECT TEAM MEMBERS (for more detail see Manual M2)

Although the precise contractual obligations of the project participants vary with the procurement option adopted, the project participants must carry out certain essential fundamental functions.

6.3 CLIENT (for more detail see Manual M2)

Usually a client would have a relatively nominal direct involvement in the construction works, their chief interest would be:

- to satisfy themselves that the contractor(s) were performing in accordance with the contract
- to make sure they are meeting their obligations to pay all monies certified for payments to the consultants and the contractor(s).

6.4 PROJECT MANAGER (for more detail see Manual M2)

The project manager has a role which is principally that of monitoring the performance of the main contractor and the progress of the works, and involves the following activities (some of which may have been accomplished in the pre-construction stage)

- Ensuring contract documents are prepared & issued to the contractor
- Ensuring the contracts are signed
- Arranging the handover of the site from the client to the contractor
- Reviewing contractor's construction schedule and method statements
- Ensuring procedures are in place and being followed
- Ensuring site meetings are held & documented
- Monitoring construction cash flow
- Reviewing progress with contractor
- Monitoring performance of contractor
- Ensuring H&S File is being maintained
- Ensuring design information required by contractor is supplied by consultants
- Establishing control systems for time, cost & quality
- Ensuring site inspections are taking place
- Confirm insurance cover on the works
- Managing project cost plan
- Ensuring client meets contractual obligations [i.e. payments]
- Reporting to client
- Managing introduction of changes
- Ensuring statutory approvals are being obtained
- Ensuring all relevant legal documents are in place
 - Collateral Warranties
 - Performance Bonds
- Reviewing construction risks
- Establishing mechanisms for dealing with any claims
- Anticipating and resolving potential problems before they develop

6.5 DESIGN TEAM (for more detail see Manual M2)

The design consultants are responsible for:

- providing production information (i.e. details of building components)
- approving working drawings being provided by specialist contractors
- responding to site queries raised by contractors
- inspecting the works to ensure compliance with the drawings and specification
- inspecting the works to ensure an acceptable quality standard has been achieved.

The structural engineer will have a general duty of care to ensure the erection of the structural frame is proceeding in a safe manner. This might be extended to cladding fixings and other architectural components, which subjected to stress, forces or loadings.

Most building contracts refer to a contract administrator, usually the design team leader or the project manager, who is the formal point of contact between the project team and the contractor, and who has a contractual obligation in relation to the issuing of formal instructions to the contractor; these include:

- issuing design information
- issuing variations
- instructions on standards of work and working methods
- arbitrating on contractual issues
- issuing interim payment and other certificates
- issuing practical completion certificate

6.6 COST CONSULTANT (for more detail see Manual M2)

The Cost Consultant has a duty to:

- measure the value of work executed by the main contractor
- agree monthly valuations with the main contractor
- agree the final account with the main contractor.

The Cost Consultant has a separate responsibility to the client, usually through the project manager, for reporting on the overall financial aspects of the project.

6.7 MANAGEMENT/MAIN CONTRACTOR (for more detail see Manual M7)

The main/principal contractor has responsibility for:

- mobilising all labour, sub-contractors, materials, equipment and plant in order to execute the construction works in accordance with the contract documents
- ensuring the works are carried out in a safe manner
- indemnifying those working on the site and members of the public against the consequences of any injury resulting from the works

6.8 CONSTRUCTION MANAGER (for more detail see Manual M7)

A client may decide on a construction management route, directly employing a construction manager as a consultant acting as an agent and not a principal with expertise in the procurement and supervision of construction. In this arrangement the construction manager's role is to:

- determine how the construction works should best be split into packages
- to produce detailed construction schedules
- to determine when packages need to be procured
- to manage the procurement process
- to manage the overall site facilities
 - access
 - storage
 - welfare
- supervise the package contractor's execution of the works

In the management contracting arrangement, a management contractor acting as a principal, would have the additional direct contractual responsibility for the performance of the package contractors.

6.9 SUB-CONTRACTORS & SUPPLIERS (for more detail see Manual M7)

Sub-contractors have specialist expertise, usually trade-related (i.e. mechanical or electrical installations, lift installation, joinery, demolition), for the supply and installation of an element of the total works.

Sub-contractors may be either nominated or named by the consultants or selected and appointed directly by the main contractor, known as domestic sub-contractors. If nominated, the Client carries some risk in respect of the sub-contractor's performance.

Suppliers provide certain materials, components or equipment for others to install.

Labour-only sub-contractors provide only labour to carry out the installation of materials, components or equipment provided by the main contractor (i.e. carpenters, bricklayers and plasterers).

Due to their specialist knowledge sub-contractors have an increasing design responsibility for the detailed design related to their installations (may include fixing details, fabrication details, co-ordination with other installations).

There is a general obligation on all the project team to ensure the site is a safe working environment, although legally this falls to the principal contractor under CDM regulations.

6.10 OTHER PARTIES (for more detail see Manual M7)

A large number of other bodies will be involved during the course of the construction works, these include:

- **Local Authority or Approved Inspector**
 - Inspection of various elements of the works (i.e. foundations, structure)
- **Highways Authority**
 - Inspection & adoption of roads and sewers
- **Environmental Health Officer**
 - Inspections related to pollution (i.e. mud, noise, smoke, water)
 - Also inspection of certain installations (i.e. drainage, kitchens)
- **Fire Officer**
 - Inspection of site for fire escape & hazards, storage of certain materials
 - Inspection of protection systems
- **Health & Safety Authorities**
 - Inspection of site for safety aspects
- **Planning Officers**

- Checks on compliance with consents
- Inspections of preserved trees
- **Archaeologists**
 - Inspection of excavations for ground disturbance
- **Trade Unions**
 - Meetings with members in relation to complaints about site conditions
- **Landlord's Representatives**
 - Inspections of scope & quality of works
- **Funder's Representatives**
 - Inspections of progress & quality of works in order to release money
- **Police**
 - Discussions on traffic control, unloading & complaints

6.11 TEAM BUILDING (for more detail see Manual M7)

Traditionally it has always been easy to execute contracts and projects using the contract and the specific duties and responsibilities for each party. However this rigid approach has more often than not brought about an adversarial environment between, usually, the contractor and the Client's design team.

Construction is a people business and thus communication is the key to a successful project. This involves the Project Manager heading up the professional design and construction team (inc. the contractor) and building trust between all the parties. The PM will be responsible for the ultimate outcome of the project and thus it is in his interest that he has a united team working towards the same goal. There are numerous individual methods of teambuilding which can be adopted by referring to numerous literature published on Management. However, the most effective and the critical period for the PM to drive home his stance on the team is at the outset of the project, as

and when designers and consultants together with the contractor are brought onboard.

Regular progress meetings and workshops (both formal and informal) can assist in developing the bond between all members of this team. More importantly, during the construction stage, the team must have a 'hands on' (immediate) approach in resolving, assisting and thus eliminating any issues hindering the smooth progress of construction.

Construction is not about individuals but teams, both at pre-construction stage and also during the work.

6.12 HEALTH, SAFETY AND WELFARE (for more detail see Manual M7)

There are two main areas of Health and Safety of which the Project Manager must be aware and be able to manage during the process: the overall Health and Safety responsibilities of the Client and the design teams and site manager during construction stage.

The purpose of these is to identify the key individuals within the construction project. The four main individual or groups are:

- The Client
- The Designers
- Planning Supervisor
- Principal Contractor

The Project Manager has a duty to monitor the activities and actions being executed by the above four individuals. This does not mean that the PM will be held liable for any wrong doing but simply the management of the project from the inception stage through design, construction and finally occupation, must have the Health & Safety firmly in mind, eliminating any risks at each stage.

There are number of tools for monitoring the successful process of H&S, the main ones being Risk Assessments, Risk Workshops, Method Statement

Analyses and the Health & Safety File (before and during construction) of individual potentially 'risky' design solutions and on site construction method issues.

During pre-construction stage the responsibility for H&S is mainly on the design team and the client and thus the management process must be considered by the Project Manager. During construction, the Principal Contractor is responsible for Safety and Welfare on site. If the standard of Method Statements concerning activities are not to the satisfaction of the Project Manager, further meetings and discussions must be arranged between parties to agree an amicable safe way forward. The Principal Contractor is responsible for preparing a construction H&S plan. This is constantly updated. At completion of the project he hands to the client a concise H&S File on the built product highlighting any potential risks to the end user.

Health, Safety & Welfare is the responsibility of ALL individuals involved in the construction. The Project Manager must take an active role in monitoring the process. He/she MUST emphasize the importance of H&S considerations to, most importantly, the Client and also the design & construction team.

6.13 ENVIRONMENT MANAGEMENT SYSTEMS (for more detail see Manual M7)

ENVIRONMENTAL STATEMENTS

Environmental concerns will increasingly affect our projects especially with the pressure to develop brown field sites and reuse old sites. The cost of addressing contaminants or other environmental issues can add significant costs and extend the project duration.

Also the Planning Authorities are more likely to instruct Environment Studies (ES) and impose restraints as part of the planning process all of which must be incorporated into the project during the construction stage.

It is the project manager that has overall responsibility to ensure compliance with these aims, objectives and constraints.

The project manager will need to:

- Understand and act upon Environmental Impact Studies
- Ensure proper environmental advice is available
- Ensure the contractor is complying with the ES criteria
- Seek and ensure action by the contractor of any remedial work should it be necessary to comply.

CONTRACTOR'S ENVIRONMENT MANAGEMENT SYSTEMS

The contractor must establish his own Environmental Management Systems (EMS), but it is for the project manager to ensure that it is being managed properly and is progressing sufficiently to achieve all ES objectives.

Therefore he/she should:

- Receive details of the contractor's EMS and his Environmental Plan (EP) specific to the project
- Ensure that the contractor has set up all necessary procedures and structure to manage his EMS and implement the objectives of the EP
- Check that the contractor's Environment Management Plan matches the aims and objectives of the ES
- Agree with the contractor any further aims, specific targets or initiatives that will maximise sustainability of the project and minimise the detrimental impact of the construction process
- Proactively monitor the progress of the contractor to maintain his environmental objectives.

6.14 CONTRACTUAL ARRANGEMENTS (for more detail see Manual M7)

The project manager has to ensure that all statutory and contractual formalities are in place prior to allowing work to start on site. It may mean that he has to

ensure that others have given the relevant notice, and if appropriate, received the relevant approval. A log may help to keep track of notices and approvals together with the owner of the task.

These are likely to include:

- Planning – Architect
- CDM notification – Planning Supervisor
- Third Party Insurance – Contractor
- PI Insurance – Consultants
- Notice to start work under the Building Regulations – Contractor
- Fire Regulation Compliance – Architect
- Performance bonds – Contractors

Also on completion various completion certificates are required, these should be specified in the particular specification, and would include:

- Fire Regulation Compliance,
- Electrical Completion Certificate
- Test Certificates both manufacturing and installation
- Lifting beams tests and marking
- Building Regulation Compliance
- Pressure vessel and boiler certificates

For special Buildings or processes, particular licenses and certificates may be required for example Nuclear projects, Pharmaceutical, Oil and Gas, Rail, If there is any doubt ask the design team for their advice, then manage the process.

6.15 ESTABLISH SITE (for more detail see Manual M7)

Once the design has been finalised and contracts signed, the project is ready to go on site. It is imperative that the site set-up process is carried out and completed in the most efficient manner prior to the start of the main construction works. The issues that the Project Manger must be aware of and monitor with the contractor at this stage are not only practical and physical

operations but also administrative plans and procedures agreed by the parties. The areas where the PM is to agree and monitor site set-up are:

- Site boundaries clearly identified with the contractor.
- Establish the contractors' proposal for security.
- Establish the contractors' proposal for emergency plans in case of fire or any incidents.
- Establish the contractors' proposal for site accommodation specifically the suitability of the welfare facilities.
- Carry out a survey of existing conditions of the site and the adjacent properties. Record any relevant issues in liaison with adjoining owners where possible.
- Establish with the contractor the administrative procedures such as Requests for Information (RFI's), Contract Variation Instruction (CVI's), daily returns, daily diaries, faxes, e-mail facility, drawing issues, etc... This activity is most important as it will set out the communication route between all parties throughout the project. The findings and agreements with the contractors should be recorded by the PM and distributed to all professionals involved.
- Ensure that the contractor is aware of and is attending to any issues that may be present due to neighbours being close to the site including the terms of any party wall awards or rights of light issues.
- Ensure that the contractor has clearly identified the H&S risks that exist on site.
- Ensure all signage is displayed correctly.

The above issues are to be agreed with the contractor. The Project Manager can not dictate how the contractor is to set up site. The PM role must be advisory and thus monitor that the correct actions as agreed are being implemented.

6.16 CONTROL AND MONITORING SYSTEMS (for more detail see Manual M7)

It is the project manager's prime duty to make sure that all necessary control and monitoring systems are properly set up and implemented by the contractor.

The project manager must ensure that these systems produce the most appropriate information and reports, on a regular and timely basis, so that he can use them to monitor and manage the project to a successful conclusion.

By carrying out his own audits and checks of the systems, he must fully satisfy himself about the accuracy of the data produced and that it does indeed indicate the 'real' position at any point in time and, where appropriate, accurately forecast the final position of the project.

Such contractor's systems will generally be (but not limited to):

- Quality management system
- Schedule management system
- Quality control system
- Cost monitoring and management system
- Health, Safety and Welfare system
- Environmental management system
- System
- Document management system

It is of absolute importance that the project manager fully understands the relevance of the information being produced by these systems. He must proactively use this information to manage the contractor and the project team through his regular management meetings. The aim is not only to understand where the project is and where it is ultimately going, but also to identify any potential problem areas at a sufficiently early stage so that any rectification procedures and/or mitigation measures can be taken to ensure best delivery of the project.

6.17 CONTRACTOR'S PROGRAMME (for more detail see Manual M7)

The project manager has a duty to the client to monitor the performance of the contractor. In order to adequately carry this out the project manager needs to ensure the contractor has prepared a construction schedule in sufficient detail to enable the construction works to be closely monitored.

The project manager needs to receive and review the contractor's schedule prior to the commencement of the works in order to:

- check that it complies with the client's time requirements
- check that it acknowledges any restraints imposed on the construction of the works
- ensure that the level of detail is appropriate for the complexity of the works
- ensure it is suitable for monitoring the progress of the works
- confirm the sequencing and logic of the schedule

The construction schedule must be supported by an information requirement schedule that realistically informs the project manager when outstanding design information is required in order for the contractor to achieve the schedule dates. Regular reports recording progress achieved against the schedule must be received from the contractor, and a progress status agreed with the contractor.

Any rescheduling of the works necessary to recover delay situations need to be received, reviewed and agreed.

In addition to the detailed analysis of progress the project manager should examine high-level progress trends to obtain an overall view of project status. This can involve graphically comparing accumulative planned progress against actual achieved.

Usually the contract requires that the contractor prepare a contract schedule that becomes part of his contract. This schedule does not normally go into a great deal of detail, as timescales, dependencies and interfaces have yet to be agreed with sub contractors to the main contractor.

The PM will need to obtain a working schedule and more detailed schedules to cover specific sections of work. These might include Fitting out schedules, phased hand over, commissioning, and a completion schedule showing how completion will be achieved.

Rescheduling required as a result of changes or slippages will be required to show how time can be recovered or how the effect on the completion dates.

It is the duty of the project manager to not only to monitor the contractor's progress, but also to monitor any work being undertaken by other advisors, suppliers or companies that have an independent input into the completion of

the project. These should all be monitored against the overall client's master schedule with its own milestone and targets. The project manager is managing the overall project for the client and its successful delivery.

6.18 VALUE ENGINEERING (RELATED TO CONSTRUCTION METHODS) (for more detail see Manuals M4, M6 & M7)

Value Engineering (VE) is an exercise that involves most of the project team as the project develops, by selecting the most cost-effective solution. However VE is about taking a wider view and looking at the selection of materials, plant, equipment and processes to see if a more cost-effective solution exists that will achieve the same project objectives.

VE should start at project inception where benefits can be greatest, however the contractor may have a significant contribution to make as long as the changes required to the contract do not affect the timescales, completion dates or incur additional costs that outweigh the savings on offer.

There is, however still a place for Value Engineering, especially at the start of construction. The application of the Job Plan remains consistent but the detail available is obviously more than during the design and pre-design stages.

The "results accelerators" originally proposed by Miles still act a useful guides to Value Engineering at the construction stage.

In all of this it is most important to remember the relationship between cost and value – value is function divided by cost. Concentration on the function of the project or product will avoid mere cost cutting.

Table 6.1

Result Accelerators

Avoid generalities
Get all available costs
Use information from best source
Blast, create and refine
Be creative
Identify and overcome road blocks
Use industry experts
Price key tolerances
Use standard products
Use (and pay for) experts advice
Use specialists processes

The project manager must take a pro-active role in both giving direction and leadership in the VE process, but must above all ensure that time and effort is not wasted and does not have a detrimental effect on the progress of the project.

6.19 MANAGEMENT OF THE SUPPLY CHAIN (for more detail see Manual M7)

The contractor has overall responsibility for the management of his supply chain to meet his contractual obligations.

The project manager has the duty to ensure that this chain is being effectively managed so as to avoid any potential delay, unnecessary cost implications or any other adverse effect on the delivery of the project.

This is an important issue as it is so very often the case that problems further down the contractual chain can be responsible for long delays and/or major disputes right back up through the whole chain. They can potentially result in the deterioration of relationships with the contractor and have a knock on effect

with not only his performance, but also the performance of the project team as a whole.

Duties and responsibilities should include:

- Receive and understand the details of the contractor's supply chain and his controls to manage it
- Establish key members and linkages within the chain
- Receive and interrogate reports from the contractor about the ongoing progress, including any reports from procurement managers and expeditors
- Implement a regular monitoring system to check the progress of key suppliers or subcontractors (against contractor's delivery schedule) so that timely warning signals flag-up any potential delays or failures that could have an adverse effect on the progress and financial stability of the project
- Agree with contractor any appropriate remedial action that may be needed to rectify any problem areas

6.20 RISK REGISTER (for more detail see Manuals M2 & M7)

The risk register is a document that should be prepared at the earliest stages of the project, identifying potential risks throughout the project. This register should be reviewed and updated according to circumstances, and stages of the project. At the construction stage the risk register should be reviewed to include any new construction risks.

In addition to monitoring those construction-related risks previously identified in the project-wide risk register, the project manager needs to ensure the contractor has instigated a risk management system for those risks likely to impact on the actual construction works.

The project manager needs to ensure that the contractor:

- establishes a fully detailed listing of construction risks

- determines the likely probability and impact of each risk
- reviews the risks with the project team
- prepares method statements and action plans demonstrating how risks will be mitigated or managed out
- identifies, and informs, the person responsible for managing each risk
- prepares contingency plans for any key risks having a significant impact
- regularly reviews and reports on the status of risks

6.21 BENCHMARKING (for more detail see Manuals M4 & M7)

In certain circumstances, particularly when framework or partnering agreements are in place, it may be appropriate to employ benchmarking of a contractor's performance against the best industry practice.

A major difficulty of benchmarking in construction is locating base data that allows for meaningful comparisons. Since 1998, as part of the annual production of statistical information gathered from contractors, the Government has collected measures of Key Performance Indicators. These provide the widest sourced comparators currently available to benchmark individual companies against the industry average levels of performance.

A number of construction clients commission their own research to assemble, from other similar organisations, meaningful performance data that allows them to carry out benchmarking of the companies they use.

Benchmarking is closely associated with the concept of continuous improvement, and a company's performance can be monitored over time to confirm that improvement measures introduced are effective.

6.22 CHANGE AND VARIATION CONTROL (for more detail see Manual M7)

The project manager should carry out the following tasks to control variations:

- Variations which result from changes to the project brief (to be avoided whenever possible or design/schedule modifications (e.g. Client's request, architect's or site instructions) must follow a procedure which:

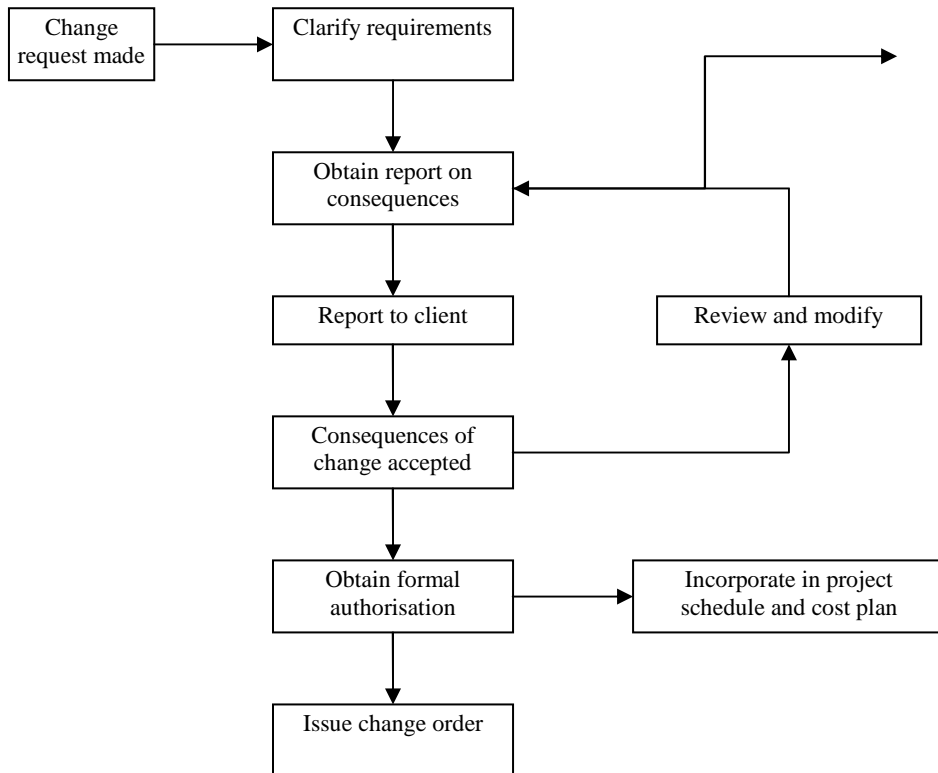


Fig. 6.1 Changes in the Client's brief

- identifies all consequences of the variation involved
- takes account of the relevant contractual provisions

- fines a cost limit, above which the Client must be consulted and, similarly, when specifications or completion dates are affected
- authorises all variations only through a change order system initiated by the project manager
- Identifying, in consultation with the Project Team, actual or potential problems and providing solutions which are within the time and cost limits and do not compromise the Client's requirements, with whom solutions are discussed and approval obtained.
- Checking the receipt of scheduled and/or ad hoc reports, information and progress data from Project Team members.

The main way of minimising claims or variations is to ensure the brief is clearly defined, and that the contract documents and drawings accurately and completely reflect the detail.

Managing change control at design development stage is far more effective than managing the process during construction.

Circumstance driven changes, mistakes or unknowns have to be effectively managed on the basis that in many instances time is more expensive than the material change. Some form of authorisation needs to be agreed (financial limits) so that instructions can be given without having to refer every change back to the customer for approval.

The project manager will need to maintain a register of changes and variations, cross-referenced to contractors Request for Instruction notices, and possibly contract claims, is important. The register should include budget costs and final costs for reporting to the client on a regular basis.

Accurately detailed daily diaries will need to be kept, complete with plant, labour and material deliveries so that consequential costs can be identified.

In dealing with the effects and costs of variations, the project manager will need, where possible, to agree costs before issuing an instruction. It is also wise to agree, again where possible, that work will be undertaken with no overall effect on the schedule.

It is vital to carefully recording events and situation at the time.

Procedurally, the project manager must inform both the design consultants and the main contractor that all Variation Instructions must be in the correct written

form and MUST only be issued via the project manager unless he is the appointed contract administrator to the main contractor. To avoid unnecessary complications in agreeing valuations and accounts, it is imperative that the Variation Instructions are issued from one source. Design consultants must raise (in writing) Request for Instruction, to the PM, who will in turn issue the instructions to the contractor. ALL variations MUST have an instruction against them in order to be valued.

6.23 SUPERVISION OF THE WORKS (for more detail see Manual M7)

Once the project is underway on site regular inspections and monitoring of progress is to be carried out by the Project Manager. There is a fine line as to how involved the PM should get with the every day issues facing the contractor, and thus the relationship as mentioned previously will determine the appropriate approach.

It is the Project Manager's responsibility to arrange from the outset progress meetings usually at 2-3 weeks intervals. During these meetings the contractor will present a report as to progress on site with any relevant design issues which require resolving. Please note that these meetings are set up to monitor progress and not to cover technical design. If necessary separate design meetings should also be set up. The reporting process to the PM must not be restricted to the contractor but must also include all designers and consultants. It is at these forums that the PM must manage and ensure all parties are working together and achieving individual target dates for producing information and maintaining progress against schedule.

Notwithstanding the formal progress meetings, if not resident, the PM should visit site at least twice during the week and spend limited time on site discussing progress with site staff and chasing up the appropriate individuals for information and progress.

6.24 REPORTING (for more detail see Manual M7)

A fundamental aspect of the project management role is the regular reporting of the current status of the project to the client.

The project manager needs to ensure an adequate reporting structure and calendar is in place with the consultants and contractors. Frequency and dates of project meetings need to be co-ordinated with the reporting structure.

Reporting is required for a number of reasons:

- to keep client informed of project status
- to confirm that the necessary management controls are being operated by the project team
- to provide a discipline and structure for the team
- as a communication mechanism for keeping whole team up to date
- to provide an auditable trail of actions and decisions

Progress reporting should record the status of the project at a particular date against what the position should have been; it should cover all aspects of the project, identify problems and decisions taken or required, and predict the outcome of the project.

The project manager needs to receive individual reports from the consultants and contractor and summarise them for the report to the client. The detailed reports should be appended as a record.

Typical contents of a project manager's project report would contain:

- Executive Summary
- Legal agreements
- Design status
- Planning / Building Regulations status
- Procurement status
- Construction status
- Statutory consents and approvals
- Project Schedule and progress
- Project financial report
- Variation Register update

- Risk Register update
- Major decisions & approvals required

Trends shown visually are an excellent mode of conveying information to clients and senior management

6.25 PUBLIC LIAISON AND PROFILE (for more detail see Manual M7)

The client would probably have set out his overall public relations and liaison strategy during the pre-construction stages of the project.

In reflection of this, the project manager should take a leading role in 'local' public relations during the construction stage. This will improve the public's perception of the construction industry in general.

Such activities or actions should include:

- Ensuring no local nuisance or negative impact arising from the project
- Maintaining good housekeeping both on site and in the immediate offsite area
- Erecting informative scheme boards and public viewing platforms
- Ensuring the contractor takes part in a local or national 'Considerate Contractor' scheme
- Taking awareness initiatives with local schools
- Attending local public meetings to raise the profile of the project
- Organising site visits for local schools, residents and business people
- Partaking in local environmental scheme or issues
- Being involved with fund raising for local charities or causes

CHAPTER 7

COMMISSIONING AND O&M MANUALS

7.1 COMMISSIONING (for more detail see Manual M5)

The project manager should receive within the early stages of construction, the contractor's commissioning programme in order to satisfy himself that it is properly coordinated with the building works programme. (As an example, the balancing of the heating and air conditioning system can only take place when the building envelope and internal spaces have been secured)

A problem may occur in that in many instances the building services contractor is a sub contractor to the main contractor and that the sub-contract may not be in place at this early stage of construction. In this case, the main contractor will need to identify the logic and sequence of the commissioning.

7.2 OPERATING AND MAINTENANCE MANUALS

The production of the O&M manuals is covered under the Engineering Services commissioning section. With systems becoming ever more complex a properly

user-friendly set of manuals is important. Detailed requirements should be set out in the contract, so that there is no dispute on the level of detail required.

The Project Manager should make certain that those principally responsible for Health and Safety deliver the Operating and Maintenance Manuals, and it is the Planning Supervisor's role to ensure that they are delivered as part of 'The Health and Safety File'. These manuals should also include details of the complete building with input from all the design team. The project manager has to monitor the progress that the Planning Supervisor is making on assembling these files and if needs be, ensure that all necessary actions are taken to expedite their completion.

7.3 PAYMENT

A vital part of the construction process is ensuring the contractor and sub-contractors receive regular payment for the work which has been carried out.

The project manager has a role in attempting to avoid disruption caused by contractors failing on the project. There are a number of actions the project manager can take:

- checking of the financial standing of contractors prior to their appointment
- on-going monitoring of the financial position of contractors
- ensuring all payments due are promptly paid by the client.

Generally the contractor makes a monthly application for payment. The Cost Consultant values work, the architect or contract administrator certifies it and the client pays for it within a stipulated period of the application/certification date

The project manager has an important role in ensuring the client honours obligations to pay contractors against certificates authorised by the contract administrator.

As projects become larger and more complex so do the means of finance. These include:

- PPP
- PFI
- DBFO
- BOOT
- Plus - cost plus, reimbursable, target cost, cost plus fee.

These forms of contract are more likely to have their own 'tailored' methods and formats for payments to the contractor or concessionaire, but set out below are the more common methods of payment for traditional or design & build contracts:

- **Valuations**

The traditional method of payment has been a physical measuring of the works carried out on site and the quantity of work costed against the rates in the BQ. Carried out jointly by the main contractor and Cost Consultant. This is done monthly. The Contract Administrator issues an interim certificate for the amount due to the client and the client has to make payment to the main contractor within a period stated in the contract.

- **Milestone**

Tenderers as part of their tenders are asked to breakdown their total price into a number of sums against pre-determined milestones. A milestone usually being the completion of elements of the construction works (e.g. completion of the structure up to a certain level). Normally likely to be 20-40 milestones.

Acknowledgement that a milestone has been achieved by the contract administrator will release payment of the sum to the contractor. This can sometimes be called an "Activity Schedule" (NEC contract).

- **Stage**

Similar to milestone payment but likely to be far fewer stages (e.g. completion of super-structure, achievement of watertight building).

- **Earned Value**

Regular payments made in accordance with an earned value system. Payment will be related to actual progress position achieved on the works. As the value

of payments is based on the schedule assessment of progress it avoids the need to separately carry out monthly measurements of works carried out.

- **Ex Gratis**

Although not a formally recognised method of payment, in certain extreme cases when lack of cash is preventing a contractor from carrying out his obligations under the contract a special one-off payment may be made with the client's agreement. This is an ex-gratis payment made in advance of the normal payment procedure to ensure certain works are carried on order to recover or prevent a delay situation or to expedite certain materials. In cases this might be accompanied by a pre-payment insurance bond. It is important that if payment is for materials or equipment that ownership is clearly established to guard against insolvency of the contractor.

7.4 CONSTRUCTION COMPLETION REPORT (INCLUDING LESSONS LEARNT)

The project manager should compile a close-out report on the completion of the construction stage of the project.

This report should include:

- An analysis of the performance of the contractor
- An analysis of the performance of the project team, including all advisors
- Performance of original quality, cost and time targets for the project against those finally achieved
- Performance of the project against its benchmarking criteria and all other targets and objectives that have been monitored
- A detailed LESSONS LEARNT Analysis

For the sake of good construction practice, it is extremely important that the lessons learnt are identified, understood and noted down. It is best done while events are fresh in the memory and before the team has been disbanded. There then needs to be an appropriate management procedure for transferring these in

order that others (the client, host company or other participants to the project) might learn for future projects.

Transferring BEST PRACTICE is a duty for ALL OF US.

CHAPTER 8

ENGINEERING SERVICES COMMISSIONING STAGE

CLIENT'S OBJECTIVES

At this stage the client should aim to prove that the engineering installation has been installed correctly, in a safe manner, and that it performs to the requirements of the design.

The project manager's objective is to ensure that the commissioning of the separate systems is properly planned and executed, so that the installation as a whole is fully operational at handover without delay to the programme and that any fine tuning necessary after handover is carried out in liaison with the Client/user.

INTERLINKING WITH CONSTRUCTION

It must be stressed that the location of this chapter does not mean that the activities involved only take place at the end of the construction stage. Engineering commissioning is a very important part of the construction process and must be addressed and considered very early within the project. The following are suggested activities that must be considered well before this stage:

- Decide the most appropriate time within the project to appoint the commissioning contractor and his role/scope of work
- Where appropriate, appoint commissioning contractor to review the design drawings and working drawings to ensure commissionability
- Ensure consultants clearly identify testing and commissioning requirements
- Ensure consultants/client identify performance/environmental testing requirements
- Ensure that the project schedule includes sufficient time to undertake the specified commissioning, and in particular, the additional time required for any performance/environmental testing and statutory testing to authorities

- Clearly identify the method of presenting, recording and electronically storing “As Installed” information
- Although not strictly part of engineering commissioning, ensure that the requirement for specialist maintenance contracts for equipment is carefully considered prior to awarding tenders for such equipment

8.1 COMMISSIONING - GENERALLY (for more detail see Manual M7)

Commissioning is carried out in four or sometimes five distinct parts:

- static testing of engineering services,
- dynamic testing of engineering services,
- performance testing of engineering services (not always undertaken),
- undertaking statutory tests for various authorities, and
- Client commissioning. Note that *performance* testing also includes *environmental* testing.

The first four items, engineering services testing, commissioning, performance testing and statutory tests are part of the construction design and installation phases of the project. *Client commissioning* is an activity predominantly carried out by the Client's personnel assisted, where required, by the consultants. This is dealt with in Chapter 9.

The engineering services testing and commissioning process objectives and main tasks are as described within this chapter.

8.2 PROCUREMENT OF COMMISSIONING SERVICES

SMALLER PROJECTS

There are many ways to procure the commissioning specialist. On smaller projects, via the main contractor, the mechanical and electrical sub contractors are most likely to be responsible for the testing and commissioning of their installation. Electrical contractors will normally use in-house resources, except where specialist items of equipment require the manufacturer to assist with their testing. Mechanical contractors will usually appoint a *commissioning specialist* to work on their behalf. Again, where specialist items of equipment are installed, the Mechanical contractor will request the manufacturer to assist with its testing where appropriate. However, it should be noted that often these *commissioning specialists* are no more than balancing engineers. This is fine for simple installations, but where more complicated systems are involved or specific commissioning and performance tests are required, their management and execution may not be adequate. Careful specification of the requirements within the design documentation is required when tendering the installation work. This is all too often ignored or given insufficient time and effort which inevitably creates problems later in the construction process.

LARGER PROJECTS

On larger projects the method of procuring the commissioning specialist can take many forms. In traditional forms of contract it can again be via the main contractor/services contractor, however, in construction management or similar forms of contract, a specialist commissioning contractor is often appointed. This commissioning contractor normally fulfils one of two roles. The role of managing the testing and commissioning process, (the actual work being done by the installation contractors as detailed for small projects above), or, the role of undertaking the commissioning work. In this latter role, the point of delineation for testing/commissioning between the installation contractor and the commissioning contractor is usually at the end of static testing and the start of dynamic testing. See below for a definition of these terms. This latter role is gaining in popularity for the following reasons:

- It provides a degree of independence to the commissioning process

- The commissioning contractor is under the control of the construction manager/managing contractor and reports directly to them, giving greater control and transparency to the process.

In either role, the benefit to the project is that the commissioning contractor can be brought in to the project very early to manage the whole testing and commissioning process.

8.3 ROLE OF THE COMMISSIONING CONTRACTOR

Below are some of the activities that can be included within the scope of work for the commissioning contractor.

- Review the design drawings near the end of design to ensure familiarity with the design intent and to add their expertise in to the commissionability of a scheme.
- Ensure that the testing and commissioning is correctly specified in the tender documentation.
- Review the services contractors' working drawings for commissionability
- Set up the testing and commissioning documentation to create consistency between the various contractors
- Define the method, media type, style and content of the As Installed information to create consistency between the various contractors.
- Manage the specialist equipment manufacturers' tests
- Liaise with Building Control and other organisations for witnessing of relevant statutory tests, (including insurers tests)

All of these functions are often given insufficient thought on projects, so if they are not to form part of the commissioning contractors brief, then it should be recognized that some other part of the project team should undertake this work.

8.4 THE TESTING & COMMISSIONING PROCESS AND ITS PROGRAMMING

It is important for the project manager to understand the differences between the terms *testing*, *commissioning* and *performance testing*, and for him to ensure that the programme has sufficient time within it to enable these activities to be undertaken. Unfortunately, with this stage of the project being so close to handover, there is often pressure to gain time by shortening the testing, commissioning and performance/environmental testing programme. This should be strongly resisted. Rarely, if ever, after the project will such an opportunity exist to fully test the services to ensure that they work individually, as a system, and, that they work under part load and full load conditions. Many problems with respect to the under performance of services within an occupied building can be related back to either insufficient quality in the testing and commissioning, or, insufficient time to test and commission.

It should also be borne in mind that various statutory services will need to be demonstrated to Engineering Inspectors, and insurers. Time should be allowed for within the programme since these activities are often taken as separate tests after the main commissioning has been undertaken.

8.5 DIFFERENCES BETWEEN TESTING AND COMMISSIONING

TESTING

During the services installation various testing will be undertaken known as “static testing”. This testing is normally undertaken to prove the quality and workmanship of the installation. Such work is undertaken before a certificate is issued to “enliven” (i.e. to make live) services whether electrically or otherwise. Examples of such are

- Pressure testing ductwork and pipework
- Undertaking resistance checks on cabling

COMMISSIONING

Upon completion of the static testing, dynamic testing commences, this being the commissioning. Commissioning is undertaken to prove that the systems operate and perform to the design intent and specification. This work is extensive and normally commences by issuing a certificate permitting the installation to be made "live", i.e. electrical power on. After initial tests of phase rotation on the electrical installation and checking fan/pump rotation (in the correct direction), the more recognised commissioning activities of balancing, volume testing, load bank testing, etc. begin.

PERFORMANCE TESTING

Upon completion of the commissioning, performance testing can commence. Some may not distinguish between commissioning and performance testing. However, for programming purposes it is worth distinguishing the difference between commissioning plant as individual systems and undertaking tests of all plant systems together, known as performance testing, (and including environmental testing). Sometimes this performance testing is undertaken once the client has occupied the facility, e.g. for the first year because systems are dependent upon different weather conditions. In such cases, arrangements for contractor access after handover to fine-tune the services in response to changing demands must be made.

However, for some facilities it is desirable, if not demanded, to simulate the various conditions expected to prove that the plant systems and controls operate prior to handover, e.g. computer rooms.

MAIN TASKS TO BE UNDERTAKEN

To assist the project manager the following has been provided to summarise the main tasks to be carried out during the three main stages of pre-construction, construction and post-construction:

PRE-CONSTRUCTION

The following items will need to be confirmed:

- The consultants/Client recognise engineering services commissioning as a distinct phase in the construction process which has an important interface with Client commissioning (see Chapter 7).
- The relevant consultants identify all services to be commissioned and define the responsibility split for commissioning between designers, contractor, manufacturer and Client. Responsibility for specialised

plant/services is defined early, particularly 'wear and tear' and the cost of consumables, fuel, power, water, etc.

- The services designers, and commissioning contractor if relevant, audit the final layout drawings to ensure that they make provision for the systems to be commissioned in accordance with the relevant codes of practice.
- The consultants/Client, and commissioning contractor if relevant, identify all required statutory and insurance approvals relating to services commissioning, and see that plans are made for meeting requirements and obtaining the approvals
- That the Client understands the importance of the presence of his own maintenance/engineering department/maintenance contractor during the commissioning process
- That the Client considers whether an aftercare engineer needs to be appointed to support the Client/user in the first 6–12 months of occupancy.
- There is a programme showing the time-scale and sequence of commissioning and testing and handover events, system by system; this is essential.
- Arrangements are made to ensure that one person only is responsible for control and management of the Client's role in commissioning of services. This could be the Client's commissioning officer or the project manager, who should be a member of the Client's team defined in Chapter 7. Although this does not preclude more than one person having the benefit of witnessing the commissioning process.
- The contract documents *must* make adequate provision for testing, commissioning and performance testing

CONSTRUCTION AND POST-CONSTRUCTION

- The consultants must inspect the work for which they have design responsibility, and report on progress and compliance with contract provisions, highlighting any corrective action necessary. A commissioning management specialist may be appointed to carry out much of this work.
- There must be confirmation that all the contractor's construction programmes include commissioning activities and that they are properly related to preceding construction activities. Activities must be complete, timings reasonable and compatible with planned handover, and properly related to preceding activities.

- Co-ordination of the consultants' arrangements is required for Client involvement in or observation of contractors' commissioning against contract arrangements.
- Monitoring and reporting progress of commissioning will be carried out to ensure that activities start as scheduled and that the requirements for completion before handover are met. Corrective action will have to be initiated as necessary. It is important that commissioning activity durations do not become eroded due to late or incomplete construction work.
- All 'completed construction' documents should be in place before commissioning an individual system commences, e.g. cleaning out, testing the electrical power and controls to it. Also, the requirements of 'permits to work', health and safety at work should be met; and responsibility for insurance should be clearly defined.
- Statutory/insurance tests should be arranged and undertaken, witnessed by the relevant authority, e.g. Engineering Inspectors, Utility Companies, Fire Brigade, Insurers, etc.
- Commissioning records, e.g. test results, calibration requirements, certificates and checklists must be properly maintained and copies bound into the Operating and Maintenance (O&M) manuals or in separate commissioning manuals to form part of the official handover documentation.
- O&M manuals, 'as installed' record drawings and Client's staff training have to be provided by the contractor as required under the contract, although it is recommended that these are fully coordinated by others, e.g. the commissioning contractor, if appointed.
- Adopting agreed structure and software for O&M manuals with copy disks provided for ease of updating
- Record drawings being provided in CAD format for ease of updating
- Using video recordings during Client training sessions for subsequent repeat visual reference and to assist new maintenance staff advance along the learning curve.

CHAPTER 9

COMPLETION, HANDOVER AND OCCUPATION STAGE

CLIENT'S OBJECTIVES

At this stage the client's aims include agreeing to a handover plan and schedule and client/supplier responsibilities, especially in terms of criteria for acceptance, provision of necessary project documentation, and defects liability; commissioning arrangements, and any instructions as to future occupation. The Client is also to agree and implement handover method and agree defect rectification plan if necessary and transfer of documentation. Also initial post occupancy review may be undertaken at this stage to highlight any immediate issues for rectification.

9.1 COMPLETION (for more detail see Manuals M5 & M7)

Completion and handover are very much interlinked. This is the final stage of work executed by the contractors and consultants prior to acceptance of the facility by the Client They are carried out under the continued co-ordination and supervision of the project manager, in close working relationship with the consultants. The project manager maintains required liaison between and acts on behalf of the parties concerned (e.g. Client/user). Occupation organised by the Client's occupation co-coordinator is usually preceded by an accommodation schedule of works which can consume anything up to 3% of the construction budget. These works may or may not involve the Design

Consultants and may be managed by the Project Manager or by the Client's accommodation manager.

9.2 PROJECT MANAGEMENT ACTIONS

This stage marks the end of the main construction works, and involves the project manager in a number of activities to successfully terminate the construction contract.

- Ensuring the contract administrator has inspected the works and, if appropriate, has issued the Certificate of Practical Completion. Attached to the Certificate should be a list of outstanding snags and exclusions together with a statement of the timescale for their final completion. The project manager needs to ensure completion of these final items does not cause disruption to the client's use of the end product.
- Issue of the '*Certificate of Practical Completion*' marks a transfer of responsibility for the end product from the contractor to the client. The project manager needs to ensure the client is prepared for the insurance and security implications of this change of responsibility.
- A Certificate marking the completion of part of the works can be issued at any time during the project. Sectional completion is used for the early handover of part of the end product, e.g. a computer room.
- Following issue of the Certificate of Practical Completion, the project manager should ensure the final account process for the completion works is concluded with the contractor as rapidly as possible. The final account is a reconciliation of the tendered works and the scope of the works finally instructed, and takes account of variations to the contract issued during the course of the project. While assessment of the cost and time implications of these contractual entitlements is initially made by the Contract Administrator, in the event of the contractor being unhappy at the proposed settlement, the project manager will be called to arbitrate.
- The final account process involves consideration of claims for additional monies and time made outside of the contract. The project manager, who will make a recommendation to the client for any

awards, will consider these claims for consequential loss. The project manager has a duty to monitor the legal liability of the client throughout the construction work.

- Ensure that during the '*Defects Liability Period*' there is a system in place for the client to report defects and for the contractor to carry out rectification works. At the end of the defects period, the project manager should ensure the Contract Administrator carries out a final inspection and, if appropriate, issue the Final Certificate.
- At '*Practical Completion*' a number of significant documents are handed over from the contractor to the client. The project manager needs, on behalf of the client, to ensure firstly, that these documents are available and secondly, that they are to the necessary quality.
 - The project's Health and Safety File
 - 'As built' drawings together with all relevant specifications, etc.
 - Operation and maintenance manual, consisting of details of maintenance schedules, operating instructions, manufacture's details.
 - Warranties and guarantees from suppliers.
 - Copies of Statutory Authority approvals and consents
 - Test and commissioning documentation

9.3 ACTIONS BY CONSULTANTS

Consultants should carry out the following actions:

- Inspect, as appropriate, the work for which they have design responsibility and report to the design team leader, with copy to the project manager, on progress and compliance with contract provisions, highlighting any corrective action to be taken.
- Inspect work at the practical completion stage, produce the outstanding work schedule and sign off, certifying, subject to completion of works listed in the schedule. As a general rule, a certificate of practical completion should not be issued if there are incomplete or defective works outstanding.

- Modern air conditioned facilities and control systems require a full range of external temperatures and full occupation to test their adequacy and stability, i.e. summer and winter working. Certificates of Practical Completion should therefore be qualified and inevitably some final commissioning will take place to services after occupation but before the issue of a final certificate.
- Inspect the work at the end of the contract defects liability period, compile defects schedule and subsequently confirm that: (1) all defects have been rectified; (2) any omissions have been made good; (3) all necessary repairs have been carried out.

9.4 PLANNING AND SCHEDULING HANDOVER

The overall objective is to schedule the required activities to achieve a co-ordinated and satisfactory completion of all work phases within the cost plan. This has to be meshed with the logistical planning of the Client's occupation coordinator and any accommodation schedule of work to be completed prior to occupation.

Generally, construction projects can be subject to phased (sectional), as well as practical completion. The relevant procedures applied depend on the nature and complexity of the project, and/or requirements of the users. In effect, phased completion means the practical completion for each specific phase of construction. However, this must not:

- prevent or hinder any party from commencing, continuing or completing their contractual obligations
- interfere with the effective operation of any plant or services installations

In cases of phased completion handover, the user/tenant is usually responsible for insuring the works concerned. Upon practical completion handover, the whole of the insurance premium becomes the users' responsibility.

9.5 PROCEDURES

The actual practical completion and handover procedures applicable to a specific project will be detailed by the project manager in the handbook for the project concerned. However, the main aspects of completion and handover will generally cover the minutiae of the following activities:

- Preparation of lists identifying deficiencies, e.g. unfinished work, frost damage, and materials, goods, and workmanship not in accordance with standards.
- All remedial and completion work carried out within the specified time under the direct supervision of nominated qualified and experienced personnel.
- Monitoring and supervising completion and handover against the schedule.
- The provision of the required number of:
 - copies of the health and safety file
 - 'as built' and 'installed' record drawings, plans, schedules, specifications, performance data and tests results
 - commissioning and test reports, calibration records, operating and maintenance manuals, including related health, safety and emergency procedures
 - planned maintenance schedules and specialist manufacturers' working instructions
- Monitoring proposals for the training of engineering and services staff and assistance in the actual implementation of agreed schemes.
- Ensuring that handover takes place when all statutory inspections and approvals are satisfactorily completed but does not take place if the Client/tenant cannot have beneficial use of the facility, i.e. not before specified defects are made good, indicating likely consequences and drawbacks of premature occupation.
- Setting up procedures to monitor and supervise any post-handover works, which do not form part of the main contract, and to monitor the defects liability period.
- Initiating, in close co-operation with the relevant consultants contra-charging measures in cases of difficulties with completing outstanding works or making good any defects.
- Monitoring progress of final accounts by assisting in any controversial aspects or disputes, and by ascertaining that draft final accounts are available on time and are accurate.

- Reviewing progress at regular intervals, to facilitate a successful final inspection, and the issuing of a final certificate.
- Establishing the plan for post-completion project evaluation and feedback from the parties to the contract for the post-completion review project close-out report.

9.6 CLIENT COMMISSIONING AND OCCUPATION

Having accepted the constructed structure from the contractor at practical completion, the client has to finally prepare the facilities ready for occupation. This stage of the project life cycle comprises 3 major groups of tasks; client accommodation works, operational commissioning and migration.

In order to allow as much time as possible for the client organisation to develop their detailed requirements, or to reflect their latest business 'shape', it is common for the client to organise a further project to carry out accommodation works. It is likely the project manager will be involved to manage the project team established to carry out these works. Often this team will be separate from the main project team and will comprise personnel with greater experience of operating in a finished project environment.

Typical elements of client accommodation works for an office building would be:

- Fitting out of special areas
 - restaurant/dining areas
 - reception areas
 - training areas
 - Executive areas
 - post rooms
 - vending areas
- Installation of IT systems
 - servers
 - desk top PC's

- telecomms equipment
- fax machine
- audio visual and video conferencing
- Demountable office partitions
 - furniture
 - specialist equipment
 - security systems
 - artwork and planting

9.7 OPERATIONAL COMMISSIONING

The principles of Client commissioning and occupation should be determined at the feasibility and strategy stage. Client commissioning (as with occupation, which usually follows on as a continuous process) is an activity predominantly carried out by the Client's personnel, assisted by the consultants as required.

The objective of Client commissioning is to ensure that the facility is equipped and operating as planned and to the initial concept of the business plan established for the brief. This entails the formation, under the supervision of the Client's occupation co-coordinator, of an operating team early in the project so that requirements can be built into the contract specifications. Ideally, the operating team is formed in time to participate in the design process.

MAIN TASKS

The main tasks are as follows:

- Establishing the operating and occupation objectives in time, cost, quality and performance terms. Consideration must be given to the overall implications of phased commissioning and priorities defined for sectional completions, particular areas/services and security.
- Arranging the appointment of the operating team in liaison with the Client. This is done before or during the detailed design stage, so that appropriate commissioning activities can be readily included in the contract.

- Making sure at budget stage that an appropriate allowance for Client's commissioning costs is made. Accommodation schedule of works can consume as much as 3% of the total construction budget.
- Preparing role and job descriptions (responsibilities, time-scales, outputs) for each member of the operating team. These should be compatible with the construction programme and any other work demands on members of the operating team.
- Co-ordinating the preparation of a Client's commissioning schedule and an action list in liaison with the Client, using a commissioning checklist
- Arranging appropriate access, as necessary, for the operating team and other Client personnel during construction, by suitable modification of the contract documents.
- Arranging co-ordination and liaison with the contractors and the consultants to plan and supervise the engineering services commissioning, e.g. preparation of new work practices manuals, staff training and recruitment of additional staff if necessary; the format of all commissioning records; renting equipment to meet short-term demands; overtime requirements to meet the procurement plan; meeting the quality and performance standards, all as defined in Chapter 6.
- Considering early appointment/secondment of a member of the Client management team to act as the occupation co-ordinator; this ensures a smooth transition from a construction site to an effectively operated and properly maintained facility.
- Before the new development can be occupied, the client needs to operationally commission various elements of the development. This involves setting to work various systems and preparing staff ready to run the development and its installations.
 - transfer of technology
 - checking voice and data installation are operational
 - stocking and equipping areas such as restaurant
 - training staff for running various systems
 - training staff to run the property
- Also part of the client's operational commissioning is the obtaining of the necessary statutory approvals needed to occupy the building, such as the occupation certificate and the Environmental Health Officer's approval of kitchen areas (if applicable).
- Occupation of developed property is dependent upon detailed planning of the many spaces to be used. For office buildings this space planning process is developed progressively throughout the project life cycle.

Final determination of seating layouts is delayed until the occupation stage in order to accommodate the latent changes to the client's business structure.

A typical space planning process consists of:

- confirming the client's space standards including policy on open plan and cellular offices
- confirming the client's furniture standards
- determining departmental headcount and specific requirements
- determining an organisational model of the client's business, reflecting the operational dependencies and affinities
- develop a building stacking in order to fit the gross space of each department within the overall space of the building
- develop departmental layouts to show how each department fits the space allocated to it
- develop furniture seating layouts in order to allocate individual names to desk

It is essential that for each of these stages the client organisation in the form of User Liaison Groups, has a direct involvement and approves each stage.

- Moving or combining businesses into new premises is a major operation for a client. During the duration of the moves there is potential for significant disruption to the client's business. The longer the move period, the greater the risks to the client. Migration therefore requires a significant level of planning. Often the client will appoint a manager separate from the new building project to take overall responsibility for the migration. For major or critical migrations, the client should consider the use of specialist migration consultants to support their in-house resource.
- During the planning of the migration a number of key strategic issues need to be addressed:
 - determining how the building will be occupied
 - establishing the timing of the moves
 - identifying the key activities involved in the migration and assigning responsible managers
 - determining move groups and sequence of moves to minimize business disruption
 - determining the project structure for managing the move
 - identifying potential risks that could impact on the moves
 - involving and keeping the client's staff informed

As some of these strategic issues could have an impact on the timing and sequencing of the main building works, it is important to address them early in the project life cycle.

- The final part of occupation is the actual move management. This involves the appointment of a removal contractor, planning the detailed tactics of the moves, and supervision of the moves themselves.
- The overall period that the moves will be undertaken over is determined by the amount of 'effects' to be transferred with each member of the staff and by the degree of difficulty of transferring IT systems for each move group.
- A critical decision for the client during the occupation stage is the point at which a freeze is imposed on space planning and no further modifications are accommodated until after migration has been achieved.

It is likely that the factor having most impact on the timing of the freeze date will be the setting up of individual voice and data system profiles.

It would be common for clients to impose an embargo on changes both sides of the migration and for the client then to carry out a post-migration sub-project to introduce all the required changes required by departments.

9.8 CLIENT OCCUPATION

Occupation should follow a very carefully planned logistical schedule managed by the incoming user of the facility following completion of construction. This can be put under the overarching control of the Project Manager or can be headed by an appointed occupation co-coordinator.

Unlike many other project management activities, occupation involves employees themselves and is impacted by the style of management and culture of the user's organisation. Consequently, well-executed planning and their involvement in the process can result in better management/employee relations, bringing a greater feeling of participation and commitment to the workforce.

It is normal to produce an Operational Policy document in the planning stages which is a blueprint for implementation of the business plan. In particular it sets out services which will be kept in house and those services which will be contracted out and how they will be procured.

The arrangements for occupation and migration from one facility to another will, on many projects, be predetermined by space-planning exercises carried out in the initial design stages by the design team or space-planning consultant. The guidance given in this chapter should be put in the context of the overall planning of a Client's needs for a particular facility.

This will follow from:

- strategic analytical briefing
- detailed briefing (departmental level)

And lead to criteria such as:

- quantifying spatial requirements
- physical characteristics for each department/sector
- critical affinity groupings
- extent of amenities
- workspace standards
- office automation strategies
- security/public access
- furniture, fittings and equipment (FF&E) schedules

On complex projects this can be taken one stage further to the production of room data sheets which form the basis of the design brief, equipment transfer or purchase, movement of personnel and facilities management.

The procedure outlined below gives a typical approach, which may need to be interpreted in order to harmonise with the practices and expectations of the users. Nevertheless, change in established practices is encouraged where doing so will smooth the process and make it more effective.

Occupation can be divided into four stages as explained below.

The following services are often outsourced on renewable annual or three year contracts:

- Reception and telephony
- Security

- Cleaning
- Building management and operation of services and equipment
- Maintenance
- IT support
- Catering and waste management
- Landscaping and ground maintenance
- Transport and courier services

STRUCTURE FOR IMPLEMENTATION

Structure for implementation means appointment of individuals and groups to set out the necessary directions, consultation and budget/cost parameters.

SCOPE AND OBJECTIVES

Scope and objectives means deciding what is to be done, considering the possible constraints and reviewing as necessary.

METHODOLOGY

Methodology is how the whole process will be achieved. Identification of individual or groups of special activities and their task lists aimed at defining the parameters and other related matters, e.g. financial implications

ORGANISATION AND CONTROL

Organisation and control means carrying out the process and keeping schedule and budget/cost under review;

The individuals and groups likely to be concerned are as follows:

- **PROJECT EXECUTIVE:** appointed by the Client/tenant at the director/senior management level and responsible for the complete process.
- **OCCUPATION CO-ORDINATOR:** project manager appointed, or existing one confirmed by the 'Client', with 'on the spot' responsibility.
- **OCCUPATION STEERING GROUP:** chaired by the project executive and consisting of occupation co-ordinator and a few selected senior representatives covering the main functional areas. Concerned with all

major decisions but subject to any constraints laid down by the Client, e.g. financial limits.

- **SENIOR REPRESENTATIVES MEETING:** chaired by one of the functional representatives on the occupation steering group and made up of a few senior representatives covering the majority of employees and the occupation co-ordinator.
- **LOCAL REPRESENTATIVE GROUPS:** chaired by manager/supervisor of own group and concerned with providing views related to a particular location or department. Membership to reflect the specific interest of the group at the location.
- **SPECIAL ACTIVITIES MEETINGS:** meetings for individual or group of special activities as identified in 'methodology'. A single person will be made responsible for achieving all the tasks which make up a special activity and will chair the respective meetings.
- **MOVE GROUP:** responsible for the overall direction of the physical move, having been delegated by the occupation steering group, the task of detailed preparation and control of the move programme including its budget/cost.
- **BRIEFING GROUPS:** concerned with effective and regular communication with all employees to provide information to work groups/sections by their own managers or supervisors, so that questions for clarification are encouraged. Special briefings may also be vital, especially during the build-up to occupation.

On many projects, the individuals and groups identified above may be synonymous with those given under Client commissioning, e.g. for commissioning team read occupation steering group and vice versa.

9.9 POST-COMPLETION REVIEW/PROJECT CLOSE-OUT REPORT STAGE

CLIENT'S OBJECTIVES

The client's aims at the closing stage of a project should include:

- To measure performance of all aspects of the project and ensure that the value of the knowledge gained can be carried forward to future projects
- To undertake an initial assessment of the new facility – so as to establish its fitness for purpose and satisfaction of requirements

9.10 POST COMPLETION REVIEW

The objective of the review is to make a thorough assessment of all elements of the project and to draw out or feed back, for the benefit of the Client, the project management practice concerned and other team members, any lessons and conclusions for application to future projects, i.e. what could have been done differently to mutual advantage: This review/report is good practice but should not be regarded as mandatory and may not be required by all Clients. It is worth involving the Design Consultants if only to check that the Client is getting maximum use out of the facilities provided and in particular that operational costs are at an optimum level. The typical review is likely to consist of the following elements.

9.11 PROJECT AUDIT (for more detail see Manual M6)

- Brief description of the objective of the project.
- Summary of any amendments to the original project requirements and their reasons.
- Brief comment on project form of contract and other contractual/agreements provisions. Were they appropriate?
- Organisation structure, its effectiveness and adequacy of expertise/skills available.
- Master schedule – project milestones and key activities high-lighting planned versus actual achievements.
- Unusual developments and difficulties encountered and their solutions.
- Brief summary of any strengths, weaknesses and lessons learned, with an overview of how effectively the project was executed with respect to the designated requirements of:
 - cost
 - scheduling and programming
 - technical competency
 - quality
 - safety, health and environmental aspects
- Was the project brief fulfilled and does the facility meet the Client/user needs? What needs tweaking and how could further improvements be made on a value for money basis?
- Indication of any improvements which could be made in future projects.

9.12 COST AND TIME STUDY

- Effectiveness of:
 - cost and budgetary controls
 - claims procedures
- Authorised and final cost.

- Planned against actual costs (e.g. S-curves) and analysis of original and final budget.
- Impact of claims.
- Maintenance of necessary records to enable the financial close of the project.
- Identification of time extensions and cost differentials resulting from amendments to original requirements and/or other factors.
- Brief analysis of original and final schedules, including stipulated and actual completion date; reasons for any variations.

9.13 HUMAN RESOURCES ASPECTS

- Communication channels and reporting relationships (bottlenecks and their causes).
- Industrial relations problems, if any.
- General assessment and comments on staff welfare, morale and motivation.

9.14 PERFORMANCE STUDY

- Planning and scheduling activities.
- Were procedures correct and controls effective?
- Staff hours summary:
 - breakdown of planned against actual
 - sufficiency of resources to carry out work in an effective manner
- Identification of activities performed in a satisfactory manner and those deemed to have been unsatisfactory.

- Performance rating (confidential) of the consultants and contractors, for future use.

9.15 PROJECT FEEDBACK

Project feedback necessarily reflects the lessons learnt at various stages of the project, including recommendations to the client for future projects. Ideally feedback should be obtained from all of the participants in the Project Team at various stages. If necessary, feedback can be obtained at the end of a key decision making stage (for example, at the completion of each of the 7 stages as outlined in this Code of Practice).

The project feedback form should include:

- Brief description of the project
- Outline of the project team
- Form of contract and value
- Feedback on contract (suitability, administration, incentives etc.)
- Technical design
- Construction methodology
- Comments on the technical solution chosen
- Any technical lessons to be learnt
- Form of consultant appointments
- Comments on consultant appointments
- Project schedule
- Comments on project schedule
- Cost plan
- Comments on cost control
- Change management system
- Values of changes
- Major source(s) of changes/variations
- Over all Risk Management performance
- Overall financial performance
- Communication issues
- Organisational issues
- Comments on client's role/decision making process

- Comments on overall project management including any specific issues
- Other comments
- Close out report

It has to be remembered that the purpose of a project feedback is not just only to express what went wrong and why, but also to observe what has been achieved well, and if (and how) that can be improved in future projects, i.e. continuous improvement .

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