Construction Quantity Surveying

A Practical Guide for the Contractor's QS

Donald Towey

WILEY-BLACKWELL

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Donald Towey,
MRICS

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Preface

This book aims to provide readers with a practical guide and insight into quantity surveying from a main contractor's (the contractor) perspective and allow them to acquire an understanding of the skills and competencies of the contractor's quantity surveyor.

As a result of various procurement pathways open to clients, some contractors are prepared to offer a design and build service and commit to a predetermined budget. As a result, quantity surveying has become a skill in demand by contractors seeking input into contemporary aspects of construction procurement. This includes measurement, estimating, contract administration and construction planning, as well as commercial, cost and project management.

The author's experience of the construction industry includes working practices in both the United Kingdom and Australia, and I have elected to use references based upon UK practice. However, many processes apply internationally, and the book will be of value to readers in any country who recognise quantity surveying as an integral part of the commercial and project management of a contractor's business.

The first chapter discusses the construction industry in general and the following two chapters focus on measurement methodology and the contractor's business respectively, including a discussion on estimating and where the quantity surveyor fits into the process. The remaining chapters have a 'hands on' approach that discusses commercial and contractual management of a construction project, including day-to-day running from commencement through to completion.

Anyone with an interest in the management of construction projects, including students working towards qualifications in construction, building economics, quantity surveying, or any course relevant to the industry, will find the book invaluable as both a learning guide and source of reference.

1 The Construction Industry and the Quantity Surveyor

1.1 The construction industry

The construction industry is a generic term for a service industry that forms part of the nation's economy, carrying out the planning, design, construction, alteration, refurbishment, maintainance, repair and demolition of structures. The industry produces a variety of structures to create the built environment and below is a range of building types together with some relevant examples in brackets:

- Commercial (hotels, retail stores, banks)
- Offices (private and government use)
- Agricultural (farmhouses, mills, barns)
- Education and research (schools, colleges, research facilities)
- Health facilities (hospitals, surgeries)
- Aged care (homes, care centres)
- Government (embassies, prisons, police stations)
- Tenancy and fit-out (stores, offices)
- Defence (military bases, training, storage)
- Vehicle parking (private and public, single and multi-storey)
- Industrial (factories, warehouses, power plants)
- Entertainment and recreation (theatres, halls, stadiums, zoos, sports centres)
- Landscaping and precincts (soft and hard areas)
- Residential dwellings (public and private development)
- Public and civil buildings (town halls, museums, transit stations, including airports, etc)
- Infrastructure (utility services, railways, roads, bridges, tunnels)
- Religious (places and monuments of worship).

According to the Office for National Statistics, the average value of construction output by contractors for the decade 2000–2009 in Great Britain was circa £100 billion per annum at 2005 prices. Of this amount, 62% was for new work

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and 38% for repairs and maintenance. This impressive value represents an increase of 17% over the previous decade, with the percentage split between new and repair/maintenance works remaining constant. Industrial reports indicate that the decade 2010–2019 will see growth, albeit to a lesser extent than witnessed between 2000 and 2009.

The industry has over 300,000 firms employing in excess of 2 million people in a multitude of roles, including suppliers, designers, contractors, manufacturers and those suppliers of goods and services that rely on the industry. The industry is buoyant in terms of economic stability, and offers employment that expands and contracts with the amount of spending by the private and public sectors. In terms of Gross Value Added (GVA), which is the economic measure of the total value of goods and services produced in the national accounts, the industry contributes 7–9% annually and is indeed a giant in terms of the contribution it makes to the national economy and workforce.

1.2 The client's team

A client may be an individual, partnership, group of persons, organisation or business from the public or private sectors that seeks and pays for building works. Public sector means central and local governments and private sector means an individual(s), firm(s) as partnerships and limited or unlimited companies. In general, the client's role is to decide a suitable method of procurement to obtain a building, which involves a series of appointments to create teams tasked with assisting and delivering a project. The client's team is made up of the following:

The design team This team comprises of consultants from a range of backgrounds engaged by a client to specify and design schemes suitable for the client's needs. Any member of the design team may engage second tier consultants with specialist skills to assist with their workload and commitment to the client and project.

The construction team The construction team is on the supply side of the industry, a term used to describe those parties appointed to physically construct a project in accordance with the design requirements. This includes:

- A main contractor (the builder)
- Subcontractors to carry out works for the main contractor
- Material suppliers (including manufacturers)
- Suppliers of plant equipment to assist with the construction operations.

The combination of design team members and a main contractor is often referred to as the building team. Under a traditional procurement arrangement, each building team member has an agreement with the client, with subcontractors and suppliers usually having an arranged dealing with the main contractor only.

The development team Members of a client's development team are an integral part of the client's business, and are appointed to issue advice on technical, financial, legal, research and business planning matters for projects. This team also includes a geotechnical engineer who is engaged to carry out a site investigation (SI) and report on the site conditions below the surface of the ground when a project involves new works or the extension of an existing building. This is to ascertain the type(s) of subsoil(s) and test for the presence of any contamination and, if found, to provide a remedial action plan so that eventually the land is suitable for development. Other members of this team include the client's parent company (that may express an interest for corporate reasons), building maintenance and facilities managers, politicians, heritage and conservation groups and local planning authorities.

Under a traditional procurement route, the client takes a contractual role with the various team members as the employer and Figure 1.1 demonstrates a hierarchy arrangement of appointments.

Selection of team members usually commences with the client vetting referred businesses and then inviting tenders for their services in line with its procurement strategy and project requirements. The exception is the mandatory involvement of authorities, including the local planning authority and statutory or minor groups who have an interest in the project for legal reasons and in the interest of the public.

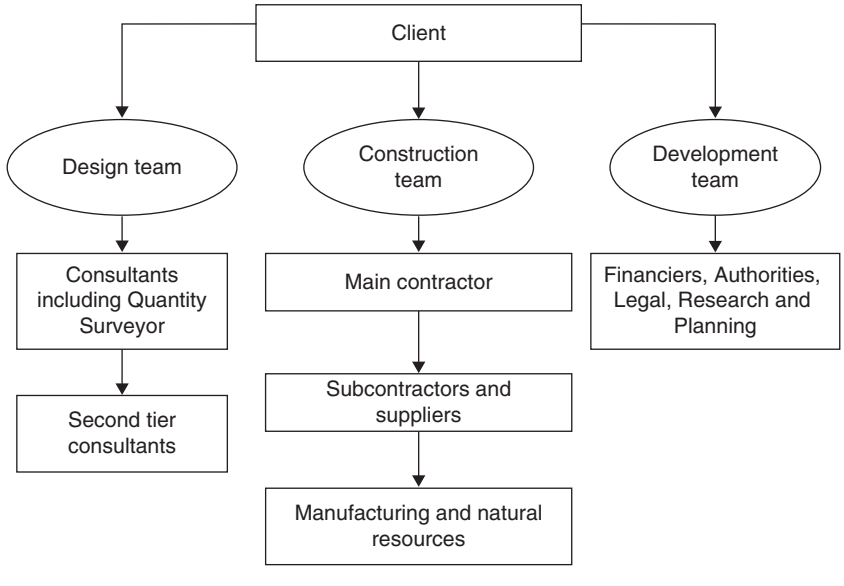

Figure 1.1

A client might be inexperienced with the design and construction process and wish to delegate some responsibility to an intermediary. This has an advantage for the client as it permits it to attend to its own business needs instead of committing resources to oversee a building project. The intermediary might be a project manager within the client's own business or an independent Project Management Company that assigns a project manager to manage the process. The project manager acts as an agent of the client and becomes the single point of contact for the building team, with all communications to the client made via the client's agent. Alternatively, the client's agent could be a member of the design team and possibly also an architect or quantity surveyor, thus serving a dual role. If an intermediary is appointed, other team members engaged are contractually bound to the client and not the intermediary with many forms of contract naming the client as the employer.

1.2.1 The professional quantity surveyor (PQS)

The professional quantity surveyor (PQS) is the client's cost consultant and cost manager for the building process. One of the services on offer to a client is *pre-contract* cost advice, which involves estimating construction costs prior to design for budgeting purposes. Thereafter, the PQS monitors the different stages of design whilst it is developed to compare with the budget, and advises the client's team of changes that impact the budget. Pre-contract services also include the preparation of trade bills of quantities for tendering purposes, vetting of main contractors' tenders, and anticipated cash flow forecasts to pay for the works whilst a project is under construction.

Once the client enters into a binding agreement with a contractor for the works, it triggers the *post-contract* period. Traditional PQS services for this period include cost management and financial certification for interim payments to the main contractor whilst work is in progress, reports on the progression of the project, valuations of changes to the works, and preparation and issue of a final account. In addition, large consultancies expand traditional quantity surveying services to provide their clients with an advisory service and project management, including:

- Recommendation of an appropriate procurement route to suit the type of project
- Risk management, including identification and analysis
- Due diligence reporting by confirming a scope of services provided in a main contractor's tender
- Selection of an appropriate form of contract
- Life-cycle costing options for various types of construction to demonstrate benefits whilst a building is occupied
- Advice on dispute resolution services if there is conflict of opinion with a contractor
- Business feasibility studies to assess the viability of a scheme prior to design

- Acting as client's/employer's agent under the title of project manager
- Certification of buildings with Energy Performance Certificates (EPC)
- Construction Design and Management Regulations (CDM) coordinator with health and safety.

The PQS may be a sole practitioner, in a partnership or operate as part of a large consultancy. To qualify, a professional needs to hold an academic degree and/or is a member of the Royal Institution of Chartered Surveyors (RICS). The RICS is the leading international body that regulates members and firms to ensure that ethics and professional conduct are maintained. Professional members are termed 'Chartered Quantity Surveyors' with the institution having the largest network of quantity surveyors worldwide. The PQS is a design team member and consultant, not to be confused with the quantity surveyor employed by a main contractor who is a commercial member for the supply side of the industry.

1.2.2 Architect

Architects usually operate from a professional practice. They are responsible for developing and coordinating a building design to ensure it is compatible with other consultants' designs, and report to a client or client's agent on the progress. An architectural practice comprises design members who create site and block plans and drawings showing elevations, plans and cross-sections of buildings. In general, a design commences from a client's brief which outlines the requirements of a project in the early stages and is conventionally produced with ink on paper or other material in schematic and sketch form. Thereafter, the design is developed using computer-aided design (CAD) software to produce details for building components that are provided on smaller-scale drawings read in conjunction with trade and product specifications drafted by the architect. Detailed drawings include cross-sections of walls, frames, roofs, etc, that show a vertical plane through the construction detail giving critical dimensions. Drawings may also demonstrate how information shown on large-scale drawings fits together as components in the final product, e.g. joinery products, junctions with ceilings and walls, etc. An architect will have an advanced building design appraised to ensure it complies with the Building Regulations and may appoint a specialist to provide certification. In addition, a building surveyor, who is preferably a member of the RICS Building and Surveying Professional Group, might be engaged if work involves the management of real estate assets such as heritage works. This is to assist the architect with the progression of the design or, alternatively, a client may decide to appoint the surveyor separately who will liaise with the architect.

Separate to building designs, an architect might design external works for a building and issue drawings and specifications that show:

- Ornamental screen walling
- fencing

- Paths, paved areas and car parking
- Hard landscaping schemes including public footways and cycle paths
- Soft landscaping schemes that encompass turf, grass, shrub and tree planting.

Some aspects of hard and soft landscaping schemes, however, may be designed by a landscape architect appointed separately by the client.

Independent and commercial architectural practices are usually members of the Royal Institute of British Architects (RIBA), which is a professional body representing architectural designers of the built environment. The accreditation is also available to individuals who must complete a recognised qualification with a minimum of five years' academic study. In Scotland, the Royal Incorporation of Architects in Scotland (RIAS) is the professional body for architecture and works closely with the RIBA to promote membership.

1.2.3 Structural engineer

When a new building is designed by an architect, the design is issued to a structural engineer for a structural appraisal. When appraising the plans, the engineer creates a structural design as a replica of the architectural proposals to provide hidden strength to a building through the foundations, walls, floor and roof, as well as product specifications to ensure a building is suitable for the intended use. When considering a type of foundation and substructure design, the engineer refers to the ground conditions obtained in the report from a geotechnical engineer. Above ground, architecturally-designed elements are analysed to confirm the suitability for the building. This involves reviewing architectural information using skill and judgement to enable the creation of suitable structural criteria. The review process considers the size, shape and functional use of a building, together with health and safety practices for construction purposes and compliance with the Building Regulations. In general, after a structural design is complete, the engineer issues the information to the architect, which may include recommendations for architectural modifications to suit the proposal. For example, walls or floors might need to be thicker than the architect's proposals in order to withstand structural stresses. In addition, the engineer may design temporary support structures, such as shoring, which is a system of bracing to stabilise existing buildings and surrounding structures so they do not collapse whilst new works are in progress. If a building is to be refurbished with the works affecting structural integrity, the structural engineer will assess the stresses imposed on existing building elements and design permanent or temporary works to suit.

During the construction phase of a project, a structural engineer reviews shop drawings provided by fabricators and checks the details for precision, accuracy and quality to permit the assembly or installation of the product into the works on site. Furthermore, the engineer carries out independent tests and reviews test results submitted by installers of installed works and has the authority to enforce the design and specification and instruct the removal and making good of any unacceptable works.

To qualify as a Chartered Structural Engineer, the Institution of Structural Engineers requires its members to undergo key stages of education and training. This involves obtaining an accredited degree and following a training programme to bridge any gap between the qualification and experience, known as the period of Initial Professional Development (IPD). At the end of this period, the graduate attends a Professional Review Interview (PRI), which must be passed together with an entry examination in order to obtain chartered status. Alternative routes apply for those who possess appropriate qualifications and have suitable experience.

1.2.4 Civil engineer

Civil engineering embraces new structures and the maintenance of existing ones in the built environment. The work also covers non-structural work, including bulk earthworks and remediation of contaminated land so that it is suitable for development.

When a new structure of a civil engineering nature is required, the civil engineer is engaged to design a scheme and write a specification for a scope of works with due concern for public protection and the environment. In addition, the service generally involves:

- Providing finished levels in relation to ground and construction items
- Issuing set-out information for the works
- Assessing tenders from contractors
- Obtaining permits
- Attending public meetings
- Supervising works in progress.

During the construction phase, the civil engineer enforces design and specification criteria and can instruct the removal of defective work for replacement in accordance with the requirements. Once a project involving a new structure is complete, it triggers a maintenance period which a contractor must oversee until the structure is transferred to an adopting authority such as local authority or other owner. For this reason, the civil engineer will work closely with the contractor and adopting authority to ensure the design and constructed works comply with the requirements to aid a smooth transfer upon the expiry of the maintenance period.

Where a project is solely engineered without requirements for a building, such as bridge structure or land remediation, the engineer takes the role of employer's agent under the title engineer or to that stated in the contract. In essence, what a project manager is to a client in a building contract as a client's agent, the engineer is the equivalent in an engineering contract.

A qualified civil engineer may be chartered and a Member of the Institution of Civil Engineers (MICE), holding a degree in civil engineering which provides a stepping-stone to other aspects of engineering.

1.2.5 Service engineers

Service engineering includes methods of supplying, installing and commissioning a system to permit utility service providers to distribute power, water and gas in a building. The term also embraces drainage, fire protection, mechanical air systems, transportation, machinery and a range of specialist services used for fitting out a building. In general, building services can account for about 30% of the cost of a project, and as the quantity surveyor is involved with cost, there is a need that he/she understands the scope that contributes to this proportion.

Electrical engineers These engineers specify and design schemes to distribute electricity for power, lighting, security, heating, information technology and communication systems in buildings. Furthermore, the discipline includes lighting for external works and methods of obtaining power supply to a building from the mains supply.

Plumbing or hydraulic engineers This engineering discipline involves the design and specification of water and gas supplies, heating and building drainage systems within buildings, as well as solar-controlled plant machinery for producing hot water supplies.

Fire protection services engineers These engineers author a fire-engineering report to identify potential fire, smoke and heat hazards and/or design, and write specifications for a building design so that it complies with a fire-engineering report. Designed schemes include active and passive measures incorporated into a building design to protect the structure, contents and occupants from the effects of fire, smoke and heat. Active measures include sprinklers, fire blankets, hydrants and hand portable extinguishers, and passive measures are architecturally-based, including doors, partitions and escape routes. Hydrants for use by the fire brigade may fall under the category of water services and possibly are included in the water supply design provided by the hydraulics engineer.

Mechanical and air conditioning engineers These engineers provide a design and specification for naturally-flowing and fan air-assisted systems to provide a building with a suitable atmospheric pressure as well as adequate heating, ventilation and air conditioning (HVAC). HVAC refers to technology that provides suitable air changes and thermal comfort to a building's internal environment.

Transportation systems engineers Engineers under this category create designs and specifications for lifts and escalators for vertical, horizontal and inclined movement in buildings to deal with a stream of people or products transported by the building's occupants.

Other engineers There is a range of other engineers who provide designs and specifications for works of a specific nature that are often project specific. These include:

- Waste-disposal systems
- Solar heating

- Oil-fired heating systems
- District heating for distributing mass generated heat (gas, cogeneration or solar) from a source to a number of buildings simultaneously
- Types of mechanical plant for specific use, e.g. cleaning swimming pools.

As with other engineering disciplines, chartered status affirms credibility and is gained by the successful completion of recognised courses that measure knowledge, competence and practical training. Large service engineering companies may employ their own quantity surveyors who are usually engineers trained within the appropriate field of engineering and acquire the position after completing a course of training in commercial management.

1.2.6 Main contractor

In general, a main contractor constructs a project in accordance with a binding agreement it has with a client. The main contractor does not normally carry out all of the works itself and will subcontract most trade works often without client involvement, thus giving the contractor the main role in procuring, constructing and delivering a scheme. Standard forms of contract generally omit the title 'Main' and recognise the capacity as 'Contractor'. The main contractor's role involves:

- Site-management duties and providing site accommodation comprising offices and amenities for personnel and operatives engaged on the site
- Managing health and safety procedures
- Coordinating, planning and supervising construction works
- Reporting periodically to the client and coordinating with the client's team where necessary
- Ensuring budgets are maintained
- Implementing a method of quality control to ensure works are achieved in accordance with the drawings, specification and conditions of contract.

Contracting companies vary in size, and range from small businesses employing a minimum number of people to suit the needs of the business to larger local, national, and international companies delivering a range of project types. In order to deliver a project, a contractor will need to assign a team. A team representing a main contractor on a large project valued at, say, £5 million is known as the site management or project team and is made up of the following members:

- Project manager in charge
- Site manager
- Structural and finishing trade supervisors
- Health and safety officer
- Quantity surveyor
- General site operatives
- Administration support staff and trainees.

A project of less value might have reduced site management by possibly omitting finishing trade supervisors, leaving supervision to the site and project managers.

The role of the quantity surveyor on a project under construction involves dealing with post-contract activities that differ from the PQS's, who of course is appointed by the client as a consultant and will have dealings with the main contractor's quantity surveyor. Normally, the quantity surveyor is answerable to a commercial and/or project manager, and the role addresses commercial, administrative and contractual responsibilities that include:

- Cost reporting
- Awarding orders to material suppliers and subcontractors
- Ensuring project insurances are current
- Vetting health, safety and environmental submissions from subcontractors for compliance with the contractor's project health and safety plan
- Providing a flow of information to a contractor's supply chain, i.e. material suppliers and subcontractors
- Assessing the price of variations
- Making applications for payment from the client
- Processing payments down the supply chain.

Team members may be qualified chartered building professionals and Members of the Chartered Institute of Building (MCIOB). The CIOB is the leading construction management voice in the construction industry and its members represent a body that has knowledge about the management of the building process.

1.3 Legislation and control of the building process

Whatever the type of building project, design and construction operations must comply with built environment legislation, which is enforced by planning control and appropriate regulatory systems. Generally, if anyone wishes to build, it is necessary to obtain permission from the local authority before commencing works in order to confirm the design and works comply with the law. With small projects, the approval procedure may be straightforward and building owners can seek permission themselves. However, with large projects, the process can be time-consuming and complex, and whoever is seeking a building might appoint a project manager or other professional to manage the procedures. Culturally, it is prudent for the industrial professional involved with planning to be aware of practices, customs and local laws or byelaws relevant to the community where the building is to be constructed. Byelaws are parochial powers granted from central government by an Act of Parliament to local authorities, enabling them to make decisions relevant to the community. Failure to observe byelaws and starting construction works without approval may result in the local authority instructing that the works be demolished.

Minor changes to buildings (usually for residential purposes) are termed Permitted Development and are usually exempt from formal approval. However, it is wise to check with the appropriate local authority about what they consider permissible prior to commencing any works. If approval is required, the process involves seeking clarification of the planning requirements and confirmation that the design complies with the Building Regulations. In addition, whoever carries out the design and building process must affirm a commitment to safe working practices as required by health and safety laws.

1.3.1 Planning approval

When a building undergoes a material change of use from one classification to another, e.g. changing a residential property into commercial premises, appropriate approval is required which is legislated by the Town and Country Planning Act 1990. The approval process commences with an applicant lodging a formal proposal, usually including a set of building plans and elevations, which activates an assessment procedure by the local authority to enable it to arrive at a decision. Part of the process involves assessing the submitted details to ensure the completed building will comply with the Building Regulations and meets legal standards to protect the health and safety of the end user and the public. Certain buildings are exempt from this part of the process, including some temporary buildings and buildings where the public rarely goes. However, it is wise to check the status before carrying out any works, as proof of exemption from the Building Regulations may be required as part of the approval process.

To arrive at a decision, the local authority's assessment takes into account the building process and impact the completed project will have on the built environment. This includes assessing the status of existing public and private buildings, amenities, infrastructure and influence on the Local and Development Framework Plans. These Framework Plans outline a local authority's future long-term controlled changes to an area that are in place when an application is received and which can cover ten years or more. The length of time it takes to issue a response varies with the type of application as well as the local authority's policy and the complexity of the scheme. If the scheme is approved, information is issued to the applicant granting outline planning permission where intent to develop is accepted in principle and subject to further review. This will be received with a sigh of relief to the applicant as it means the scheme is generally accepted and the process of preparing design information can progress beyond that submitted with the application. This stage of the approval process will aid a landowner who wishes to sell a parcel of land for development. This is because outline planning permission is required prior to the sale of land as, without the permission, the land may be worthless.

The second stage of approval is acceptance with reserved matters. This means a scheme can proceed and is subject to a set of terms and conditions that is discharged over time, usually by the end of the construction phase. An example

of this stage of approval would be if an application is lodged seeking permission to construct a building where building plans are submitted without details of an adjacent landscaped area. The local authority's response may be to grant permission to build, with a reserved matter stating the final works must be completed in accordance with the landscape scheme which is yet to be lodged and approved.

The third stage is for full planning or detailed planning permission, which is approval to develop without conditions and, understandably, the favoured outcome. If an application is refused, the applicant may lodge an appeal but this can only be lodged if it relates to specific matters permitted by legislation. These matters include:

- Legalities involving covenants, i.e. the existing ownership of land, buildings or parts thereof not owned by the applicant
- A request to review existing outline planning permission not recognised by the local authority
- Resolution of conflict between outline planning permission and any existing Local and Development Framework Plans.

Until resolution of an appeal, the applicant would be unwise to commence building works as the local authority would probably instruct the removal of anything built and impose fines.

1.3.2 Building Regulations and control

Building Regulations are statutory requirements that seek to provide guidance and define standards for the purpose of designing and constructing buildings. They are contrived with skill to ensure a completed building is constructed with due consideration to the environment and the health and safety of the occupier and public. The current regulations comprise of 14 parts and include items such as structure, ventilation and hygiene. Each part explains standards and requirements for compliance illustrated by explanatory text and diagrams. The Regulations are modified from time to time to reflect changes in legislation, which may apply to any part at any time. The enabling act empowering the Regulations is The Building Act 1984 (England and Wales) that underwent change to become the Building Regulations 2000 (England and Wales). In Scotland, the driving legislation is the Building (Scotland) Act 2003 that steers the Building (Scotland) Regulations 2004.

A contractor constructing a building must ensure works comply with the approved design and implement a method of controlling operations during the construction phase. A diligent and experienced site manager will ensure works in progress are carried out in accordance with an approved design by making regular checks. However, and to ensure compliance with the Regulations, it is necessary for the client or contractor to adopt a level of

control with independent inspections. This is carried out by representatives of the local authority or independent building inspectors in consultation with the contractor's site manager. The representatives of the local authority and inspectors have delegated authority to authorise the destruction and rebuilding of any works that do not comply with the Building Regulations. Under a separate arrangement (usually upon the advice of the client's agent), a client may appoint a clerk of works, who is a skilled tradesman engaged to inspect works in progress. The role is one of inspector only and the clerk cannot issue instructions to the contractor to alter works and can only enforce the contractor's agreement with the client. The clerk can enforce compliance with the Building Regulations if a contractor fails in its duties to construct works that do not comply that may go unnoticed by a building inspector. Usually, it is only the client's agent who can issue an instruction resulting in a variation of the works and who may do so based upon reports from the clerk's inspections. For example, the client's agent might request the opening up of covered works such as a backfilled drainage trench to see if the pipes are encased in concrete as specified and direct the clerk to inspect. Any subsequent instruction by the client's agent based upon the clerk's findings is enforced by the contract because, as a matter of procedure, the parties acknowledge their legal obligation to comply with the Building Regulations. In essence, the clerk of works inspects the works to ensure they comply with the contractual agreement and a building inspector enforces statutory requirements for the Building Regulations. The contractor must face these levels of building control and has a legal obligation to comply with both.

1.3.3 Health and safety

The adoption of a suitable and proactive health and safety system is an important factor for the successful delivery of a project. The positive culture it creates has advantages to a contractor that includes:

- Improved productivity and quality of work
- Lower staff absence and staff turnover
- Reduced insurance premiums
- Promoting good corporate image.

Significant legislation for the United Kingdom construction industry occurred with the introduction of the Health and Safety at Work (etc) Act 1974. Broadly, this Act is a fundamental structure for the encouragement and regulation of general duties and responsibilities of health, safety and welfare applicable to employer, employee, contractor and any persons involved with the workplace. The Act also sets the basis for the establishment of the Health and Safety Executive (HSE) as enforcer of the Act and which is empowered to delegate authority to health and safety inspectors.

The status of health and safety in the industry received a legislative boost in the 1990s with the introduction of the Construction Design and Management Regulations 1994 (CDM 1994) that had the aims of improving safety through the design, construction and occupational phases of a building project. Following the enforcement of CDM 1994, HSE statistics declared a fall in the number of fatalities, major injuries, and injuries that resulted in over three days absenteeism from work, a result arguably arising from the legislation. However, CDM 1994 became the subject of scrutiny by contractors and industrial leaders, including the HSE, because of its bureaucratic approach that appeared to create apathy. The compounding effects of the scrutiny over the years led to its cessation and it was eventually replaced with CDM 2007. This current five-part legislation reduces the complexity of its predecessor, using simplified language for regulations that benchmark rules for working activities lasting longer than 30 days or involving 500 or more person-days.

Under CDM 2007, a CDM coordinator (instead of a planning supervisor as required by CDM 1994) is appointed to oversee safety design management. This new role extends the original duties and includes an expressed obligation for a coordinator to prepare and/or update health and safety files. The coordinator is engaged in the early stages to issue advice to the design team on safety policies as well as information for planning the stages of work. When a project is subject to the rules of CDM, a principal contractor is appointed; this may be the main contractor responsible for delivering the project, or a management contractor in a supervisory capacity that has a responsibility to implement a construction phase health and safety plan. The plan is implemented through written risk assessments and method statements of working operations. Furthermore, the regulations call for good practice, which is achieved by adopting a register of site safety checks as well as the collection of material safety data sheets and the recognition of a hierarchic management structure within a construction company. The role places the onus on the contractor and subcontractors to embrace the use of systems, including the collection of data and reporting procedures, whilst works are in progress.

CDM coordinators are not empowered to approve or check designs, or approve and supervise the principal contractor's construction phase health and safety plan. Neither are they empowered to monitor the works on site as this is the principal contractor's duty. During the construction phase, the principal contractor will liaise with the CDM coordinator regarding ongoing design activity. This is updated by the CDM coordinator whilst the principal contractor supervises the scheme in accordance with the approved plan.

1.4 Industry networking

Networking is an expression of interest in a subject using resources, contacts and advice for growth and development. The use of networking may be for personal gain or benefit to the industry, employer or professional community.

Two significant professional bodies involved in networking in the construction industry are the Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Building (CIOB). The RICS and CIOB have their head offices in the United Kingdom with additional offices worldwide. Professional members of both institutions enjoy the benefits of networking the industry at national and international levels and must comply with the rules of membership.

1.4.1 RICS

The RICS was founded in 1868 and is a regulating body that recognises qualifications in land, property and construction. It has approximately 100,000 professional members worldwide (as at 2011), of which 40% are quantity surveyors. The institution has a number of professional faculties, including Quantity surveying and construction and Project management, which are part of the Built Environment Professional Groups. Other faculties that form part of this group are Building control, Building surveying, and the Dilapidations and Insurance forums. The Institution has aims that:

- Promote research for development
- Regulate and maintain membership ethics and standards
- Carry out market surveys with comments and forecasts for business and governments
- Improve and promote the various professions through educational links
- Publish books appropriate to the business of the RICS.

Approximately one third of members is in the student class. This class offers students career advice, help with studies and networking through RICS matrices to provide an active programme of social and charity events and to build a network of contacts in the industry. Students must have commenced one of the accredited (cognate) courses, which include Higher National Certificates and Diplomas (HNC/HND) or degree courses relevant to the profession which can act as stepping-stones towards chartered status.

The traditional method for obtaining chartered status is along the graduate route and requires candidates to graduate with a cognate degree and complete a structured training programme combined with work experience. Traditionally, a postgraduate commences structured training and experience in order to obtain APC (Assessment of Professional Competence), which is the measure of an acquired qualification linked with practical training and experience in a related field of work, e.g. quantity surveying. Students enrolled on cognate courses can commence the APC pathway whilst studying or in employment, which involves regular meetings with a counsellor who is a member of the RICS. The structured training and work experience minimum timeframe for training is two years. During this time, the student records their training and experience in a logbook and produces a mandatory record

that includes details of professional development. This information is collated and issued as part of a Critical Analysis Report which is issued as a final submission. Subject to the submission being acceptable, the candidate attends a professional interview as a final assessment with an RICS panel to discuss the Report and to test the candidate's understanding of professional practice and ethics. The panel later completes its assessment with either a recommendation for membership or a deferral. If successful, the student is invited to enrol as a Professional Member and, if accepted, receives chartered status and is permitted to use the initials MRICS. Alternative routes to the graduate pathway are Associate, Senior Professional, Adaptation and Academic. The entry requirements for these routes vary and are suitable for persons with various levels of experience and qualifications, or are members of affiliated organisations.

Individuals and companies may apply for chartered status and, once accepted, are bound by the Rules of Conduct for maintaining ethical standards. The RICS is self-regulating and responds to the needs of the profession. Because membership routes may change, those interested in becoming members should become acquainted with current information which is found on the RICS website, www.rics.org.

1.4.2 CIOB

The CIOB has a national and international reputation for excellence in construction matters. The institute places particular emphasis on construction management and the sharing of knowledge with companies, members and clients that influences the way the industry operates. It was founded in London in 1834 as the Builder Society, was incorporated as the Institute of Builders in 1884, changed its name to the Institute of Building in 1965 and was granted Royal Charter in 1980. The total number of individual members is in excess of 47,000 (as at 2011). However, there is capacity for this to expand because of the number of registered Chartered Building Companies that employ consultants and staff who may be eligible for membership.

The traditional route to professional membership is along the graduate route where candidates follow an educational pathway that requires graduation from a cognate degree and training along a Professional Development Programme (PDP). The PDP is a measure of a candidate's educational qualifications combined with practical learning and experience to assess occupational competence. A candidate's education and occupational experience is measured within a framework of support involving a CIOB-approved assessor who reviews and endorses the candidate's assessments. Completion automatically entitles the student to attend a Professional Review where a panel assesses a candidate's industrial and management competence, together with his/her commitment to professionalism. The panel's decision is graded as a pass, conditional pass or deferral. A successful interview allows a candidate to apply for professional membership which, when

granted, permits the professional to use the credentials MCIOB. Alternatives to the graduate route are available to any persons without appropriate qualifications who are company directors, contracts managers or senior managers of appropriate companies and who agree to follow a structured training programme. Other routes are available for persons who are members of organisations affiliated with the CIOB, hold a cognate/non-cognate degree and are industrial professionals working at senior level with a minimum of 10 years' experience.

There is also a two-tier membership system available for technicians who seek admission to the Incorporated and Associate classes. Members admitted to these classes are entitled to use the initials ICIOB and ACIOB respectively. An Incorporated member must be HND- (Higher National Diploma) qualified or have received exemption from the Institute's examinations. An Associate must have acquired HNC (Higher National Certificate) status as well as completing a minimum of two years' working experience. Students may commence learning along an HND or HNC framework and may receive the Institute's grades, which act as an incentive towards attaining chartered status. Current membership criteria and the most recent information can be found on the CIOB's website, www.ciob.org.uk.

Benefits of membership Benefits of membership of the RICS and CIOB include:

- Status and respect from clients and colleagues
- Invitations to seminars to learn about current industrial and business trends
- Legal advice
- Eligibility for assistance from benevolent funds
- Career advice
- Discounts on insurances, software and financial services.

Continual Professional Development (CPD) One of the requirements for professional membership of both the RICS and CIOB is a member's commitment to updating knowledge and skills in order to remain competent using lifelong learning (LLL). Methods of carrying out CPD include attending courses and seminars through work, social activities and invitations from professional bodies and through private learning. To be effective, learning should aim to improve knowledge of subjects that a member considers are important to their employment and profession. Advantages of CPD include:

- It updates and refreshes knowledge from educational courses
- It acts as a catalyst for the learning of new subjects
- It improves competence in business which may provide enhanced employment prospects.

Variance of a work task within a normal working day is not normally part of lifelong learning. However, skills gained through study or coursework to

Table 1.1 Logging and goal setting record for Continual Professional Development

Item	Goal	Current skill level	Required skill level	Learning method	Start date	End date	Learning outcome	CPD hours
1	Maximise business development potential	2	3	7	TBA			
2	Learn principles of teamwork	2	3	6	TBA			
3	Acquire knowledge of IT and the software system to be used on new projects	1	2	4, 7	TBA			

KEY*:*
Skill levels
1 = Limited 2 = Aware 3 = Competent
Learning methods
1 = Day release 2 = Evening course 3 = CPD event 4 = Private study 5 = Internet
6 = Work base project 7 = Employment training 8 = Other
TBA = To be advised

increase competence could be considered sufficient, e.g. training in the use of computer software for improved business acumen. To monitor learning for use as CPD, it would be wise to plan objectives and then focus on methods of obtaining sources to achieve the objectives and logging the achievements once they are learned. To aid the process, the number of learning hours should be recorded – a usual timespan is 20 hours per year, although this is not mandatory. The record should include the title of the subject matter to be learned or updated, objectives, chosen learning method and the considered level of skill before and after the event. There are various methods of recording this information which may be on a computer spreadsheet, or in a diary or a notebook. Table 1.1 demonstrates goal setting and logging objectives for self-learning a number of different CPD events.

1.5 Funding and market drivers

The construction industry relies on funding to spend on developing construction projects and this is obtained from financial reserves derived from the public and private sectors. Public sector funding is generated from accrued local and central government reserves and is obtained by income from various taxations, rates and sell-offs, whereas funds for spending by the private sector are generated from loans, reserves, investments and windfalls.

The various types of project funding and spending for each sector are:

Public

- Government-backed schemes
- Issue of grants
- Defence projects
- Government building upgrades or new works
- Overseas grants (European Union/International Monetary Fund, etc)
- Government stimulus packages.

Private

- Cash reserves and equity
- Private and corporate loans and mortgages
- Company profit and investments
- Insurance works
- Profit withdrawal from the sale of stocks and shares
- Charities
- Religious organisations
- Investment strategies from businesses and individuals
- Land banks, i.e. reserved funds to acquire land to develop property
- Government incentives.

Funding of construction projects in either sector is subject to change, which may be the result of an economic cycle or due to a specific event impacting the national economy. When the economy expands, the construction industry is usually the first to witness expansion as the demand for buildings increases. Conversely, it may be the first to witness decline. When local authorities and central government play positive roles in the stimulus of an economy, they influence industrial output and create interest from other sectors, which increases socio-economic development. An increase in socio-economic development creates an abundance of funds which in turn increases spending that leads to expansion of the construction industry. Neglect or decline, of course, have the reverse effect. In order for central government to monitor growth or decline, it relies on data provided by advisory bodies such as the Office of National Statistics. This data provide a snapshot of the industry at any time with the status generally regarded as a reputable indicator to the strength of the national economy as a whole. This information is often relayed in Treasury reports that could act as catalysts for the funding of public works which act as market drivers.

Market drivers are processes at local and national levels that drive the supply and demand of services for the construction industry and which fluctuate over time. When there is an abundance of contractors, trades and professionals without consumer demand, it leads to lower prices and a surplus to employment requirements with a negative impact on the workforce. By contrast, when consumer demand is high and the supply remains unaltered, prices are driven up and there is a need for additional resources, i.e. more employment. If the supply is increased to meet the demand, it creates equilibrium and the control of prices.

Markets are driven by events and circumstances that influence the level of supply and demand which is linked to spending from the public and private sectors. One such event is an economic recession that triggers a reduction in spending and starves the industry of projects. By comparison, an increase in demand creates a surge of supply, albeit for circumstantial reasons, which is usually for the short term and which may be perceived as a temporary fix to a prolonged problem, such as a lack of overall demand. This can be modified by a correction in the amount of long-term public spending under the control of local and central governments, which contributes to more than half the number of projects undertaken by contractors.

Other market drivers include trading partners in allied industries because the status of one partner can influence another, as found with exports and imports. A positive example of a market driver is the success of the mining sector in the Australian economy, which has enjoyed a resources boom since 2005 due to the remarkable growth of the Chinese economy. China has a high demand for the supply of ore used in the manufacture of iron for conversion into steel to satisfy the needs of her construction industry. The ore is abundant in Australia, leading the way for the material to be mined for export to China. This market driver has boosted the Australian economy and benefited mining

and construction industries as consumer demand for commodities such as housing stock has increased. By default, it also benefits the Chinese steel and construction industries. The luxuries of positive market drivers found in this example include economic security and resilience to recession that lead to employment stability and economic growth and are certainly the basis of a strong economy.

1.6 Economic and construction cycles

The gross output of the construction industry is measured as the sum of completed and uncompleted projects over a specified period captured from data from national statistics. When statistics show an increase in demand for projects, it encourages optimism that leads to confidence and allows businesses to plan ahead with investment strategies. In general, this optimism leads to an increase in the purchase of properties and consumer goods which increases construction output.

The output of the construction industry depends on the national economic cycle at any time and, historically, most cycles run their course over a period of seven to nine years. When growth is sustained at the top of a cycle (or boom), a slowdown eventually occurs, with rising interest rates leading to diminishing share and commodity prices, tighter money and a depressed property market to the bottom of a cycle. Once at the bottom of the cycle, the economy is vulnerable and may trigger a recession (bust) when the economy deteriorates and retracts. A recession is normally short term unless special circumstances entrench the decline. No circumstance in recent times has been as severe as the Global Financial Crisis (GFC) of 2008–2010 that entrenched a recession in various parts of the world. The GFC is an isolated case that impacted on a massive scale. However, it demonstrates what can happen at the bottom of a cycle, making it hard for struggling businesses to survive. Low demand for building work during a recession may mean competition for contracts with businesses working to reduced margins or no profits at all. This exposes businesses to risk in order to obtain cash flow to remain solvent and they may need to rely on short-term borrowing in an attempt to remain in business. The aftermath of a downturn and possible climb from recession starts with a fall in interest rates and continues with rising share values, better commodity prices, easier money available and the eventual increase in property prices back to the top of the cycle. A demonstration of this cycle is shown in Figure 1.2.

Figure 1.2 shows the key characteristics of an economic cycle that are reflected in the construction industry. The pattern of these events can affect investments that drive or diminish the demand for buildings. Falling interest rates encourages more lending and activity for construction work with the opposite in force after a boom. Knowledge of these trends permits developers and design teams to be aware of the likelihood of changes in demand over both

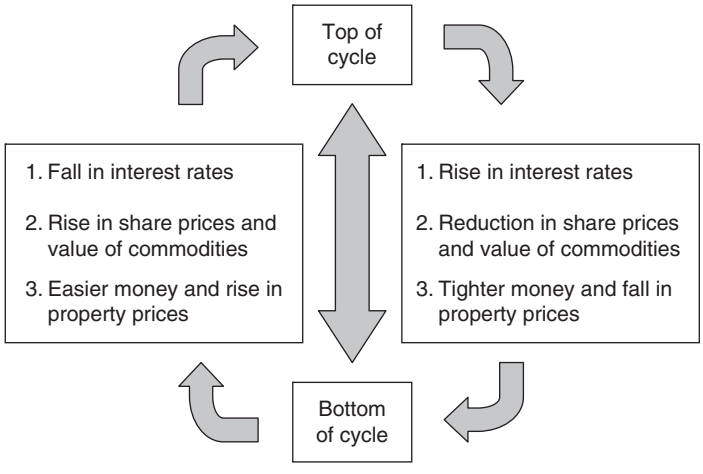

Figure 1.2

long- and short-term periods and to implement strategies for future planning. With this information, decisions can be made around the risks and opportunities available in specific markets to recognise the type of consumer demand that will be in force at given times.

1.7 Global construction

According to a report entitled *Global Construction 2020*, published by Global Perspectives Ltd based on their partnered research with Oxford Economics, the global construction market for 2009 accounted for approximately 13% of world output. This is expected to increase to approximately 15% by 2020, with China predicted to overtake the United States as the world's leading construction market by 2018. For the period 2010–2020, Western economies in general are predicted to see growth, albeit to a lesser extent than that of the previous decade, with a number of non-Western nations predicted to grow at a better rate.

Countries normally rely on their own national companies and citizens as the primary source of construction development and recruitment. However, with an international network of recruitment and professional institution reciprocal agreements in place, foreign involvement in filling skill shortages and corporate investment in projects is becoming widespread. Successful foreign involvement or investment in schemes by companies can lead to the expansion of a business and the opening of overseas branches that raises the corporate profile. Integration by a construction company with the construction industry of another country requires a commitment of time and resources and a risk management strategy is normally carried out by any

business seeking to diversify its interests. This includes an understanding of the following:

- Financial stability of the country
- Performance on completed projects
- Health, safety and environmental attitudes
- Population growth
- Availability of 'home grown' labour skills and material resources
- Political stability of the country
- Cultural working practices
- Existence of corruption
- Legislation with planning and building control
- Currency rates of exchange
- Land availability and terrain
- Sources and status of utility services
- Terrorism and militants
- Communication methods including knowledge of the language
- Climate and volatility of the scheme to natural disasters, i.e. earthquakes, hurricanes, etc
- Set up and/or relocation costs
- Business development potential
- Processing time and availability of working visas for employees who would relocate.

These items are the drivers for realisation and potential of an overseas investment that require careful consideration prior to commitment. With effective strategies and the potential analysed, involvement with overseas business investment may prove worthwhile. A fine example is the company Laing O'Rourke, created when R. O'Rourke and Son bought out John Laing Construction in 2001. Since formation, this company has grown internationally, with offices in the United Kingdom, Ireland, Germany, Canada, India, Hong King and Australia executing projects in building and construction as well as other sectors such as investment and development, manufacturing, infrastructure and support services.

1.8 Development of the quantity surveyor

1.8.1 Background

In 1785, Henry Cooper, the son of a Master Builder, set up Henry Cooper and Sons in Reading, England and in 1799 opened a London office that dealt with measurement and the cost aspects of building works. The mid-19th century saw the use of 'measurers' or 'master tradesmen', who were called upon to assess the amount of materials and labour required for building operations. At this

time, clients employed an architect to design a building and invited builders to submit tenders. There was only one way to assess a cost for a tender and that was to measure the works and apply a rate. The 'measurer' created schedules for competing builders, each of which would apply their own rates to the schedules to create a price. Clients, however, were inquisitive about the cost to construct pre-tender, which set the path to the birth of the independent quantity surveyor who was appointed separate to the architect. The given task for this new entity was to measure and assess the cost of works prior to tender and assess the cost of changes during the construction phase. Demand for this service in the late 19th century led to the expansion and recognition of the role as a profession which, in turn, was set up within the RICS, an institution with a majority of English-speaking members.

The migration of professionals from England has seen the transfer of knowledge and the teaching of techniques on an international scale with global expansion of the profession. This expansion has created quantity surveying institutions in a number of countries with reciprocal agreements in place where each recognises the other's qualification.

The solid foundation of the quantity surveyor's role is based upon a thorough knowledge of construction techniques and competencies to measure works and assess rates that determine a cost. This is linked to the capability of administering contractual and commercial aspects of projects. It would be incorrect to perceive the role of the modern quantity surveyor as one of a mere measurer of materials and trade works, as quantity surveying has expanded to create different job titles that attract additional responsibilities in the process. Responsibilities include the management of financial, contractual and commercial matters that apply both before works commence and during the construction phase, which carries a degree of decision-making obtained from a diverse set of skills. Prior to the role's expansion, there had been a general lack of understanding from other industrial professionals about advice issued by quantity surveyors for cost aspects of a project, as it appeared inconceivable that anyone could provide cost advice without a design. The background for issuing this advice is with the systematic recording of past projects in a database collected by both the PQS and contractors. For the PQS, the role has been perceived by some as one of cost advice only without management of the advice; this created a vacuum resulting in cost overruns, much to the dissatisfaction of clients. It is possible to fill this vacuum with the use of cost planning where the PQS monitors designs prepared by consultants engaged by a client through the various stages of design development to ensure predetermined budgets are maintained. With alternative procurement routes available, clients may bypass this approach by ensuring contractors take responsibility for design and construction costs, thus providing financial certainty to cost advice. Here, the contractor's professional staff acquires knowledge and confidence to provide a package service and can design and build a project to a sensible, predetermined budget that satisfies the client if they do not wish to engage consultants direct.

1.8.2 Personal traits and skills

For those with knowledge of the industry, the role of the quantity surveyor is both recognised and established, yet outside the industry it is not so familiar. So what influences someone to become a quantity surveyor, a title somewhat unfamiliar to the public? The answer could be family influence via a parent or caregiver who is a quantity surveyor or possibly an industrial professional or tradesman who has an entrusted role to provide career advice. Or it might be the result of a review of career study options in school or college or via a friend or network of friends employed in the industry who consider it a suitable role for a certain individual. Traits within a personality may assist with the progression of skills and the details are shown in Figure 1.3.

Traits may be natural and, when assisted by education and experience, can develop as skills. In summary:

- Skills
  (a) A flair for mathematics, figures and geometry is of value because this skill set provides an understanding of measurement and the use of financial calculations. In addition, problem solving and logical reasoning will be of benefit.
  (b) An ability to concentrate for long periods and accepting the office as part of the working environment, which applies on or off a building site.
  (c) Quantity surveyors require good literacy and concise communication skills, including a good command of oral and written techniques and the ability to use information technology systems. Language for

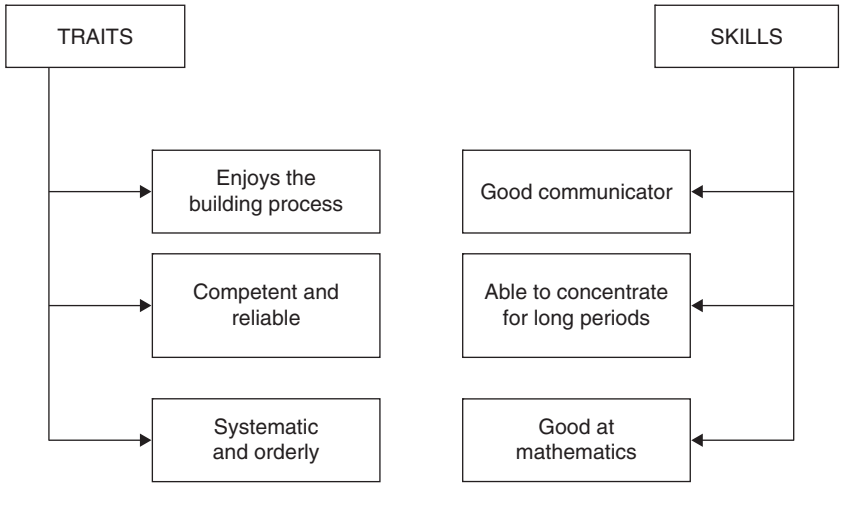

Figure 1.3

reporting on project activities needs to be precise, with an understanding of when and where to use jargon as not all readers may understand every aspect of the professional language used. Where possible the use of diagrams to illustrate points will make better communication than describing something with a thousand words.

- Traits
  (a) Traits also stem from a person who is systematic, orderly and a reliable team member. For example, a quantity surveyor may prepare a bill of quantities that describes trade works for an estimator who relies on the bill to include descriptions and measures that are clearly understood in order to produce an estimate of cost to construct a project.
  (b) Competency stems from a sound knowledge of the building process that embraces materials, customs, construction technology and economic factors. In addition, suitable skills are required to understand the role of industrial relations and the range of disciplines involved for a project. The quantity surveyor requires an understanding of project management and knowledge of contract law including the reasons for a contract to exist which is valuable for the administration of a project.
  (c) Natural prerequisites would be to enjoy the building process, as well as having a thirst for knowledge of building techniques and customs and the ability to thrive being a team member with an attitude of wanting to learn.

1.8.3 Time and self-management

Construction projects often develop at a fast pace and often there is need for anyone involved with managing a scheme to time manage effectively in order to achieve desired objectives. Effective time- and self-management creates good working habits and helps to develop a mindset for overcoming obstacles which is important if deadlines are to be met. The following tips are aimed for individual use to assist in achieving a desirable outcome on any active working schedule.

- Clear the working desk of clutter and organise the workspace with documents in order of priority. This also applies to electronic filing and storage.
- Avoid keeping documents as attachments in emails by storing them in a project file on a computer as quickly as possible after receipt. This reduces the chance of losing any documents when deleting emails. It also eases the burden of responsibility of being the only recipient of information.
- Make use of management tools by creating 'to-do' and priority lists and using a calendar for logging events in advance. With a calendar, a maximum of two weeks in advance would be sufficient because anything longer requires flexibility.

- Give yourself small self rewards after completing any of the management tool items.
- Plan and set realistic goals by starting with the small items and breaking each into smaller steps that progressively lead to the desired goal.
- Be efficient and plan each day by filling gaps of time with small items of work that can be completed easily.
- Go with your internal clock and, if a morning person, get in early and finish on time.
- If in full swing on a task, go with it, see it through and capitalise on the motivation.
- Work on a day-to-day basis and deal with matters that need completing within the day. Where this is not possible, either draw a line in the sand or phase the work and completely finish one section before commencing the next.
- Remove distractions and stay focused on the subject. Jumping from one task to another is not advantageous.
- Learn to be concise and create the self-confidence to be able to make quick decisions.
- Do not over-commit or be afraid to say no.
- Overcome procrastination by doing the hardest things first. They will have to be faced at some time and, once they are out of the way, the easier things will usually become easier.
- Recognise and change any negative thoughts about a task by anticipating the enjoyment and relief in getting the job done.
- Use effective delegation when possible. Ensure you communicate intent with the person or persons you wish to delegate to instead of dumping any workload on them without prior notice.

Applying some or all of these tips will create effective time management as it is certainly better to work smart and produce more than to work hard and provide less.

1.8.4 Education and training

Generally, students commence a course of studies lasting for a period of four years, following a set curriculum to achieve a university degree. Early semesters revolve around core subjects of construction technology, industrial relations, management, building materials, contract law, quantity surveying and building services to provide the student with an understanding of construction at a technical level. Thereafter, training becomes more in depth and to an advanced level, dealing with the specifics of the core subjects in further detail and involving sub-topics that lead to examinations. Students may be content with only passing a degree or may seek chartered status in addition to a qualification. There is an abundance of degree courses available in the United Kingdom recognised by the RICS and CIOB as a pathway for achieving

chartered status. If the aim is for chartered status with the RICS or CIOB, students need to be aware of the appropriate degrees because the decision to transfer or leave partway through a course could be costly in terms of both time and money. If seeking chartered status, students may elect to begin a probation period set by the appropriate professional bodies whilst on a degree course. The subject of achieving chartered status with the RICS or CIOB is discussed in Section 1.4 above.

1.9 Construction innovation and the quantity surveyor

Since the 1990s, probably the most salient features of innovation influencing the construction industry have been the growth of information technology and changes in environmental attitudes. As these subjects change regularly, it is in the interest of the quantity surveyor and others engaged in the industry to remain innovative by exploiting CPD to its full potential. This is required in order to keep abreast of continuous growth in these subjects as they influence the way we work and the buildings that are produced.

1.9.1 Information technology (IT)

Traditional communication methods for relaying information such as post, fax, meetings, courier, and telephone are still in use and no doubt will remain so. With the growth of IT, modes of communication have expanded from relying on traditional methods and modified the way we work. With the introduction of electronic systems, data is relayed faster which aids the design and construction process, thus saving on the duration of construction projects.

Emails

The simple use of text emails is a part of everyday life for a business and is a suitable method of communication. However, time spent on a computer can take up a lot of time, which can be managed with netiquette. 'Netiquette' is a phrase introduced since the start of the World Wide Web and concerns the social conventions of email dialogue by keeping text concise and clear in order to reduce the time spent on computers. In addition to text, emails are also suitable for issuing files to one or more recipients at the same time. These includes spreadsheets, letters as word documents, presentations, drawings and scanned portable document format (.pdf) files created by Adobe Systems that are included as attachments and opened by anyone with the appropriate software. Emails are also a suitable method for the exchange of drawing information other than scanning. This is possible by using files such as .DWG, .DXF or similar carried out by an interchange within AutoCAD (Computer Aided Design) software systems to transfer graphic programmes, usually with copyright protection. As this has grown in popularity with construction projects,

forms of contract may include conditional clauses on the method of exchanging electronic information to ensure parties act efficiently and responsibly. An obvious advantage of emails is the rapid transfer of information. However, a downside is the size of files sent as attachments because the recipient's capacity must be capable of receiving the sender's information.

Document communication systems

Collaborative document transmission is the distribution of project management information such as drawings, meeting notes and general correspondence through a host network. Once information is uploaded to a selected network, authorised recipients receive an email informing them that the details are available for retrieval. Recipients then log on to the host network using a password to access the information for downloading. Features of the system include tracking and audit trails, search engines by category, calendars, diaries, recorded contact details and the management of formal correspondence, all with 24-hour access. The adoption of the system is discretional and depends on the duration and financial value of a project. If a client considers a collaborative system is viable, the name of the host provider is usually mentioned in the tender documents. This advises potential stakeholders of a client's intention to include a communicative system and for tendering companies to provide suitable training for staff, the cost of which must be included in the tender. For this reason, a collaborative system is suitable for projects where the cost of training is small in proportion to the value of the project. Some host providers for the construction industry can be found on the following sites: www.aconex.com, www.4projects.com and www.dochosting.co.uk.

Project management planning

Construction project managers make use of Microsoft Project, a software programme designed to assist with the planning of time, resources, budgets and tasks on a project. Probably the most commonly-used format for a construction programme is a Gantt chart (named after Henry Gantt, American engineer and inventor of the chart), a horizontal bar chart used to identify project activities and the length of time it takes to start and complete a task. The chart also includes a critical path that follows the duration of activities to be started and completed before the next stage can commence. For example, a programme of works may state a requirement for electrical wiring to be run within partitions and walls. Here, the wiring must be complete before the partitions and walls are lined with plasterboard and the critical dates for starting and completing the wiring create the duration of the critical path. Programming information can be distributed via a hard copy or electronically by email with a scanned copy of the document attached. Alternatively, an electronic file created from the software programme can be issued via email as an attachment, as long as the recipient has Microsoft Project installed as it cannot be opened through any other source.

Cost management systems

These technical and powerful systems produce reports on the status of project expenditure and cost forecasts together with a variety of cost reports. Main contractors use these systems as part of project management reporting, where reports are produced following interaction between the contractor's accounts department and the quantity surveyor, usually on a monthly basis. Software is either purpose-made to include estimating, cost planning and accounting which focuses on a business's specific activities, or can be purchased off the shelf with standard management tools. Purpose-made systems are expensive to purchase and install and take time to produce whereas readily-available systems have become relatively inexpensive due to the growth of information technology and the number of cost management systems available from software suppliers.

Video and teleconferencing

Visual and audio systems permit people in different buildings or locations to communicate over the telephone in a live meeting with the option to link audio communication to a projector and screen for visualisation. The popularity and practical use of this system mean they are widely used in boardrooms, meeting rooms and auditoriums.

Webcams

Webcams can be used to video record construction activity with cameras placed in strategic locations on construction sites for optimum viewing. The use of webcams for office use has become outdated due to the high-quality teleconferencing equipment now available.

Conference displays

Illustrations, graphics, charts and text can,with the use of systems such as Microsoft PowerPoint, be used in a commercial presentation which displays information on to a screen. Presenters can navigate between files throughout the presentation and provide a running commentary. For maximum effect, it is usual for presenters to plan and prepare the information beforehand.

Forums

This is a type of networking which involves discussion groups where bloggers meet online and log topics of interest. Bloggers share ideas, raise subject matters and ask advice from other bloggers who leave their comments in response. The RICS has a forum where information is shared between members.

E-tendering

This tendering system is an electronic method of procurement that commences from an invite to tender through to an award of contract. It is paperless,

sustainable and uses quality control and audit tracking in the process. In general, it involves an administrator uploading tender documents to a host website to be downloaded by tendering companies. Completed tenders may be submitted on line or in person, with the preference usually stated in the conditions of tendering. Various levels of security and sophistication exist with e-tender systems for accessing documents and may involve an approach similar to a document communication system in project management. A main difference between the host web provider of a project management system and e-tendering is that e-tendering is usually via the client's own site instead of a collaborative on-line system.

E-tendering has advantages over a paper system as it reduces tender periods, is spontaneous and depletes the need for manually inputting receipt of tenders. To maintain procedural integrity, tendering companies may be requested to pay a fee or (non)refundable deposit to an administrator to cover the cost of the service.

Cloud computing

Clients may employ an architect to draw up a master plan for an office that includes space for a central server. A server backs up and stores information stored on computers in the event of hardware failure. Cloud computing is an alternative to servers where they are replaced with a cloud host which frees up office space. The term 'cloud' is a metaphor and represents a cloud in which a list of providers, such as Google or Microsoft, can be accessed from computers. The service is internet-based, and a business rents capacity from a data centre online and pays for consumption generated in the cloud. A provider installs software and hardware in the hirer's office and upgrades the existing system as necessary. The hirer makes use of storage space in the cloud by saving data such as accounts, project files, emails, etc, which is charged by the provider under the terms of an agreement. A luxury of the system is ease of use, as amendments to the hirer's needs mean the system can be upgraded or downscaled to suit changes in a business's needs. The system is available for mobile computing including laptops, portable computer devices and phones. The omission of servers and freeing-up of functional space is an advantage as it can yield additional working or storage space.

Building Information Modelling (BIM)

BIM is the digital representation of a building in model form using three dimensional or greater images. These images create a visualisation of a building through the various stages of design, construction and occupational life which are displayed in real-time mode. The tools used for BIM during the design stage set the pathway to create a computerised system that stores everything from standard plans and 3D (or greater) drawings to planning documents, specifications and finer details of specified product components. This includes logging information of components to illustrate exactly where they are located in a building

once it is occupied for identification and maintenance purposes. In addition, BIM simulates construction processes that enable various items to be addressed, including sustainability issues for reducing waste and choosing the most cost-effective schemes. Images and presentations available include animations and a walk through of the building at different phases of construction showing virtual construction methodology and occupational stages showing business activities once a building is operational. This aids the process of managing data for facilities management and assists with estimating the running costs of a building.

Where BIM is required for a project, a BIM manager provides advice to the client and design consultants about their requirements for the system's operation and the features available. For the system to operate, software is installed which may involve overhauling existing hardware systems and this is usually carried out by a BIM manger or IT consultant. Changes or upgrades for compatibility may be expensive and staff training is required in order to gain the most benefit. The system has distinct advantages over traditional design approaches as virtual reality demonstration means there is no doubt about the images and function of a building, avoiding something that may be incorrectly perceived when viewing traditional flat drawings.

For the PQS, BIM permits measures and quantities to be calculated from 3D figures, which saves on printing and the time required for measuring trade works. With BIM, it is possible to quantify materials and assess life-cycle cost appraisals from 3D drawings that are otherwise unavailable with flat drawings. In the future, main contractors may become more involved in the process as the United Kingdom government has recommended BIM for public buildings which will impact contractors that provide design and build services. Here, a contractor will be expected to take over the early design produced by the government's designers and appoint their own consultants to complete the design. The main contractor's quantity surveyor will need training in the use of the system in order to produce quantities in a fashion currently restricted to the PQS.

BIM benefits the industry and client because it:

- Enhances health and safety requirements
- Improves communication
- Is collaborative and reliable
- Reduces the chance of errors
- Mitigates design and construction risks.

Disadvantages include:

- The size of the electronic files and storage required to retain information
- A lack of general understanding and training in the use of the system
- Incompatibility of software provided with an existing system unless users consider that the cost to upgrade is a financial investment.

Disadvantages are outweighed by the benefits over time as outgoings in early investment provide dividends for the future and involvement in future schemes.

1.9.2 Environmental issues

A major influence in the preparation of a construction design and specification is environmental issues. This has brought a new thought process to the way buildings are designed, constructed and managed through their occupied life. This change in attitude has resurrected words that would otherwise be obsolete from industrial vocabulary and turned them into pertinent buzzwords. They include conservation and sustainability in construction which, combined and in general, is the capacity to protect, endure, maintain and support resources through the building process and occupational life of a building. Arguably, the impetus for a call to change has been at a political level, after the hole in the earth's ozone layer was discovered which was brought about by the use of chlorofluorocarbons (CFCs) used in many industrial processes. Fortunately, this has been controlled by subsequent legislation and regulation with degrees of success. However, the situation has been accentuated by an increase in global warming brought about by carbon emissions. The source and quantity of emissions and the effect on global warming have prompted radical thinking from a range of industries with the consensus to act responsibly and show consideration for the environment. The construction industry has recognised the problem and contributed to the control of environmental impact whether by organisational practice, customs, client requirements, law or contractual requirements, and has adopted trends and practices that form part of environmental business jargon.

Green business

This term expresses a company's policy regarding its commitment to cancelling any negative environmental impact during business operations at local and global level with a view to safeguarding community, business and society.

Green certification

In 2003, the European Union (EU) issued a Directive for member states entitled COM 2002/91/EC: Directive on the Energy Performance of Buildings. The legislation calls for energy savings in buildings to reach a benchmark reduction in greenhouse gas emissions of 20% by the year 2020 in comparison with benchmarks set in 1990. The directive places the onus on states to adopt common methods for calculating energy performance of new buildings and any building undergoing major renovation. The British response to the Directive was the introduction of the Housing Act 2004 and Housing Act (Scotland) 2006 together with the use of Energy Performance of Buildings (Certificate and Inspections) (England and Wales) Regulations 2007 and the Home Information Pack (No 2) Regulations 2007. This legislation makes it mandatory to display

Energy Performance Certificates (EPC) in new residential buildings (or those for sale or rent) and Display Energy Certificates (DEC) for public buildings. Certificates are graded as A (best energy efficiency and lower running costs) to G (least efficient and higher running costs) with the average being D.

In 2011, the United Kingdom government pledged an improvement on greenhouse gas emission reductions to around 50% by 2025 with views to cut this by 60% by 2030 and 80% by 2050. This courageous move means that the United Kingdom is the first country in the world to commit to reductions in the 2020s. However, a get-out clause has been set up to see how other EU members stack up against current emission reductions; the government may review the outputs, the presumption being it cannot go it alone.

Introduction of legislation and certification requirements underlined prior accomplishments of BREEAM (Building Research Establishment Environmental Assessment Method). BREEAM was established by the Building Research Establishment (BRE) and is the voluntary measurement for assessing the environmental impact of a range of building types for the use of clients, developers, designers or persons interested in the environmental aspect of buildings. BREEAM assessments include suggested methods for reducing running costs through the whole life cycle of a building and provide innovative assessment tools for guidance, the goal being to achieve a minimum impact on the environment. Certification is possible with the use of templates containing benchmarks, with a scoring system for ideas and standards that can be included in the design of a building.

Green certification schemes also exist in Australia under the control of the Green Building Council, and in the United States (and others countries) with LEED (Leadership in Energy and Environmental Design). LEED was developed by the US Green Building Council and is a private non-profit trade organisation that promotes sustainability in buildings with regards to design, the construction process and occupational use.

Sustainability

This broad term refers to the activity of any business which participates and promotes Green Business by having an environmentally-friendly attitude. The theme of sustainability ensures work processing and product manufacturing address environmental concerns whilst the organisation maintains a business profit. The objective is to meet the 'triple bottom line' that refers to people, planet and profit as discussed in the Brundtland Report, published by the United Nations World Commission on Environment and Development.

Sustainable materials and buildings

Part of Green Business policy promotes specifications that seek to control the use of natural materials and to promote the use of recycled products as an alternative. This is to sustain resources by keeping them in their natural habitat, e.g. specifying timber products produced from trees that, when left in their

environment, will clean the air and reduce pollution to make it more breathable. Recycling is possible for a number of building materials, including aggregates, metals, glass and papers that, when recycled, produce new products as an alternative to natural resources. For example, suitable crushed and graded inorganic demolition debris can be used as aggregate for the production of concrete instead of quarried products obtained from natural resources.

Sustainable buildings use performance and descriptive specifications that embrace insulation, water storage and reticulation, acoustics, efficient heat exchangers, heating systems and solar panels. The additional cost for including sustainable measures in a new building ranges from 2–5%. However, this is influenced by specification criteria and should be viewed on a case-by-case basis as projects will vary. In general, the higher the financial value of a building, the more attractive sustainable buildings are, because the add-on prices become less significant.

Life-cycle costs

A client venturing into a construction project may express a need to satisfy environmental matters, yet has concerns about the additional costs to construct a building and the expense of maintaining, heating and cooling once it is occupied. This is possible to address with a life-cycle cost assessment. The assessment is usually carried out by a PQS or specialist consultant and is a critical analysis of a full building design or part thereof that compares construction expense with benefits. A completed assessment will demonstrate how cost premiums included in a design can provide benefit to a building through the anticipated life cycle and provide a return on investment. For example, let us say the façade treatment of an office building is not decided; the options for walling between windows are for glazed cover, stone panelling or metal cladding and the client wishes to understand what benefits could be provided, other than aesthetics. This could be appraised by firstly assessing each option with its capital costs, i.e. the cost to supply and install, plus the maintenance and replacement charges over a given length of time. A period of 20 years would be an ideal duration as this is a reasonable length of time before a full replacement is required. The collation of capital cost for each option would be offset on a yearly basis by a reduction in energy consumption that would vary with each façade option because they have different insulation values. The options would provide the owner with a snapshot of the cost to install, maintain and replace in comparison with energy consumption costs for each façade through the life cycle.

Life-cycle assessments are figures orientated and are not conclusive, but provide an indication to the value of a building beyond a price to build. This is because any financial awareness is linked with environmental aspects and the rewards they may deliver. The perception of a building may be one that is enhanced if it receives certification for Green Business as it may mean the corporate profile and reputation of the building become salient. This will then help

to promote interest from tenants or purchasers who place environmental issues high on their list of priorities.

The subject of life-cycle appraisals extends to whole-life costing that includes a 'cradle to the grave' assessment of assets, whether a building or a component of a building. If life-cycle factors are a consideration, they should be addressed with options as early as possible to aid the design process, as afterthoughts involving redesigns could cost time and money.

Waste management

It is estimated that the United Kingdom construction industry produces one third of all waste generated in the country as a result of demolition, excavations and surplus product waste created during the construction processes. To mitigate this and make creators of waste aware, a landfill tax is levied by the government on waste disposal fees, with the funding generated used to pay for long-term plans dealing with environmental impact. The levy is charged by weight and for the type of waste disposed, i.e. if it is active or inactive, with varying rates applying. For this reason, there are two main benefits to a contractor for managing and reducing waste during a construction project. Firstly, a reduction in the estimated waste allowance included in a contractor's budget will save the contractor expense on disposal fees. When a contractor submits a tender, an amount of material waste in comparison with the installed quantities is allowed for risk due to working, cutting to length, damage, etc, e.g. an additional 5% for timber, 15% for face bricks, and so on. If a site supervisor orders materials to a value that exceeds the allowance, it will result in a financial loss to the contractor which is not usually recoverable from a client. However, it may be possible to avoid the burden by implementing waste management strategies that aim to reduce waste and save on disposal fees. This management style involves a policy of ordering materials for 'just in time deliveries' where goods are installed as soon as practically possible after delivery. For maximum effect, the provision of adequate storage and protection of unfixed materials are required as well as the careful planning of site activities. Secondly, the inclusion of a Waste Management plan on a project demonstrates commitment to the environment that also raises corporate image.

In England and Northern Ireland, the client has a duty to provide a system of management to demonstrate how waste is dealt with. This is legally enforced by the Site Waste Management Plans Regulations 2008 and Site Waste Management Plans Regulations (Northern Ireland) 2011. Although not legally enforceable in Scotland or Wales, creation of a site waste management plan is recommended by NetRegs, a partnership body that provides free environmental guidance for small- and medium-sized businesses. The Regulations make it mandatory for a client to provide a Site Waste Management Plan (SWMP) for construction projects valued in excess of £300,000. In practice, the contractor prepares the plan and the client and contractor are jointly responsible for its implementation. At the core of the plan are the contractor's methods for management that require

a statement of the type and quantity of waste to be produced and strategies in place for its handling and disposal. A declaration must be completed stating that the client and contractor (who is referred to as the principal contractor) will take reasonable steps to ensure waste materials are handled and managed in accordance with the Environmental Protection Act 1990 and Environmental Protection (Duty of Care) Regulations 1991. The plan is updated as the project develops, and it is enforceable by local authorities and/or the Environment Agency if intervention is required, with penalties applying if procedures are not followed.

The contractor's quantity surveyor must show an interest in waste management as it can affect budgets and profit margins. Effective measures for limiting waste disposal include compacting and breaking up bulky items and placing them into skips. Furthermore, when dealing with excess spoil generated from earthworks operations, it is wise to accommodate the material on site by spreading and levelling the material around low levels of land and compacting in layers. This process is used by developers during new housing construction on green (new) or brown (reclaimed) land where topography permits innovation with ground levels. If low levels of land are unavailable for filling, an option is to raise the level of a building by a nominal height and fill the low areas created. This option requires the quantity surveyor to carry out a cost exercise by assessing the additional cost for varying the construction works. This additional expense is offset by the reserved budget allowance for loading, hauling and disposing the waste. If proved viable, the method will require approval by a person in authority to ensure any increase in building height is practical and complies with planning approval. Furthermore, any filling works are subject to approval by the engineer and contractor who must consider handling of the material if it is hazardous and capping the fill with inert material if required.

Lean construction

'Lean construction' is a term coined in the 1990s by the International Group for Lean Construction, and refers to the use of good practices in end-to-end processes. This lean approach aims to continuously improve standards, minimise cost and maximise value whilst maintaining a client's needs. The strategies commence from design and continue through the construction phase to limit maintenance works after a building is occupied. One theme of lean construction is to limit waste by using proactive management that seeks flawless behaviour by improving communication and using procurement with strong supply chains, which is influenced by environmental bodies and governments. The ideology focuses on holistic pursuits of the built and natural environment including design, construction, activation, maintenance, salvaging, recycling and concurrent improvement of each process. It has aims of a 'Master Builder' concept not restricted to environmental issues and applies a lean theme for minimising time and efforts in the process.

1.10 Prospects and augmentation of the quantity surveyor

1.10.1 Employed roles

Is a quantity surveyor an estimator, contract administrator or a project manager? The short answer to this question is yes, yes and yes. People from a quantity surveying background may find a working environment compatible with any of these roles because the training and qualifications acquired from quantity surveying create the pathways. It is up to the individual whether they wish to divert and specialise and, if electing to do so, must commit to acquiring the required skill sets. In order to obtain the desired skill set, there is need to distinguish the differences as each discipline requires separate skills and levels of responsibility.

Estimator

It is worth understanding the difference between an estimating service provided to a client as advice and the estimating process required by a contractor to secure work. The PQS provides a cost planning service for a client in the capacity as consultant. In this capacity, an estimate of probable cost to construct a project for budgeting purposes is issued to a client, possibly in the absence of a design or with only sketch proposals, which is monitored whilst the design is developed. It is a cost management role to advise the client's team of cost forecasts until the design and documentation are suitable to invite tenders from main contractors. A main contractor's estimator may be a quantity surveyor who prepares a cost estimate based upon the tender documentation. Once the cost estimate is complete, a sum is added to cover business overheads and profit which converts the estimate into a tender and an offer to carry out the works. Ideally, the PQS's final estimate of probable cost should be similar to the tender prices received. If there is a discrepancy between the advice given by the PQS and tenders received for the works, it has nothing to do with the main contractor's estimator and is a matter for the client and client's team.

Contract administrator

Contract administration refers to post-contract activity and deals with commercial and contractual matters, procurement and cost management of live construction projects. In the United Kingdom, quantity surveyors are engaged as contract administrators by a PQS practice, main contractors and large subcontractors, each responsible to their respective project manager or team leader. Incumbents, who are usually employed full time to administer one or a number of concurrent schemes (depending on their size and complexity), usually go under the title of quantity surveyor or contract administrator. In Australia and a number of other countries outside the United Kingdom, the title quantity surveyor is used solely with reference to the PQS and individuals carrying out commercial activities on live projects for a contractor or

subcontractor are referred to as contract administrators. One main reason for the distinction is the British tradition of including a bill of quantities as a contractual document in some procurement routes, which warrants its inclusion in quantity surveying and building degree courses. The general view taken in some countries outside the United Kingdom is that a project bill of quantities is not a contractual document and, if available, is for reference only. Therefore, the consensus by some is that the skill of measurement and bill of quantities production is specific to the PQS. It is therefore considered an integral part of a quantity surveying degree course and included to a lesser extent in construction management degree courses.

Project and commercial managers

A project manager engaged by a client acts as an agent of the client and addresses matters required for the successful delivery of a building project. On large projects, a client may engage a project management company under the control of a project director. The project director does not carry the legal status of a company director for a project because a project is not usually a business. However, a project director may be a director of a project management company that supervises an in-house team to oversee a scheme. The scope of services provided by a project management company broadly includes:

- Obtaining planning permission
- Preparing a project brief of key requirements
- Recommending appropriate consultants for appointment
- Budget setting
- Procurement selection and monitoring development of the design
- Selecting contractors to tender the works and vetting tenders received
- Negotiating the terms and conditions of a construction contract and advising the client
- Overseeing construction of the works to completion.

Project managers employed by contractors provide working programmes, technical and contractual advice for staff and accept responsibility for delivering a scheme to a client on behalf of the contractor. They also provide feedback from committed projects to identify risks that influence commercial decisions for works under tender. Contract administrators and quantity surveyors may benefit a contractor's business because of their commercial awareness, and incumbents in this capacity often excel to the role of a project manager.

Commercial managers have varied roles that focus on commercial activities of a business including:

- Marketing and business development for company expansion
- Contract negotiations including reviewing conditions of pending awards
- Property management

- Supply chain management including vetting and administration of their contracts
- Cost managing projects
- Management of business overheads.

Large companies undertaking a number of concurrent projects may engage one or more commercial managers to oversee a group of people. When employed in this capacity they are usually responsible to a director for commercial activities and may have extensive legal training, specialising in contract law. With smaller companies, the commercial manager would normally be responsible for tasks themselves and be aware of strategic functions of the business.

1.10.2 Independent roles

Some people seek flexibility and diversity in their career for personal reasons or may have other commitments, and employers can offer a solution to this with short-term contracts. These contracts benefit employers when particular tasks require completing to fill short-term needs and may also suit independent contractors who do not wish to commit to full-time roles. The independent role benefits the quantity surveyor, estimator, contract administrator or project manager who is already qualified and wishes to train for other qualifications that are otherwise hard to achieve for a person employed full time. For example, a main contractor may require a quantity surveyor to prepare variation claims or assist with awarding trade packages when permanent staff members are on leave, and the arrangement is suitable for a quantity surveyor who may be training for another field of work.

Individuals may seek supplementary fields of work to their career and make use of short-term employment opportunities to provide income whilst undergoing training. The combination of existing qualifications and experience is the prerequisite for creating new skill sets, and a choice of supplementary roles that may become available once a skill set is learned and accredited includes:

- Statutory adjudicator for assessment of payment disputes in construction contracts as legislated by the Housing Grants, Construction and Regeneration Act 1996 and Local Democracy, Economic Development and Construction Act 2009
- BREEAM Assessors of Quality Assurance certification
- Book writing
- CDM coordinator.

The key to independent working is reliability, good communication and being organised, together with proven experience and marketing skills. The downside is the lack of permanent job security, no entitlements for holiday leave or career progression in a company. On the upside, independent roles provide opportunities for alternative career paths and a choice of commitment.

1.10.3 Women in the industry

In the United Kingdom, women represent approximately 10% of construction industry workers. The orientation of building work has meant most blue collar workers are men, with the few exceptions being women who enrol on certain craft skill courses. Most women workers are white collared professionals, including project managers, engineers, interior designers and quantity surveyors. In the interests of women, the National Association of Women in Construction (NAWIC) was chartered in the United States in 1955 as a not-for-profit organisation. Since its formation, the association has expanded with affiliations in Canada, Australia, New Zealand, South Africa and the United Kingdom. Primary objectives of the association are to raise the profile of women working in the industry, promote cooperation as a positive instrument for change, and provide a support and networking arrangement. Membership is made up from occupation sectors that include sales and office staff, professional and management positions, roles associated with natural resources, construction, maintenance, service occupations and the transportation and delivery of materials. With the expansion of recruitment businesses specialising in the appointment of both male and female co-workers in construction and engineering, women engaged by such recruitment companies are also considered women in the industry and may apply for membership. Benefits of membership include social and industrial networking, access to members' databases, the opportunity to campaign for better deals for women in the industry and participation with industrial research. NAWIC differentiates itself from other industry groups as being an outward-facing organisation first and foremost with a force for change that makes a construction career an attractive option for women.

1.10.4 Global and multicultural diversity

Although quantity surveying is British in origin, it has expanded globally, with Australia, Canada, Jamaica, Kenya, Malaysia, New Zealand, Nigeria, Singapore, South Africa, Sri Lanka and the Pacific/Asia region all having Institutes of Quantity Surveyors. The creation of these institutes permits the possibility for members of the RICS to hold dual membership, which helps to bridge cultures and formally recognise quantity surveying education and training as a global network. Suitably qualified professionals may travel overseas for reasons such as personal development or adventure which can be a rewarding experience and, while doing so, aid their career progression. A qualified individual with a degree who wishes to work overseas would be encouraged to seek chartered status of the RICS as it acts as a stepping stone to obtaining an overseas qualification. Prior to obtaining the overseas qualification, the individual may be required to undergo a probation period to assess their competencies and understanding of national practices that may differ from their home country or country where the education and training was gained. Advantages

of membership in a host country include access to cultural and working practices through networking and advice on licenses to work. Members may belong to local affiliations or chapters which apply in large countries such as Australia and Canada. These countries have states, provinces and territories with subtle differences in working practices between regions, and membership provides access to affiliate or chapter networks in order to understand the variances. Reciprocal agreements between institutes confirm core training and education. However, it is important for anyone making the move to understand nuances in order to adapt culturally.

The demand to work internationally depends on a country's political and migration policies which control the number of visa work permits available at any time. This is influenced by the national economy of the country as well as employment supply within the home-grown workforce. This is subject to periodic change at political level that drives demand and the need to fill skill shortages in particular industries.

1.10.5 Prospects

The role of quantity surveying has expanded from one of traditional core principles involving measurement and the pricing of building works to one of broader involvement in the construction industry. There is a demand for quantity surveyors who may wish to diversify into various roles as discussed in this chapter, and individuals are encouraged to seize the opportunity and work in their chosen field. The construction industry changes at a fast pace and with the growth of information technology, environmental issues and project procurement methods available, there is a need to share ideas that benefit employee, employer, client and the industry. Although the profession has strong traditional values that have stood the test of time, it is encouraging that the future certainly appears to warrant the continuous need for the quantity surveyor, albeit manifesting in a number of forms.

2 Measurement and Quantities

2.1 Measurement guides and coverage rules

Measurement of construction work is at the core of quantity surveying and has long been the basis of construction tendering systems. The traditional document used to show this information is a trade bill of quantities (BOQ) prepared by a PQS for a client. If a client wishes to include a BOQ as a tender document in order to obtain a lump sum price for a construction project, the BOQ and stated quantities will become binding on the contractor and client if included in a contract. After becoming a contractual document, the quantities stated take priority, and it is only possible to adjust them with a variation authorised either by the client's agent or another authorised title named in the contract.

In general, a BOQ is a document formatted and worded in accordance with a set of coverage rules provided from a measurement guide, which comprises a measured quantity alongside a description of the works. This permits the contractor's estimator to understand the requirement and apply a rate to a given quantity that includes labour, plant and materials in order to determine a price. When preparing this type of bill, the design detail and specification need to be sufficient for tendering purposes and represent the detailed final information. This is because the objective of a BOQ is for competing contractors to provide a fixed lump sum price based upon firm quantities on a completed design. If a client wishes an early start on a project with the design part complete, a bill of approximate quantities can be prepared in lieu. Here, quantities are measured from the design and documentation available, and contractors apply rates to permit the works to commence at an agreed price. Subsequently, the actual installed quantities are remeasured by the contractor's quantity surveyor and valued in accordance with the rates provided.

Clients may decide not to include a BOQ as a tender document because of the alternative procurement routes available, which make it possible to transfer risk for quantities to main contractors. Main contractors, and in turn subcontractors, have adopted the term BOQ generically to refer to a measured schedule of works

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prepared by the parties responsible for measurement. However, the use of the traditional BOQ as a tender and contractual document refuses to become obsolete, and many contractors and PQS practices recognise the advantages it provides:

- It forms an integral and valuable source of reference for a tender, reducing contractors' tendering costs, and leading to more competition between contractors, which benefits the client
- A competitive market is created as contractors and subcontractors are more willing to price work from scheduled quantities rather than prepare measures themselves
- Negotiation periods following receipt of tenders are rapid with a quick start on site due to the scope identified in the bills
- It assists contract administration to identify and value the works in progress
- Rates in the bills are used as a basis for pricing variations
- It assists with the preparation of a final account as it sets the basis of the contract sum.

The format of a BOQ must follow industrial standards and be consistent, as the bill will pass through the hands of many individuals during the tender period and construction phase. For this reason, a standard format and common understanding of phraseology with descriptions are required. To satisfy this, the industry adopts standard guides defining rules of measurement and descriptions so that the final document is recognisable with concise terminology. There are a number of standard industrial guides available that provide coverage rules to prepare BOQ/measured schedules.

Standard Method of Measurement of Building Works (SMM) The first SMM was published by the RICS in 1922 with the aim of providing advice to quantity surveyors about how to measure building works for the production of a BOQ. The purpose of the guide was to define a suitable method that clearly detailed work requirements for obtaining competitive tenders for a building project. Subsequent editions have dealt with the introduction of metric measurement and decimalisation as well as industrial changes. The latest edition, SMM7, was published in 1988 as a joint publication between the RICS and the Building Employers' Federation. The format was changed and reissued in 1998 in line with the Common Arrangement of Work Sections (CAWS). CAWS is a working convention that standardises detailed coordination between a BOQ and product specifications and has has a series of code references cross-referenced to specifications to assist contractors when tendering works. SMM7 provides uniform and concise information for the preparation of trade bills and is suitable when the design is sufficient for final production.

RICS new rules of measurement This suite of documents was developed by the Quantity Surveying and Construction Professional Group of the RICS.

Volume 1, entitled *Order of Cost Estimating and Elemental Cost Planning*, was published in 2009. This volume sets guidelines for the preparation of cost estimates and cost plans at different stages of design development. Previously, quantity surveyors acting as cost planners used the SMM for guidance but this is not suitable when design is in the early stages of development. The new rules for Volume 1 apply more detail for the pricing of separated elements (substructure, upper floors, etc) and give a clearer understanding of what is included in a cost plan estimate. Volume 2, *Procurement*, is seen as an alternative to SMM7 rather than a replacement. It is intended to assist those not needing detailed bills of quantities yet who require a measurement schedule which is seen as an important tool for tender evaluation, post-contract cost control and variation evaluation. At the time of writing this book, Volume 3, *Whole Life Costing*, is in the pipeline for publication. It is intended to be a reliable and trustworthy source for the measurement and evaluation of costs once a building is occupied and in use. This may have a similar theme to the model contained in ISO 15686: 1 'Building and constructed assets – Service life planning'.

Civil Engineering Standard Method of Measurement (CESMM) The Institution of Civil Engineers published their first Standard Method of Measurement in 1976 and provided quantity surveyors with advice and rules for measuring civil engineering works. It has since been updated and currently is available in a third version (CESMM3), published in 1991.

Generally, CESMM3 differs from SMM7 because of the nature of civil engineering works. Much of the coverage is defined within composite items that embrace a list of inclusions, whereas other guides consider the finer details of construction requirements for buildings. The nature of civil engineering means certain works carry a higher degree of risk to price certainty compared with building works, with the client retaining a share of the associated risk. For this reason, a civil works BOQ might include a list of provisional sums and/or provisional quantities to recognise items of work that are ascertained once the works commence. Completed works are valued upon a physical measure and charged at a schedule of priced rates included in the BOQ provided by the contractor. Provisional sums are also included in a BOQ for building works, which generally are less frequent and to a lower value than found with civil engineering.

Manual of Contract Documents for Highway Works (MCHW) This manual is produced by the Department of Transport and is made up of documents dealing with the specification, design and management of highways. It includes model forms of contract and notes for guidance, with one section dedicated to the preparation of a BOQ, including a Method of Measurement.

Standard Method of Measurement for Industrial Engineering Construction This guide is produced as a result of an authorised agreement between the RICS and the Association of Cost Engineers (ACostE). ACostE is an association representing the professional interest of those with a responsibility for the

prediction, planning and control of resources and the cost of activities involving engineering, manufacturing and construction. ACostE has also produced the Standard Method of Measurement for Industrial Engineering Projects, dealing with measurement principles and the management and commercial aspects of industrial engineered projects.

Overseas There are a number of guides, similar in principle to SMM7 but developed culturally in countries outside the United Kingdom, that focus on building works. In Australia, the *Australian Standard Method of Measurement of Building Works – Fifth Edition*, published by the Australian Institute of Quantity Surveyors (AIQS), is widely used. This guide includes measurement rules and coverage for preparing a BOQ for tendering purposes or a schedule of requirements. The AIQS has over 4,000 members and is an educational body representing the interests of quantity surveyors, project managers, estimators and anyone interested in construction economics in the region. Similar guides are also published in Canada and Hong Kong.

2.2 Arrangement of documents and project information

Before commencing measurement, it is necessary to be in receipt of a suitable set of documents and project information. Usually, a commercial manager is responsible for producing a BOQ. This may be a manager in a PQS practice preparing the document for a contractor or building owner. Alternatively, it might be the head of the main contractor's estimating team, overseeing a team of surveyors, who produces a BOQ for their own purpose as part of the tender process. Whatever the scenario, documents are usually sent with a document register. This register lists the project title, address and given job number as well as the client and design teams' names and contact details (although, in some cases, the client's details may not be released for privacy reasons), and a list of documents. The list includes design and document titles with each having a unique reference number and revision, if applicable, which is dated. When documents are distributed, they are usually accompanied by a document transmittal, i.e. a copy of the document register highlighting the type of documents transmitted and date of issue. The mode of distribution is via hard copy by hand, courier or post in single, duplicate or triplicate consignments depending on the recipient's request and sender's agreement. The alternative is to burn information to a CD (compact disc) which recipients download, storing the files for electronic reading with the option to print. CDs have advantages over hard copy distribution as they have the capacity to store significant amounts of information and are a substitute for print consignments. Other alternatives for distribution include the use of email and electronic collaborative systems. Information supplied generally includes drawings, specifications and reports.

Drawings Drawings relay information in dimensional and illustrative forms to create the image of a building. The number of drawings issued depends on the size and complexity of the project and, for bill preparation, they need to be consistent in clarity (including to scale), accurate and suitable for the purpose. A project in an advanced stage of design development and suitable for preparing bills will include the following:

- Survey drawings which are based on a measured survey or Ordinance Survey, including site and block plans and any existing buildings and services plans, e.g. gas, water, etc.
- Demolition plans (if applicable)
- Architectural floor plans, elevations and building sections
- Specific construction details more detailed than shown on other drawings
- Detailed joinery
- Ceilings and partitions layouts if not already a specific construction detail
- Door, windows and ironmongery schedules
- Wall and floor finishes
- Structural engineering drawings
- Building services engineering drawings
- Civil engineering drawings
- External works layouts with any specific details for fencing and hard surfaces
- Landscaping layouts
- Specialist trade works that may be read in conjunction with any of the above
- Specifications when not issued as separate documents.

Specification A specification is a technical document prepared by a consultant that details project requirements and standards which encompass materials, workmanship and the level of service expected from the products. It is an important document because it defines the quality and standards expected so that a completed building is suitable for the intended purpose. There are two types of specification: functional and descriptive. A functional (sometimes called a performance) specification is the expressive detail of a building's requirement in order for it to function and serve the intended purpose. This may apply in whole or to part(s) of a building and is drafted in the early stages, possibly in the absence of a design, when identifying the outline needs of a project. This type of specification is dynamic and lateral in order that it can provide a snapshot of the project requirements, i.e.

> 'A primary school building to be constructed to provide accommodation for three hundred children including classrooms, an assembly hall, staffroom, dining areas, toilets, a playground and car parking spaces as amenities for staff and visitors.'

Descriptive specifications are a later version of the outline needs and a continuation from the functional/performance specification which segments requirements into specific components. The components are detailed requirements that set the pathway to satisfying the needs of a building to achieve the desired results. Wording in this type of specification becomes defined and uses descriptions that break down the functional requirements into fine detail to achieve the purpose. This fine detail comprises of sections that have descriptive formatting to create specifications for trades, general items, codes of practice, quality standards, legal requirements (including Building Regulations), health and safety and the environment. For the purpose of measurement and BOQ preparation, the descriptive specification is of interest to the quantity surveyor because it defines requirements for items that form part of the bill descriptions.

Each descriptive specification comprises a series of headings and sub-headings and a usual layout takes the following form:

- General items: These items cross-reference the functional project requirements as well as sundry items for a trade including the submission of samples, testing requirements, inspecting the works, related work sections, appropriate standards and, ideally, a brief scope of works
- Materials, products and components with sub-headings including manufacturers' and/or trade names
- Means and methods of installation.

Table 2.1 shows a descriptive specification for insulation and water resistant barriers suitable for a project that has this requirement.

Reports Depending on the type of works under tender, documents can include various reports giving information for particular aspects of a project. For example, a hazardous material report might be prepared for a refurbishment project to identify the presence of asbestos. When disturbed, this material poses a risk to the health and safety of operatives and, if the report is supplied, it must be mentioned in the bills. This is because if the material is to be removed, specialists would need to be engaged to pay particular attention to health and safety requirements and, because of the requirements, the charges they apply for handling and disposal are above normal costs. Naturally, an estimator will need to recognise this requirement when preparing the cost. In addition, a note of the presence of this material, together with a method of handling and disposal, is required as part of a pre-tender health and safety plan that competing contractors must supply with their tender.

On new works and building extensions where ground will be broken, a Site Investigation report (SI) prepared by a geotechnical engineer is usually provided and, if available, must be referred to in the bills. This report provides information on the type of soils, including the presence of any groundwater, and evidence of toxic materials and remedial recommendations that a contractor must consider when pricing a project.

Table 2.1

Insulation and barriers

1 Quality

1.1 Scope

The scope of work for this trade includes the following:

1. Supply and installation of water vapour permeable membrane
2. Supply and installation of thermal insulation boards to the new roofing
3. Supply and installation of thermal insulation boards to existing roofing required to be modified.

1.2 Cross-references

General
Conform to the General Requirements of the specification

Related work sections as follows:

- ROOFING
- SEALANTS
- LIGHT TIMBER FRAMING AND BATTENS
- PLYWOOD AND TIMBER COVERINGS

1.3 Environmental Management System (EMS)

Refer to the General Requirements section that outlines the EMS. Products used are to comply with best energy savings with the lowest environmental impact in accordance with ISO 14001.

1.4 Standards

Installation of mineral wool insulation

Comply with Health and Safety practices in accordance with the Construction Design and Management Regulations (CDM) 2007 and Control of Substances Hazardous to Health (COSHH) Regulations 1988

2 Quality

2.1 Inspection

Undertake and record inspections of the following to ensure compliance with the contract requirements

- Sarking type material before being covered up or concealed
- Thermal insulation boards before they are covered up or concealed

(continued)

Table 2.1 (*cont'd*)

3 Materials and components

3.1 Thermal insulation boards

Boarding: Polyisocyranate foam core with aluminium foil composite to both sides for warm and cold roof pitch construction. National Building Specification P10 – sundry insulation / proofing work, sub code P140 – Insulation fitted at rafter level to BS 4841 Part 5

Boarding strength: Compressive strength to BS EN 826

Fire protection: SAA rating to BS476 Part 3 2004

Thermal resistance: 'R' value 2.61 (m^2 k/w)

3.2 Sarking material

Sarking: Spunbound polypropylene composition with polyolefin coating. National Building Specification P10 – sundry insulation/proofing work, sub code P310 – Vapour control layer at rafter level to BS 5250

Water vapour permeability: Not exceeding 20g/m^2 per day to BS4177

Nail tear resistance: 260 N

Flammability: DIN 4102: B2

Head of water sustained without penetration: to 2 metres as BS20811

4 Execution

4.1 Roof insulation

- Sarking material – secured between battens in accordance with the manufacturers recommendations
- Thermal insulation boards – secured to timber battens and plywood in accordance with the manufacturer's recommendations

2.3 Measurement terminology

2.3.1 Take off and measuring techniques

The term 'take off' refers to the scaling or transferring of critical dimensions of construction components from drawings to paper or software that are quantified as units of measurement. Take off also includes a description of works that are influenced by the appropriate measurement guide. The paper comprises of a series of columns which are usually printed on both sides of an A4 sheet. All measurements and calculations are 'nett as fixed in position', which is usually mentioned in the guide. This means measurements are taken or scaled direct from drawings without allowing for methods a contractor may use to carry out the work, i.e. waste and shrinkage by mixing with water or cutting material to length which is risk an estimator must consider within the chargeable rate. Table 2.2 shows the take off format together with descriptions and the purpose of each column.

Table 2.2

A	B	C	D	A	B	C	D

Column A This is the multiplication column for multiplying the dimensions entered in Column B.

Column B The dimensions column is used for recording measurements that are 'taken off' the drawings. The sequence of measuring is to enter figures in order of length (first), width (second), followed by depth.

Column C This is the squaring column, sometimes referred to as the working up column, and is the calculated quantity from the information entered in columns A and B. Squaring of the calculations are rounded to two decimal places.

Column D The description of work is entered here that forms a part of the final bill of quantities. The column is also used to demonstrate methods of assessing dimensions in Column B known as 'waste calculations' and how multiplications are assessed for Column A.

The method of inserting dimensions and quantities into columns A, B and C is straightforward. What are more complex are the waste calculations that drive columns A and B. For this reason, column D requires notes on the calculations as they may need to be referred at a later date if the works change and the take off needs revisiting. The rule with taking off is to always use ink and not pencil as this shows integrity and authenticity. Any errors should be struck through with a single line and not erased, so they are disregarded yet leave a trace. If an entry is struck through, only to realise later it was correct in the first place, the word *Stet* inserted close to the strike will advise the reader to refer back to the original detail and ignore the striking. 'Stet' is a Latin word meaning 'let it stand'; it is used by proofreaders and report writers so is suitable for the take off process.

Measurements require recording in a format that uses metric dimensions together with conversions. Table 2.3 lists examples of the most frequently used units and method of presenting dimensions and calculations.

The format of a take off must ensure that each dimension has reference to a description. Whilst taking off, there will be times when dimensions require reusing for another description. For example, plasterboard to walls and painting may have identical measures but require measuring separately because they are different trades and so are presented as separate bills. Similarly, repetitive lists of descriptions may be required for the same list of dimensions and repeat writing of descriptions would become time consuming. To avoid repetition, editing will aid the process and Table 2.4 shows a range of techniques and their uses.

With taking off, there is a need for accuracy. A generally accepted rule is that properly prepared measures have a variance of around 1% to allow for the rounding of calculations in the waste and squaring columns.

Table 2.3

A	B	C	D	
	21.50	21.50	Length in metres (m)	Dimensions and squaring are underlined to create a definition between measures and calculations to avoid overlapping with another description. When an item is singular, column A is left blank, as the description is single by default.
2/	30.00	60.00		Where more than '1' is required, the quantity is input with a forward slash.
	11.20 32.00	358.40	Length × width in square metres (m^2)	Metric squared calculations are listed as (m), (m^2), (m^3), numerated (Nr). General descriptions without a quantity are an item. Billing of steel is in tonnes with the unit (t) and the length is measured in metres (m), which is multiplied by the appropriate weight.
	10.50 30.00 0.15	47.25	Length × width × depth in cubic metres (m^3)	
4/	50	200	Number (Nr)	
		Item	Description and note of the works	
10/	10.00	100.00 100.00	UB310 – Universal beam, (10 @ 10.00) x 32 Kg/m 1000 = 3.20t	A method for calculating steel weight is to use the dimensions columns for waste calculations and insert the weight of the component and conversion factor, 1000 Kg =1 metric tonne. With steel, dimensions are abbreviated in the description.

Table 2.4

A	B	C	D	
4./2	12.00 0.90 0.60			If extra quantities are required, they are 'dotted on' to indicate an additional amount. In the example opposite, 6 are required.
5/2	8.00 0.90 0.60			When a given quantity requires multiplying, a multiplication factor with a forward slash is entered. 'Dotting on' may also be used for additions. In the examples opposite, 10, 24 and 10 respectively are required.
4/2/3	6.00 1.00			
4./3/2	8.00 0.90 0.60			
	12.00 0.60 0.15 8.00 0.60 0.15		In situ concrete bed poured against earth not exceeding 150mm thick (1: 3: 6 / 40 agg)	Where a list of dimensions is for the same description, wording is linked to each set of dimensions to save duplicate writing. In the example opposite, concrete of the same specification is required for two different areas of a building.
	20.00 0.60 0.90 15.00 0.40 0.60 12.00 0.60 0.60		Excavate trench exceeding 300 mm wide, not exceeding 1.00m deep & Filling with excavated material exceeding 250 mm thick	There will be occasions when identical dimensions are suitable for other descriptions. To save duplicate writing of dimensions, the symbol & is used to link descriptions to the calculations, known as 'anding on'. In the example, three separate trench excavations are required, all of which have two items of identical work.

(continued)

Table 2.4 (*cont'd*)

	35.00		20 × 120mm wrot softwood square edge skirting plugged and screwed to blockwork & Prime general surfaces of timber prior to fixing, not exceeding 300mm wide & Knot, prime and stop with one undercoat and two coats of gloss paint on general surfaces of timber in isolated areas, not exceeding 300mm wide	If only one dimension is required for a list of works, the descriptions are linked.
	40.00 10.00	400.00	Excavate topsoil for preservation, average 200mm deep &	'Anding on' may be used for different units of measurement as shown.
	8.00 8.00	64.00 464.00	Deposit in heaps on site, average 50m from excavation × 0.200mm = 92.80 m^3	
	8.00 0.75 8.00 0.90 11.00 2.75	—— NIL ——	Compact bottom of excavations	If errors occur and a set of dimensions is not to be included, inserting NIL in the multiplication column will ensure the quantities are excluded. In the example opposite, the squaring of the first set of two dimensions are ignored.

4/	1.20		Ddt 140mm blockwork for windows (W1 – 4)	Where deductions are required, they are noted and abbreviated as Ddt together with reasons and a reference. The same applies if there are additions when the word Add is used. The 'anding on' and linking is beneficial as it groups the sequence in a logical manner. In the example, a deduction is made to areas of walling that require reducing for the windows and doors that create voids. Deductions are bracketed as a reminder to ensure they are not added in error.
	1.20	(5.76)	&	
			Ddt 140mm blockwork for doors (D1 – 12)	
			&	
12/	1.10		Ddt plasterboard to walls over 300 mm wide	
	2.10	(27.72)	&	
			Ddt render to external walls over 300 mm wide	
			&	
		(33.48)	Ddt painting to plasterboard on walls over 300 mm wide	
			&	
			Ddt painting to rendered walls over 300 mm wide	
	20.00		Ddt Filling with excavated material exceeding 250 mm thick	When a description and quantity is deducted with the same quantity added for another description, a link is shown to the dimension
	0.50		&	
	0.50	5.00	Add Disposal of excavated material off site	
			Excavate basement, maximum depth not exceeding 4 m	The length of a description may be considerable and to save time in writing or word processing, wording becomes abbreviated. A good understanding of abbreviations is required to ensure they are interpreted correctly, hence the reason to use a set of standard abbreviations.
			Exc basement, max depth ne 4 m	
			Brick walls in Class B engineering bricks, 215 mm thick English bond with facework one side in cement mortar (1:3)	
			Bk walls in Class B eng bricks, 215 th, English bond with facework one side in cm (1:3)	
	35.00		Reinforced in situ concrete to retaining wall over 150 and up to 450 mm thick (in 70 m^2)	Extra measured units (EMU) are required in situations when the identified unit of measure is insufficient on its own and the EMU provides the estimator with additional information. For example, the volume of poured concrete in a wall is m^3 and a note of the wall area measured one side is stated in m^2. Another example is the glazing of small glass panels to wood frames measured in m^2 and enumerated.
	2.00			
	0.50	35.00		
40/5	0.30		Glazing to wood with pins, bedding and pointing with putty in panes not exceeding 0.15 m^2 (200 Nr)	
	0.20	12.00		

2.3.2 Centre line calculation

When measuring trade works to the perimeter of a building, the mean girth dimension provided by the designer is a suitable benchmark from which to base other measurements as it applies to a number of trades. This includes foundations, substructure and perimeter wall construction together with wall coverings and finishes. The geometry of buildings dictates they have shape with either angles or curves and drawings may show a mean girth. However, for practical reasons, construction drawings seldom show a mean girth as in general it is unnecessary for construction purposes. To assess the mean girth, it is necessary to calculate a centre line and the quantity surveyor will need to adjust given or scaled lengths of external or internal dimensions to do this. In the case of an external wall, if external measurements are given, the adjustment is a deduction and if internal dimensions are provided, it is an addition. Figure 2.1 shows the plan of a rectangular building where the external wall dimensions are given and Table 2.5 shows the take off and method of determining the centre line.

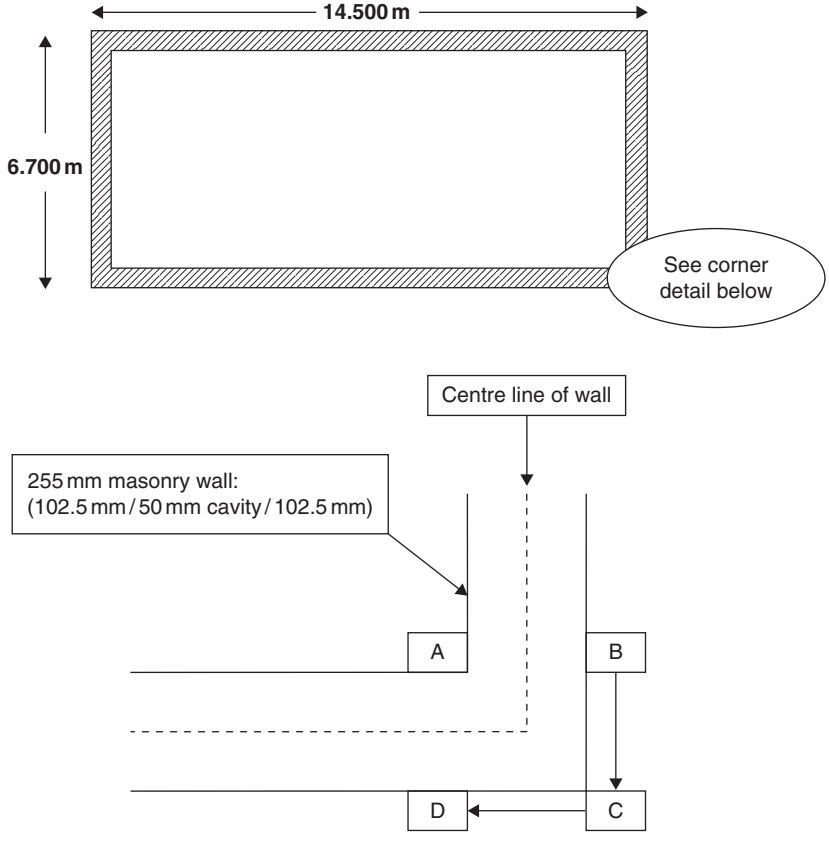


Figure 2.1

Table 2.5

	42.40 2.50	106.00	Half brick wall 102.5 mm thick facework and pointing one side in gauged mortar (1:1:6) *(External skin of brickwork)*	Wall dimensions provided are external and the centre line is required at the intersection. This is demonstrated with the use of arrows to the outside face of the wall that show the distance to the outer face to be deducted, BC and CD. These locations are the thickness of the perimeter wall and equal AB and AD. To ascertain a centre line using external dimensions, it is the number of external corners to the building, twice (BC and CD) multiplied by half the wall thickness.
	41.18 2.50	102.95	Half brick wall 102.5 mm thick, common brickwork and pointing one side in gauged mortar (1:1:6) *(Internal skin of brickwork)*	The calculated centre line will form a basis from which additions and deductions are made in order to calculate perimeter construction components. In the example, the centre line is determined and a length is required for the external and internal brickwork skins. In this example, the forming of the cavity is also the centre line of the wall thickness.
	41.38 2.50	103.45	Form cavity in hollow walls, 50mm wide including stainless steel wall ties, 3 Nr/m², 150 mm long	To determine areas, the centre lines are multiplied by the height of the wall and for this example is 2.500m as shown in the dimensions column. *Centre line* 2/ 14.500 29.000 2/ 6.700 13.400 42.400 LESS 4/2/1/2/ 0.255 –1.020 41.380 *External skin of brickwork*: Centre line 41.380 ADD half the cavity thickness and full skin thickness to give the external dimension of the outer skin 25 mm + 102.5 mm = 127.5 mm 4/2/127.5 1.020 42.400 *Internal skin of brickwork*: Centre line 41.380 LESS half the cavity thickness to give the external dimension of the inner skin (25mm) 4/2/ 25 –0.200 41.180

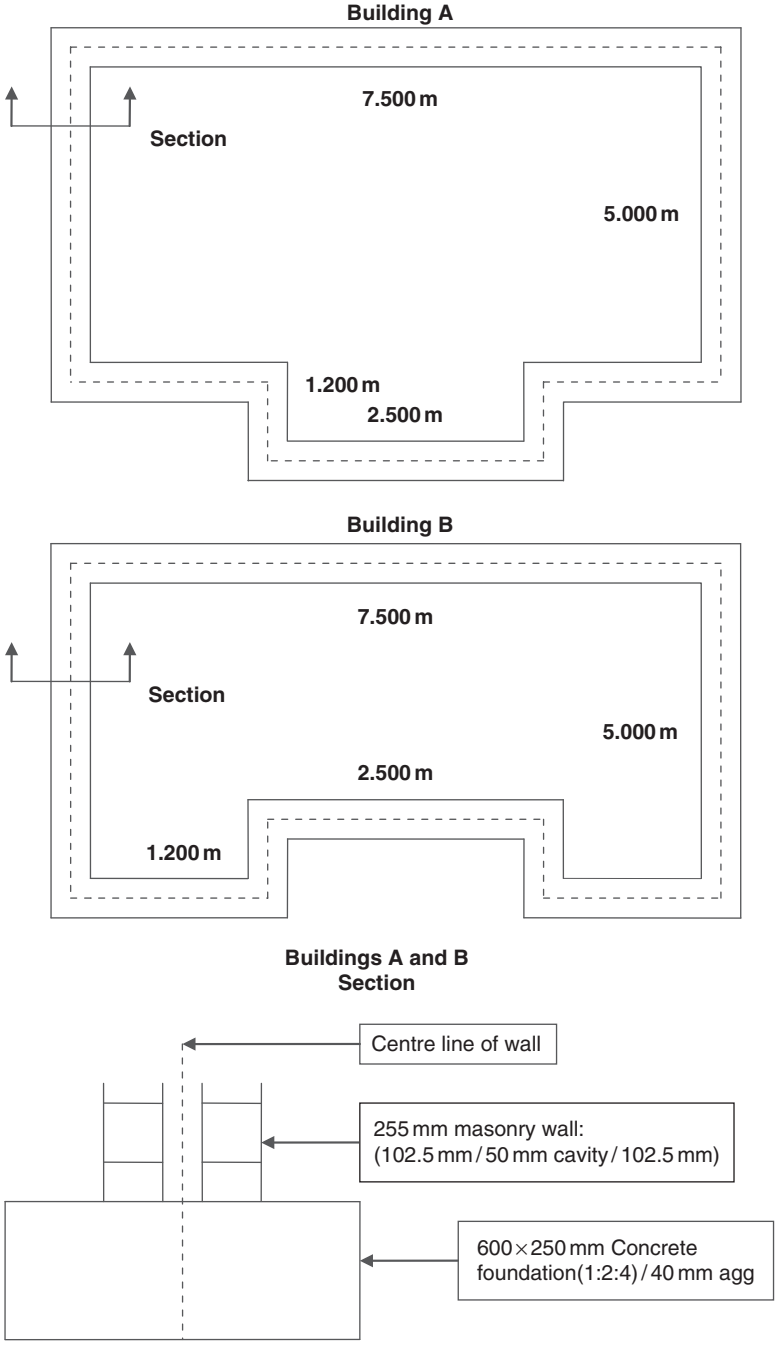

Building A
7.500 m
Section
5.000 m
1.200 m
2.500 m
Building B
7.500 m
Section
5.000 m
2.500 m
1.200 m
Buildings A and B
Section
Centre line of wall
255 mm masonry wall:
(102.5 mm / 50 mm cavity / 102.5 mm)
600 × 250 mm Concrete
foundation(1:2:4) / 40 mm agg

Figure 2.2

Table 2.6

			Building A	
	29.80 0.60 0.25	4.47	In situ concrete foundations over 150 and up to 450 mm thick poured against earth (1:2:4 / 40 agg)	The dimensions provided for both buildings are internal and the centre line is required to measure the foundation. Building A *Centre line*: Internal dimensions are given of a 600 mm foundation. The centre line is ascertained by adding each corner twice by half the foundation width. The internal and external angles to the projection cancel themselves out so the total number of corners is 4. 2/ 7.500 15.000 2/ 5.000 10.000 25.000 ADD Projection 2/ 1.200 2.400 ADD 4/2/1/2/ 0.600 2.400 29.800
			Building B	
	29.80 0.60 0.25	4.47	In situ concrete foundations over 150 and up to 450mm thick poured against earth (1:2:4 / 40 agg)	Building B *Centre line*: Here, the foundation is the same as Building A and the internal and external angles to the recess cancel themselves out. The centre line is calculated using the same procedure as above. 2/ 7.500 15.000 2/ 5.000 10.000 25.000 ADD Recess 2/ 1.200 2.400 ADD 4/2/1/2/ 0.600 2.400 29.800

Where projections or insets occur, it is necessary to consider the effect of angles on the centre line. Figure 2.2 demonstrates two scenarios applicable to the measurement of concrete foundations on a foundation plan which is demonstrated in the take off in Table 2.6.

2.3.3 Spot and composite items

A spot item is a description of a single item of work on a trade bill that defines the practical aspects of a task. For example, it is used on a refurbishment project when drawings and specifications outline the scope of works yet lack detailed information because the extent may only become apparent once the work commences. A composite item is the description of an item that will form part of the new building and which may be measured as a single item or with a unit of measurement. This applies to, e.g. staircases, windows and joinery items where the intention is to include wording that describes the item sufficiently to identify salient features. There are no set rules to the paraphrasing or length of a description for spot and composite items; this will vary between surveyors and is influenced by the amount of information available in the documentation and drawings. A key point for the surveyor is to ensure the description addresses the subject in enough detail so that an estimator can read it and immediately be in a position to understand the requirements. For example, a composite item for a timber staircase should include a description of the main components and the source of information. It does not need to mention the type of glue or fixings used in the stair manufacture even if mentioned in the specification as they are a minor part of the works.

Table 2.7 demonstrates an example of a spot item for restaining a staircase and a composite item for the supply and installation of a new flight of timber stairs.

To create these items requires more a knowledge of construction technology and appreciation of the scope than the ability to measure. If the quantity surveyor is inexperienced with the matter, it would be wise to ask an experienced colleague for advice.

2.4 Control of the system and delegation of tasks

With the tender documentation to hand, it is necessary to instigate a plan for bill preparation within a period to suit the needs of the project under tender. With projects valued up to say £1 m, it is usual for a contractor's estimator and assistant to prepare the bills without the need to outsource from a PQS. Anything in excess of this amount might need to be outsourced or will depend on the contractor's staffing resources. After documentation is fully developed and the full set of trade bills required for a project is prepared, a team of surveyors employed by the contractor might be involved. This justifies the need for a controlled procedure involving a supervisor who may be an estimator, chief

Table 2.7

			Spot Item	
		Item	Prepare timber substrate to receive new finish using abrasion by hand or mechanical means for a light surface finish, including removal of discolourations and staining from oil, grease or nail heads; fill cracks and holes with suitable filler; knot and stop defective timbers; apply caulking to visible gaps between staircase and wall; fine sand all surfaces; clean down areas with sharp solvent before base staining; apply one coat of base stain, base coat and top coat at recommended intervals in accordance with the internal schedules of finishes to; newel post (1), handrail (1), treads and risers (13), stringers (1), balusters (12) including submission of the stain manufacturers published recommendations for maintenance upon completion, all as per Drawing A5000 (Stair 1)	The description should be in sequence of the works, and in this example commences with the preparation of the surface through to the final coating.
			Composite item	
		3.00	Custom made internal single flight of softwood stairs, overall 1100 × 3400 mm comprising; 275 × 32 mm bullnosed treads with clamped 80 × 80 mm blocking pieces to the underside of and including 25 × 150 mm risers (13); 20 × 250 mm inner and outer rebated stringers (2); 25 × 45 mm balusters, 1000 mm high with vertical chamfered edges secured to stringer and handrail (12); 100 × 100 mm newel posts overall 1200 mm high with chamfered edges fixing to treads (2) including site fixing to timber joists (measured elsewhere) all as per Drawing A6000 (Level 01–02 : Stair 4)	The staircase will be factory made from timber as detailed in the carpentry trade section of the specification. Descriptions include key timber components together with fixing methods. Any loose timbers for securing the stairs and not part of the staircase manufacture are measured separately as the manufacturer may not provide them. The squaring column states a measure and the unit of measurement is M/R (metre rise) which is the vertical dimension the staircase spans between floor levels.
		3.20	125 × 65 mm hardwood handrail, rebated 28 × 50 mm, screwed to balusters	As the handrail is made from a different material than the stairs, it is measured separately. Finishes to timbers are not included in the carpentry section and will be included within the painting trade.

quantity surveyor or commercial manager to oversee a team of a size to suit the nature and complexity of the project. With this scenario, it is necessary to implement a system to meet deadlines that includes delegation for the responsibility of duties. There are two approaches to manage the process.

Group method This approach involves the delegation of tasks to surveyors and apportioning building elements into measurement groups. With a large project involving a number of surveyors, a supervisor normally sets an agenda to ensure building elements are recognised in groups and distributes the workload accordingly. A suitable checklist and delegation of tasks is shown in Table 2.8. The objective of the checklist is to ensure adequate monitoring is in place to avoid double measuring or oversights and to guarantee that trade bills are prepared within the time available. This is aided by targeting the number of working days for each element as shown in the table.

Communication between surveyors is crucial for the successful delivery of the bills. Trades may overlap and for this reason there is a need for interaction between surveyors. For example, it may be necessary to understand who will amend external wall measures to account for deductions in wall openings to suit the doors and windows. It may be that one individual is measuring the doors and windows and another measuring the walls; if there is no communication, deductions may be overlooked. Here, a supervisor will make a decision and delegate the responsibility: a suitable decision may be for the surveyor measuring the doors and windows to make the wall deductions as this surveyor is in possession of the relevant window and door drawings.

Abstracting The abstract stage is a checking and summary process used to collect information from the group method and make summary adjustments for additions and deductions to arrive at final quantities. Upon completion, information is transferred to a draft bill where trades are used as main headings as set out in the measurement guide for final checking. Table 2.9 shows a take off for the substructure of a building and abstracting method for the excavation and filling trade operations.

Trade by trade With this process, trades are used as main headings in the take off as set out in the measurement guide that form the draft and final bills to which descriptions and calculated quantities are transferred directly, thus bypassing the abstract stage. This is known as billing direct and has the advantage of saving time. A disadvantage is the omission of double checking because the abstract method transfers quantities logically and cross-references page numbers and adjustments to ensure there are no errors. This disadvantage may result in errors going unnoticed and is better for simple projects or those low in value where the risk is minimal. For this reason, large and complex projects require a method of abstracting or checking prior to transferring. A trade by trade approach is also harder to organise for a large project as trade work groups can repeat with different elements, meaning additional supplies of drawings are required for use by other surveyors. For example, concrete trade works are

Table 2.8

Measurement group tasks		***Project Nr: 1755***	
Project: New office block - Anytown, Manchester		***Date of receipt of documents:***	
Project description: New multi storey office block		***Draft bill review date:***	
Group task leader: DT		***Final bill review date:***	
Client:		Electrical Services:	
Architect:		PQS:	
Landscape Architect:		Surveyor 1:	S1
Structural Engineer:		Surveyor 2:	S2
Civil Engineer:		Surveyor 3:	S3
Water Services:		Surveyor 4:	S4
Mechanical Services:		Not applicable*	NA
Fire Services:		*Subcontractors to price works	
Element	**Measurement group**	**Task**	**Measure complete**
1.0 Substructure (10 days)			
1.1	Excavations	S1	
1.2	Piling and pile caps	S1	
1.3	Ground floor	S1	
2.0 Superstructure (15 days)			
2.1	Columns	S2	
2.2	Upper floors	S2	
2.3	Staircases	S2	
2.4	Roof	S2	
2.5	External walls	S2	
2.6	Windows	S3	
2.7	External doors	S3	
2.8	Internal walls	S3	
2.9	Internal screens	S3	
2.10	Internal doors	S3	
3.0 Internal finishes (10 days)			
3.1	Wall finishes	S3	
3.2	Floor finishes	S3	
3.3	Ceiling finishes	S3	
4.0 Fittings/fitments (10 days)			
4.1	Fittings	S2	
4.2	Fitments	S2	
4.3	Equipment	S2	

(continued)

Table 2.8 (*cont'd*)

5.0 Services (15 days)			
5.1	Sanitary fixtures	NA	
5.2	Drainage	S4	
5.3	Water and gas	NA	
5.4	Space heating	NA	
5.5	Fire protection	NA	
5.6	Mechanical	NA	
5.7	Electrical	NA	
5.8	Other services	NA	
5.9	Builders work	S4	
6.0 Prov and PC Sums (1 day)			
6.1	Provisional Sums	DT	
6.2	Prime Cost Sum items	DT	
7.0 Client Contingency (1 day)			
7.1	Contingencies	DT	
8.0 Others (1 day)			
8.1	Dayworks	DT	
9.0 External works (10 days)			
9.1	Site preparation	S1	
9.2	Paved surfaces	S2	
9.3	Fences and walls	S2	
9.4	Landscaping	S2	
9.5	External services	S4	
9.6	Roads and drainage	NA	
10.0 Design Fees (10 days)			
10.1	Design Fees	DT	
11.0 Main Contractor (5 days)			
11.1	Preliminaries	DT	
11.2	Client's contractors	DT	
11.3	Margin	DT	

Table 2.9

			SUBSTRUCTURE	In this example, the take off is entered on the abstract sheet and when complete, the items are struck through to show they are transferred. The unit of measurement (m^2, m^3, etc) is written as a prefix to the abbreviated description with the quantities entered and take off page number noted in brackets for reference. Deductions and additions are shown separately and transferred across. Final quantities are shown in bold and/or underlined if preferred, and rounded to the nearest whole unit.
			Site preparation	
	22.80 20.30	462.84	Exc topsoil av 150 mm th for preservation & Deposit in temp spoil heaps av distance 50 m from excavn x 0.150 = 69.43 m^3	
			Excavations	
	80.00 0.60 0.90	43.20	Exc trench over 300 wide, ne 1 m deep & Filling with excd materials obtained from site, av th > 0.250 m	
			Earthwork support and / or maintaining faces	
2/	80.00 0.90	144.00	Earthwork support, max depth ne 1.0 m & distance between opposing faces ne 2.0 m	

(continued)

Table 2.9 (*cont'd*)

	80.00 0.60 0.15	7.20	**Concrete** In situ concrete bed poured against earth > 150 mm th & Ddt Filling with excd mats obtained from site, av th > 0.250m & Add - Disposal of excd materials off site	
2/	80.00 0.75	120.00	**Brickwork** Walls, 102.5mm thick in bwk commons laid stretcher bond in cm (1:3) & Ddt Filling with excd mats obtained from site, av th > 0.250m × 0.255 = 30.60 m^3 & Add Disposal of excd materials off site	

ABSTRACT SHEET ***SMM7 Trade: Excavation and filling***				***Project Nr 1855***			
Excavation m^2/ Exc topsoil av150 mm th for preservation		**Earthwork support and / or maintaining faces** m^2/ Earthworks support, max depth ne 1 m & distance between opp faces ne 2 m		**Disposal** m^3/ Disposal of excd materials off site		**Filling** m^3/ Filling with excd mats obtained from site av th > 0.250 m	
	Ddt		**Ddt**		**Ddt**		**Ddt**
462.84 (1) **463 m^2**	0	144.00 (1) **144 m^2**	0	7.20 (1) 30.60 (1) 37.80 **38 m^3**	0	43.20 (1) –37.80 5.40 **5 m^3**	7.20 (1) 30.60 (1) 37.80
m^3/Exc tr over 300 wide, ne 1m dp 43.20 (1) **43 m^3**	0			m^3/ Deposit topsoil in temp spoil heaps av distance, 50m from excavn			
				69.43 (1) **69 m^3**			

required for the substructure and different elements of the superstructure such as floors and columns. When measuring this trade, drawings for all elements involving concrete must be provided, thus restricting the availability of some drawings for use by others unless duplicates are provided.

2.4.1 Requests for Information (RFI)

During the measurement process, there may be reasons to raise queries with the client's agent regarding the design and documentation provided. However, before a query is raised it would be wise to explore the documents first. It might be that, although the answer may not be obvious, nonetheless it is within the information provided. The consultant's response might be to refer back to something already issued, which could cause embarrassment. Of course, there may be a misunderstanding about the information supplied and if the quantity surveyor has doubt about any content, it would be wise to ask a colleague for a second opinion. Descriptions in design and documents could include industrial or cultural jargon, and a colleague may have experience with such matters and be aware of industrial practices or the cultural working of designers or report authors. Sharing this knowledge could ease any burden of doubt and provide the answer without the need to raise a query.

When a query is necessary, the usual approach is to issue a Request for Information (RFI), which should be in writing and recorded in a register. The recording is necessary because delays in a response may jeopardise timeframes for the bill preparation. The request should be addressed to the client's agent, or directly to the appropriate consultant with the client's agent copied in. An RFI should be concise and refer to drawings, specifications, reports and location in a building or elsewhere if applicable. This is to enable the consultant to quickly identify the nature of the query as there may be a large number of documents to sieve through in order to locate the problem. The RFI should include a timeframe for a response which should be reasonable, and a period of seven working days should suffice unless the query is of an urgent nature. What is considered urgent may be open to question, and the quantity surveyor should contemplate timing especially if the query involves the need for a new report or issue of drawings that may take longer to provide. Whilst awaiting a response, it is not good practice to delay measurement, and for this reason the RFI can include an assumption for the process to continue without disruption. For example, if measuring structural steel members to a roof and the surface treatment is unknown, an RFI could be worded by saying:

> 'Unless advised to the contrary, it will be assumed that all members will be hot dip galvanised to ISO 9002.'

When making an assumption, it would be wise to state the source that prompted the idea. In this example, the source might be from a specification within metalwork and not structural steel that includes a general note stating that

steel components for the project are to be galvanised to ISO 9002. In this example, the assumption is not bold on the part of the surveyor as it reasonable to assume treatment is required to the surfaces of steel in the roof to prevent corrosion.

The register should record the date the RFI was issued and to whom it was sent as well as a description of the query, the date of receiving a response and whether the response was conclusive or inconclusive. For example, if a response states there will be no answer until the architect is back from holiday, it means the response to the RFI is inconclusive. A completed tick box on the register indicating the status of each RFI will suffice to confirm whether the response received is adequate and conclusive. The register permits a supervisor to understand if anything is outstanding at any time to enable the production of the bills to meet the deadline.

2.5 Measurement example

Once a choice of managing the process is made, it is necessary to prepare a take off list. Let us say that bills are required for a contractor who is preparing a tender and the preferred arrangement is trade by trade. The guide used is SMM7 and it would be wise to have highlighter pens to hand to mark drawings and specification notes to demonstrate they have been transferred to the take off paper, word processor, or commercial software if used.

Figure 2.3 shows a foundation and ground floor slab plan for a residential property that requires a piled foundation. After studying the design, the first process is to create a take off list for each trade which can be obtained from the guide.

Trade: **Piling**
Piling platform: Excavate and dispose of spoil, construct a piling platform.

Piling operations: Mobilise the rig to and from site, set out and construct the piles and test upon completion.

Builder's work in connection with piling operations: Dispose generated spoil from the piling operations, cut piles to level.

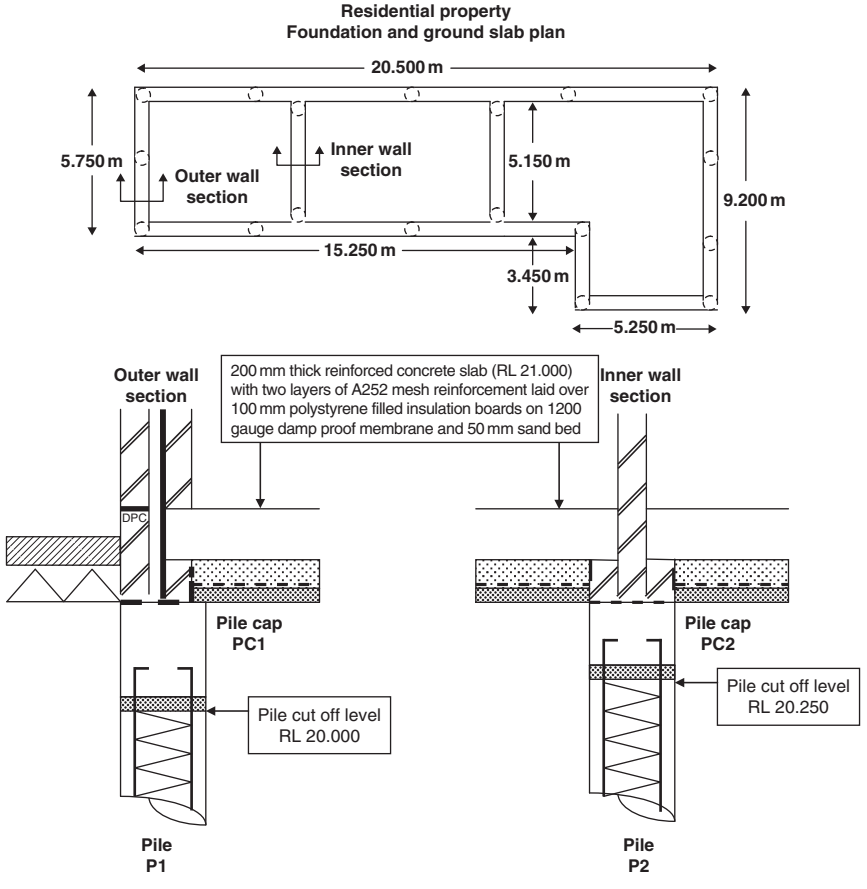
Trade: **Excavations**
Excavate ground level and trenches around the piles, dispose of generated spoil, compact the bottoms of the trench, earthwork support.

Trade: **In situ concrete**
Sand blinding, etc: Blinding below the pile caps and slab, insulation and damp proof membrane.

Concrete: Pile caps and slab, surface treatment to the concrete.

Formwork: Pile caps and edge board to the slab.

Reinforcement: Mesh sheeting to the slab and bar reinforcement to the pile caps.



Pile schedule – Continuous flight auger piles						
Type	Size	Reinforcement	Concrete	Ground RL	Founding RL	Cut off RL
Pile P1	300 mm dia	R24 vert, helix R12 @ 300 mm pitch	50 N/mm^2	21.000	15.000	20.000
Pile P2	300 mm dia	R24 vert, helix R12 @ 300 mm pitch	50 N/mm^2	21.000	15.000	20.250

Pile cap schedule				
Type	Size	Reinforcement	Concrete	Notes
Pile cap PC1	300 mm × 600 mm	150 Kg/m^3	50 N/mm^2	50 mm sand blinding below pile cap
Pile cap PC2	300 mm × 350 mm	150 Kg/m^3	50 N/mm^2	50 mm sand blinding below pile cap

Figure 2.3

The wall trade measure is excluded as it overlaps with the superstructure and is read in conjunction with other drawings.

The take off for these trades is shown in Table 2.10.

2.6 Builder's bills of quantities

The original format for the presentation of a BOQ is to BS3327:1970 and comprises a 7-column bill. This format has since been withdrawn to permit flexibility with the use of alternative bill formats, including the builder's bills of

Table 2.10

			New residential property	
			Trade: PILING	Piling is a type of building foundation created at deep level. It is suitable where soil conditions close to the surface are unsuitable to form a traditional trench and concrete strip footing. For residential properties, it is generally economically viable to construct wide strip footings and substructure to depths of 3.0 m. However, for depths in excess of 3.0 m, the solution is piling. For this example, the specification calls for a continuous flight auger (CFA) piling system, a soil replacement type formed on a bed of rock. The formation of the piles involves boring the ground to a founding rock level and encasing it with lining for stability. Caged bar reinforcement is then inserted along the length with concrete poured down the shaft to form the pile. For this bill, it is not necessary to measure the lining, concrete and reinforcement as the piling contractor provides a complete service including the supply of testing results.
			Piling platform	
	20.50 9.20 0.20	 37.72	Exc to RL, ne 250 mm dp	
	15.25 3.45 0.20	 (10.52)	Ddt inset & Dispose of excd mat off site &	
		27.20	Filling with imported material, hardcore ne 250 mm th	
	20.50 9.20	 188.60	Trim and level formation	Due to the weight and size of the rig, the contractor is responsible for providing a level platform to avoid ground collapse. The platform here is to be a 200 mm thick bed of compacted hardcore to permit the rig to maneuver within the footprint of the building and between the piles. Any haul road from the entry point of the site to the footprint of the building for the rig to travel will be used for general site access. This will be suitable for material deliveries and included separately within the preliminaries.
	15.25 3.45	 (52.61)	Ddt inset & Compact hardcore ne 250 mm th	
		135.99		

(continued)

Table 2.10 (*cont'd*)

			Piling operations	
		Item	Mobilisation of piling rig including set up on site and demobilisation upon completion of the works	
	18	***18***	Setting out of piles	P1 - Outer wall - 14 P2 - Inner wall - 4
18/	6.00	***108.00***	Bored augured piles, 300mm dia, depth range 5.0–6.0m comprising boring, socketting into rock, casing, bar reinforcement and 50N/mm² concrete (P1, P2)	P1 Grd level RL 21.000 Form level RL 15.000 6.000 P2 Grd level RL 21.000 Form level RL 15.000 6.000
		Item	Allow for pile integrity testing upon completion	The design shows a series of levels co-related to a fixed level point in a position selected by the land surveyor or engineer. When a site is first surveyed, a fixed level point is required as a benchmark from which design levels relate. This point is a station and the level it creates is a datum from which reduced levels *(RL)* are noted. This means design levels are either above or below the datum that commence from the station.
			Builders work in connection with completed piling operations	
18/22/7	0.15 0.15 6.00	***7.64***	Dispose of spoil generated from piling works off site	The handling and disposal of soil replaced by the piles is recognised.
	18	***18***	Cut 300 mm dia piles to level, ne 1.0 m high	P1 @ GL 21.000 Cut off level 20.000 Cut depth 1.000 P2 @ GL 21.000 20.250 0.750
			End of piling	

			Trade: EXCAVATIONS	
	20.50		Exc to RL, ne 1 m dp	First, it is necessary to reduce the ground level down to the top of the pile caps. Pile caps are concrete beams that sit on the pile and have the building loads transferred to them and the piles.
	9.20			
	0.35	66.01		
	15.25		Ddt Inset	
	3.45		&	
	0.35	(18.41)	Dispose of excd mat off site	
		47.60		
	58.20		Exc trench, ne 1m deep, working around piles	PC1 – Building perimeter
	0.30			2/ 20.500 41.000
	0.65	11.35	(PC1)	2/ 9.200 18.400
				59.400
2/	5.15			
	0.30			Less corners, 5 – 1 offset
	0.40	1.24	(PC2)	4/2/1/2 0.300 –1.200
			&	Centre line (CL) 58.200
		12.59	Dispose of excd mat off site	The depth of excavation is the pile cap depth plus the blinding.
	20.50			
	9.20	188.60	Compacting bottom of excavations	
	15.25			
	3.45	(52.61)	Ddt inset	
	58.20			
	0.30	17.46	Add (PC1)	
2/	5.15			
	0.30	3.09	(PC2)	
		156.54		

(continued)

Table 2.10 (*cont'd*)

2/	58.20 0.65	75.66	Earthworks support, max depth ne 1.0m and 2.0m opposing faces	Earthwork support refers to a method of providing a safe working space in ground to comply with CDM and H & S regulations. Measurements are to the outer and inner faces of trench excavations.	
2/2	5.15 0.40	8.24			
		83.90	**End of Excavations**		
			Trade: IN SITU CONCRETE		
			Sand blinding etc		
	58.20 0.30	17.46	Sand blinding, 50mm th (PC1)		
2/	5.15 0.30	3.09	(PC2)		
		20.55			
	20.00 8.70	174.00	Sand blinding, 50mm th & 100mm rigid polystyrene filled insulation boards	Building length LESS Walls 2/ 250mm Building width LESS Walls 2/ 250mm	20.500 –0.500 20.000 9.200 –0.500
	15.25 3.45	(52.61)	Ddt inset		8.700
2/	5.15 0.30	(3.09)	Ddt inner walls		
		118.39			

	20.50 9.20	 188.60	1200 gauge damp proof membrane laid horizontally, > 300mm wide	
	15.25 3.45	 (52.61)	Ddt inset	
	57.74 0.15	 8.66	Add	The membrane extends up the face of the inner blocks and an adjustment is required. CL 58.200 Less half cavity & block 4/2/1/2 /0.115 0.460 57.740
2/2/	5.15 0.15	 3.09		
		147.74		
			Concrete	
	58.20 0.30 0.60	 ***10.48***	Reinforced in situ concrete pile cap over 450mm th, 50 N/mm² (PC1)	
2/	5.15 0.30 0.35	 ***1.08***	Reinforced in situ concrete pile cap 150 to 450mm th, 50 N/mm² (PC2)	
	20.20 8.90 0.20	 35.96	Reinforced in situ concrete bed 150 to 450mm th, 50 N/mm² (slab)	Building length 20.500 LESS outer wall and cavity 2/ 150mm –0.300 20.200 Building width 9.200 LESS 2/ 150mm –0.300 8.900
	15.25 3.45 0.20	 (10.52)	Ddt inset	
2/	5.15 0.30 0.20	 (0.62)	Ddt inner walls	
		24.82		

(continued)

Table 2.10 (*cont'd*)

	58.20 0.60	34.92	Surface treatment to concrete, trowel finish (PC1)	Horizontal surfaces are to have a trowel finish for follow on trades
2/	5.15 0.60	6.18	(PC2)	
	20.20 8.90	179.78		
	15.25 3.45	(52.61)	Ddt inset (slab)	
2/	5.15 0.20	(2.06)	Ddt inner walls	
		166.21		
			Formwork	
2/	58.20 0.60	69.84	Formwork Class A finish (PC1)	Formwork is required for retaining concrete whilst it cures and a Class A finish is suitable, as the faces of pile caps are not exposed.
2/2/	5.15 0.35	7.21	(PC2)	
		77.05		
2/	20.20	40.40	Formwork Class A finish, ne 250mm wide (slab edge)	No edge formwork is required to at the slab edge to the cross walls on PC2, as the block will act as a form.
2/	8.90	17.80		
		58.20		

			Reinforcement	
2/	20.20 8.90	359.56	Mesh reinforcement A252 mesh with 150mm min side and end laps	
2/	15.25 3.45	(105.23)	Ddt inset	
2/2/	5.15 0.20	(4.12)	Ddt inner walls	
		250.21		
			Bar reinforcement to pile caps	Reinforcement to pile caps is by ratio to the volume of in situ concrete.
		10.48	(PC1)	
		1.08	(PC2)	
		11.56	***x 150 Kg/m³*** ***1000 = 1.734 t***	
			End of In situ concrete	

quantities. The original format remains unsurpassed with subtle differences applied by quantity surveyors and computer software writers with variations depending on the author of the software. A builder's bill of trade quantities is flexible and informal, and uses measurement and descriptions to define a scope of works from the builder's perspective. Descriptions include working or operational methods and a number of shortened descriptions that are abbreviated versions of SMM rules or Volume 2 of the RICS new rules of measurement. Builders adopt the use of these bills in the absence of a trade BOQ when they are responsible for producing their own quantities as a tender requirement. Alternatively, they may create their own method of measurement in-house guide with coverage rules.

2.6.1 Components

On small projects such as that demonstrated in Figure 2.3, a builder's trade bills will suffice to assess quantities and apply rates to calculate an estimate of a cost to build. With larger projects, the bill comprises of a number of divisional parts which are organised in a sequence and are made up of the following sections:

Measured works (Trade headings) including General Items This is the largest section that arranges trades in sequence as laid down in the measurement guide. The measured work sections divide the bill into trade parts with each having a main heading and a series of sub-headings that include a description of the works.

General Items is a list of secondary notes to the measured works that permits contractors to isolate parts of the works associated with the trade and apply as a separate cost. They are specific in nature to a project and require inclusion in the bills to avoid being overlooked, as they express expectations a client would consider inclusive in a trade price. These items may commence with a standard sub-heading, for example, 'The contractor shall allow in the price for the following…'. The description then gives specific requirements, e.g. to allow for a particular quality control system within the specification, method of dealing with rainwater in excavations, etc. General Items are not to be confused with spot or composite items which have either a unit of measurement or are described as an 'Item' within a trade bill.

Preliminaries and General Conditions Preliminaries are time- and fixed-related on-site overheads and sums of money a main contractor incurs for running a project. Time-related charges include the following:

- Supervision of the works
- Mechanical plant and equipment hire, including fuel consumption when not subcontracted
- Other management and support staff if not part of supervision
- Security arrangements including out-of-hours site watchmen and protective fencing
- Access and lifting equipment such as scaffolding, tower cranes, and hoists

- Water, fuel, and power consumption for the site accommodation and building operations
- The cost to run the site accommodation including maintenance and cleaning
- Health and safety purchases, i.e. hard hats, protective equipment, etc.

Fixed-related charges are for lump sum payments that include:

- Insurance and finance charges for the works
- Site signage
- Minor plant hire purchases
- Building cleaning prior to handover
- Surveying and setting out of the building
- Mobilisation and demobilisation of site accommodation
- Connection and disconnection of temporary services.

General Conditions provide details of the project including a broad description of the scope as a snapshot of the scheme. For example,

20 nr two storey detached residential properties

1a Any Street

Anytown

The General Conditions also include the client's team contact details and a list of documentation that will form part of the tender. This includes:

- The form of contract with definition of any amendments
- Contractual terms in an appendix stating items such as the retention sum to be withheld from interim payments, dates for possession of the site and the envisaged construction duration
- Specific conditions such as phasing of the works for handover
- Sequence of operations including night or weekend work
- Restrictions, i.e. working hours and parking
- Client's site accommodation requirements
- Noise and dust control during the construction operations
- Existing tree protection
- Any requirements to comply with conditions of planning approval relevant to the duties of a main contractor.

As part of the tender, a contractor will require a contribution to company overheads which is a charge to cover the running costs of the business plus an amount as profit. This combination is termed the contractor's margin, and is either a fixed fee or a percentage of the total price that forms part of the tender. Tendering techniques dealing with recognition of the margin differ and may be included within the preliminaries, General Conditions, as a General Item or included in the chargeable rates in the trade bills.

Client directed sums Where directed, documents may include a list of sums or schedules for inclusion in the bill and part of a tender.

Contingency A contingency is a nominal monetary sum to cover the cost of additional expenditure released at the discretion of the client at any time during

the construction phase. It is not usually included in the bills as it is for budgeting purposes only and is included if there is a specific request in the documents.

Provisional sums When it is not possible to measure works due to the absence of a design, or it is not possible to measure the scope until the works commence, a predetermined amount is included in the bills as a provisional sum. It is not the contractor's responsibility to assess a provisional sum – the client usually provides the amount in the documentation for competing contractors to include in their tenders, even though it may be vague and an approximate cost. This is naturally a risk to the client and the quantity surveyor can only include the stated sum in the bill even if it is an arbitrary value. In broad terms, there are two types of provisional sums. The first is an *undefined* provisional sum: an approximation which is broad in context without fine logic with the hope the allowance is sufficient. When logic is applied and there is a source and basis for a calculation, it becomes a *defined* provisional sum. For example, let us say a footpath needs reinstating and the consensus is to reinstate 10 m length × 2 m wide at a given rate. The defined provisional sum would calculate as:

20m^2@£250.00 = £5000.

Provisional sums may form part of the General Conditions or within the appropriate trade bill. Sometimes these sums can be considerable and a realistic approach is to allocate the sum to the trade bill as it provides an accurate guide to the overall trade price.

Prime cost sums During preparation of the documents, a designer such as an architect (who may also be the client's agent) might seek specialist advice from suppliers or companies that provide particular products and/or services. The satisfactory continuation of the negotiations is to include the services and products in the contract documents as a preferred choice. For example, companies who supply and install underfloor heating systems may be nominated because their specification and low running costs are suitable for a client's needs. In this scenario, the architect will obtain quotations for budgeting purposes and instruct the budget sum to form part of a pending contract with a main contractor when it becomes a prime cost (PC Sum). The intention here is for the successful contractor to enter into an agreement with one of the subcontractors who provided the quotations. Main contractors competing for works include any stated PC Sums in their tender together with charges for specific and general attendances to complete the works. Specific attendance refers to physical works a main contractor carries out for a subcontractor to successfully complete and commission the trade works covered by the PC Sum. An alternative term for this is 'builders work in connection'(BWIC). General attendance refers to attendance by the main contractor for supervising and providing the duties of a main contractor. This is to oversee the subcontracted works covered by the PC Sum with the option to make a separate allowance if the charges are not included within the preliminaries.

Where the documents refer to a PC Sum, the bills are prepared to include a brief description of works to enable tendering contractors to consider the cost of attendances. Contractors price this work as either a percentage of the PC Sum or as an accurate assessment to provide a fixed price. When a PC Sum is for the supply and delivery of goods only, excluding installation or fixing, specific attendance includes fixing the materials and the supply and fix of any sundry materials (screws, supports, etc) required to carry out the fixing.

PC Sums and attendances attract sums of money to cover company overheads and profit for the main contractor. This gives contractors the option to include any additional amount not recoverable within the preliminaries or project margin. An amount to cover the subcontractor's overheads and profit is excluded as these are reflected in their quotations and require no mention in the bills. PC Sums also apply when a final product selection is unknown. For example, a specification note might state, 'Allow the PC Sum of £300.00 per thousand for the supply of facing bricks'. This instructs bidding companies to allow the sum as a base cost for the purchase of facing bricks. A PC Sum may be included under the General Conditions or appropriate trade heading. When set out under trade headings, the description and nominal PC amount are included in the take off to ensure the PC Sum is included in the final BOQ.

Dayworks Certain projects require the recording of dayworks, which is a method of paying a contractor on a 'do and charge' basis for works not included in measured trade sections of the bill. In practice, this involves recording the total hours of trade labour to complete an item of work as well as providing proof of the cost of materials purchased and any items of hired plant. Dayworks is a suitable method of reimbursement to a contractor when the scope of the work is unknown or not possible to quantify beforehand. The approach is often used to evaluate the expenditure of provisional sums once works are in progress. The system is widespread in refurbishment works, and is also used in some new works when the consensus is that they are the most practical method of carrying out out works by logging real time and constituents of expense. When dayworks are a known requirement and are to be included in a project, a daywork bill is prepared for the estimator's consideration. This is to permit main contractors to insert percentage additions to the prime cost of employing labour and the cost of materials and plant hire which include company overheads and profit. Table 2.11 shows a daywork bill for inclusion in a BOQ.

Client-engaged contractors Some projects call for scopes of work that are excluded from a contract between the main contractor and client where the client intends to employ contractors direct. This is usually due to a client's existing working relationship with a business for its services. It may also be for works to be carried out by businesses that are not usually involved with the construction industry, e.g. ornamental work, artwork, interior design, date plaques, etc, or works that are the normal business of the client. The intention here is for the client to have a contractual say in the project by entering into direct agreements

Table 2.11

					£	P
	Bill Nr 1					
	Preliminaries and General Conditions					
A	Allow the following DAYWORK percentage additions for unpriced works ordered by the Architect prior to Practical Completion. The additions are to include for overheads and profit to the prime cost of labour and the purchasing and hiring of goods and services to complete the works					
	Labour - Prime cost PLUS _____%					
	Materials - Cost PLUS _____%					
	Plant - Cost PLUS _____%					
	1 / 6					

for their services. When this scenario applies, the documents should include a list of works and preferably names of the businesses that will carry them out. In usual circumstances, the scope of their works commences and finishes during the construction phase and the contractor acts as supervisor and provides specific and general attendances. Therefore, the bill will need to list each trade with a note of attendance requirements for the contractor to insert a price, as well as allowances for company overheads and profit. The price of each trade works requires no mention as it is of no concern to anyone but the client and the directly employed contractor(s), which makes it distinct from a PC or provisional sum. The list can be included as a single trade bill encompassing all client-engaged contractors or may be included within the Preliminaries General Requirements.

Preambles Preambles are coverage notes for anything not mentioned in a description that need to be made obvious to a contractor preparing a tender. The notes are applicable to each trade bill and comprise of a list of items cross-referenced to the specification, drawings and the method of measurement used for preparing the bills. They also have an inclusion list which is an expression of items that are to be included in a tender. Preambles precede measured work descriptions and General Items and are worded in sequence under a series of sub-headings below a main trade heading. Experienced contractors preparing their own bills tend not to include preambles because they may be of the opinion they are aware of inclusions and consider the reminder unnecessary. However, if preambles are omitted, there is a danger of making assumptions with regards inclusions within a trade scope and a PQS preparing a builder's bill for a contractor will normally include them to ensure there is no doubt.

As preamble notes are often generic and suitable for a range of project types, there is a danger that notes will be transferred from one project to another

Table 2.12

					£	P
	Bill Nr 2 **Excavating and Filling** SPECIFICATION AND DRAWINGS The Contractor is referred to the specification and drawings for a full description of the works, materials and workmanship and allow full compliance METHOD OF MEASUREMENT This builder's bill of quantities has not been measured in full accordance with the Standard Method of Measurement of Building Works (SMM7). It has however, been prepared using SMM7 as a guide for preparing relevant trade bills and the general rules of measurement This builder's bill of quantities is issued for the purpose of assisting tendering companies and will not form part of any contract. It is the responsibility of each contractor to ensure allowances for waste, cutting and fixing are allowed within the rate MEASUREMENT COVERAGE AND PRICES Excavations It is assumed reduced level excavations and disposal of material will be carried out prior to commencing trench excavations and stockpiled material will not hinder operations No allowance has been made for bulking of the material after excavation and the contractor shall make due allowance The contractor shall note the commencement levels of excavations as noted on the drawings and work in a logical sequence of work and allow here any cost for any alternative methods The contractor is to be acquainted with the Site Investigation Report and include for all costs associated with handling, transporting and disposing of the subsoil as per the classification table. This is to include all statutory and legislative fees for licensed disposal and compliance with the Waste Management Plan					

(continued)

Table 2.12 (*cont'd*)

	<u>Hardcore and filling</u> Filling material shall be excavated material to the trenches and imported hardcore elsewhere Prices for installing hardcore in layers shall include adequate tamping and compaction to ensure the material does not exceed the maximum moisture content permitted for hardcore beds beneath the ground floor slab All filling material is measured nett in position with no allowance for purchased bulked material that compacts to a lesser volume <u>Working space and maintaining faces</u> The contractor is to allow here for a working space including additional excavation and disposal of material as well as maintenance and repair to comply with the Health and Safety Plan and CDM Regulations 2007 2 / 1					

which may have irrelevant coverage. For this reason, any transferred items must be reviewed and edited to ensure they serve a purpose for a project undergoing a tender. To demonstrate their use, Table 2.12 shows a suitable list of preambles for the excavating and filling trade.

2.6.2 Draft and final bills

Descriptions and quantified measures from the take off are entered in appropriate columns and rounded to the nearest whole unit, e.g. 7.4 m becomes 7 m, 11.50 m^2 is 12 m^2 and 23.485 m^3 becomes 23 m^3. Steel is entered by weight in tonnes with calculations rounded to two decimal places, e.g. 6.6788 t becomes 6.68 t and 8.4429 t is 8.44 t. This should be completed for the draft bills if not already carried out in the abstract.

When creating a draft bill, abbreviations used in the take off and abstract are entered onto the bill layout for word processing as a final document. Draft bill preparation involves numbering each page of a trade bill in sequence and fetching the information to a collection page at the end of the section so that, when rated and extended, a total trade price is created. This is repeated for each trade and, when complete, is brought forward to a summary page. The process is unlike a book that runs in sequence to the end and is necessary in order to create individual trade sections and prices that form the total cost. Once items are drafted, they are spell-checked for errors and word processed as a final document.

In the final document, headings are in bold and underlined if preferred using single-spacing between descriptions. Table 2.13 shows the layout of a builder's

Table 2.13

Builder's bill of quantities		***Project Nr 2500***	
New residential property			
Element: Substructure			
Trade: PILING			
	Quant	**Rate**	**Cost**
Piling platform			
Excavate to reduced level, ne 250mm deep	27 m^3		
Dispose excavated material off site	27 m^3		
Trim and level formation	136 m^2		
Filling with imported hardcore ne 250mm th	27 m^3		
Compact hardcore ne 250mm th	136 m^2		
Piling operations			
Mobilise rig to site and demobilise	Item		
Setting out piles	18 Nr		
Bored piles, depth 5–6m, 300mm dia	108 m		
Pile integrity testing upon completion	Item		
Builders work in connection with piling			
Dispose excavated material off site	8 m^3		
Cut 300mm dia piles to level, ne 1.0m high	18 Nr		
Total Piling		£	
Trade: EXCAVATIONS			
Excavation items			
Excavate to reduced level, ne 1m deep	48 m^3		
Excavate trench ne 1m deep, around piles	13 m^3		
Dispose excavated material off site	61 m^3		
Compacting bottom of excavations	157 m^2		
Earthwork suppt, max depth ne 1m	84 m^2		

(continued)

Table 2.13 (*cont'd*)

Total Excavations		£	
Trade: IN SITU CONCRETE			
Concrete items			
Sand blinding, 50mm th	139 m^2		
100mm rigid polystyrene insulation board	118 m^2		
1200g DPM, over 300 mm wide	148 m^2		
Concrete pile cap 150–450 mm th, 50 N/mm^2	1 m^3		
Concrete pile cap over 450 mm th, 50 N/mm^2	10 m^3		
Concrete slab bed 150–450 mm th, 50 N/mm^2	25 m^3		
Surface treatment to concrete, trowel finish	166 m^2		
Formwork items			
Formwork Class A finish ne 250 mm wide	58 m		
Formwork Class A finish	77 m^2		
Reinforcement items			
Mesh reinforcement A252, 150 mm min laps	250 m^2		
Bar reinforcement by ratio to pile caps	1.73 t		
Total In situ concrete		£	

bill that represents the take off from Table 2.10 and, as this is a small project, the trades are combined to make one substructure bill to encompass the trades.

2.6.3 Using computers

This chapter has focused on measuring techniques using a traditional format that, in the author's opinion, provides an excellent method of understanding the process, whilst at the same time providing knowledge of construction technology and industrial mannerisms. This approach has undergone radical change over time due to the introduction of computer software that provides swift and accurate methods for preparing trade bills. The quantity surveyor is therefore in a position where construction knowledge and the management of information technology go hand in hand. This combination acts as a base for the successful delivery of a reputable document, whilst also providing the luxury of self-checking for errors or omissions that may otherwise go unnoticed when preparing take offs and final bills by ink and paper. The following notes address technology for trade measurements and bill preparation.

Electronic measuring Electronic measuring includes the use of hand-controlled digitisers for taking off dimensions from scaled plan drawings and is suitable when dimensions are unavailable. To obtain a reading, plans are placed flat on a workbench with a scale and unit of measurement entered on the digitiser. To obtain a reading, a separate hand device with a transparent base is manoeuvered along the plan from a commencement point, clicked at various locations and completed when the device returns to the start, thus giving a reading. The alternative to hardware is commercial software that permits screen digitisers to calculate the number, area, linear and volumes of materials or works involved, with computations displayed on a computer screen. Here, electronic design drawings such as .pdf or computer-aided design (CAD) files are opened and read from a computer. Design can be viewed in the predetermined scale or zoomed in for an expanded view to a reduced scale and may have location points that are colour coded for identification. Designs may be viewed as three-dimensional figures (3D) and printed in reports, and a high level of accuracy is provided for measuring large areas, elaborate plan shapes and irregular depths.

Bills of quantities and management systems To produce standard bill formats, many contractors use computer software systems that are either purpose made or purchased off the shelf. These systems have advantages compared to traditional take off techniques using ink and paper as they save time and have the ability to self-calculate quantities from take off screens. See Table 2.14 for an example. A further advantage is the omission of abstracting because the software is written so it self-calculates and, if managed correctly, makes allowances for deductions. Technical advantages of these systems outweigh traditional techniques as they have functions for setting up projects to provide various amounts of information. A system may permit a project to be initiated and provide options which link trade prices with elements to provide both trade and elemental prices. This assists with a trade that can apply to a number of elements, such as in situ concrete which deals with, e.g. foundations for the substructure, columns and upper floor slabs for the superstructure, etc. With this link, a luxury of the system is that it may be possible to obtain trade and element prices if rates for the trade work are known. This is beneficial on large projects where a building is multi-storey because it is possible to price the works by level and, in the event of changes such as the number of levels changing, it does not mean the measure needs to start from scratch. These systems require users to undergo training: this might be given by the software provider who provides on-line help or telephone assistance for a specified duration as part of technical support.

On smaller projects, bills may be produced on excel spreadsheets using different font styles and sizes with coloured trade headings for identification. Tabs are used for the take off, and the use of formulas in cells saves time when calculating dimensions which reduces the risk of human error. An advantage of this

Table 2.14

Quantity Calc Sheets

Job Name:	MEDICAL CENTRE	**Job Description**
Client's Name:		

No.	**Description**	**Factor**	**Length**	**Width**	**Depth**	**Amount**	**+/–**
Trade: ***External walls***							
Item:		*Over 300mm wide*			*m²*	**260.00**	
1	North elevation	1.000	24.000	4.000		96.000	
2	South elevation	1.000	12.000	4.000		48.000	
3	West elevation	1.000	24.000	4.000		96.000	
4	East elevation	1.000	12.000	4.000		48.000	
5	Ddt windows	10.000	2.100	1.050		–22.050	–
6	Ddt doors	3.000	2.100	1.100		–6.930	–

Trade Breakup without Rates

Job Name:	MEDICAL CENTRE	**Job Description**
Client's Name:		

Item No.	**Item Description**	**Quantity**	**Unit**	**Rate**	**Amount**
Trade:	1 *External walls*				
	Block walls in dense concrete (1990 Kg/m³) 440 × 215, 100mm thick with keyed face, bed and joint in gauged mortar (1:1:6)				
1	Over 300mm wide	260.00	m²		
			External walls	**Total**:	

system is that it is low cost because the software is available with most hardware purchases. A disadvantage is the need for traditional take off skills that requires insertion of figures and descriptions as the software is not purpose made for BOQ production.

2.7 Alternative bills of quantities

There are a number of ways to present the measurement and description of works for a project other than builder's bills. Factors to consider when selecting a format include: who the measures are for, the time available to prepare the bills, and the amount of design and documentation available.

Operational bills These bills were developed by the Building Research Establishment and describe works in terms of the amount of labour, plant and materials required for each physical operation. With these bills, operations are scheduled as labour requirements in gang(s) plus materials and items of plant required to carry out the specified works (or an operation) to which rates are applied to arrive at a price. Operation bills have advantages for a builder as they provide effective cost control during the construction works. In addition, they assist with estimating the price of a project because of the division of components that makes each work operation easier to recognise. This bill format is suitable for builders on small projects as it provides detailed information and therefore is advantageous for the ordering of materials. It has disadvantages on large projects because it is a bulky document and costly to produce.

Activity bills These bills are a modification of operational bills and involve measuring works in accordance with a method of measurement and arranging trades in order of site activities instead of operations. The bills take into account activities as a network and programme each activity with a series of codes with locations for reference. They have similar values to a builder as an operational bill because they provide the impetus for the effective management of works and suitable distribution of materials, labour and plant and show activities in set locations of a project. These bills are suitable for projects that are small in value and simple in nature. However, they are not normally used by contractors involved on large projects.

Annotated bills Some firms produce bills with annotations using special terms unique to a project. The wording on these bills refers to general or trade specifications together with the physical location of the works. The objective is to read the works as localised and the bills are used by builders as well as subcontractors for their own purpose. As the wording is specific, local, and informal, these bills are not suitable for large projects involving a number of parties who require a recognisable industrial format.

Elemental bills When pricing a project in the early stages of design development, the building and project requirements are segmented into elemental

parts, e.g. upper floors, external walls, preliminaries, etc. These elemental parts are measured as composite items and have inclusion lists to which a suitable rate is charged to arrive at an elemental price with the total of the priced elements being the anticipated cost of a project. As this is an aspect of estimating before works are tendered, elemental bills are widely used by quantity surveyors for cost planning advice only. The RICS' *New Rules of Measurement* Volume 1 includes guidelines that define elements and promote consistency by suggesting cost planning techniques for use with these bills.

Approximate quantities These are very similar to builder's bills of quantities and are used by cost planners to assess the price of each construction component of a construction element, e.g. excavation, concrete, hardcore, etc, for the substructure. This is suitable for estimating purposes whilst a design is under development and forms the basis of an inclusion list under Volume 1 of the RICS' *New Rules of Measurement*. Approximate quantities should not be confused with a trade bill of approximate quantities for use as a tender and contractual document and is normally prepared by the PQS, as discussed in Section 2.1 above.

3 Working with the Main Contractor

3.1 Contracting organisations

The smallest size of contracting organisation is the jobbing builder, usually a business managed by a self-employed individual who is probably a tradesman and has an office either at home or in a small commercial premises. The jobbing builder carries out minor building works with the help of subcontractors, possibly carrying out its own trade work whilst dealing with job estimating and business administration. Other contractors range from low- to mid- and high-tier companies carrying out work of unlimited value, operating from rented or purchased offices.

Low tier contractors Low-tier and small-sized contractors tend to be 'hands on' in their approach for securing work and running a business, and are usually managed by at least one director. In these types of businesses, one or more directors act in the capacity of business manager and/or estimator and appoint managers to organise and run their projects. They may also employ office support staff to oversee accounts and administration and engage an estimating assistant. Small contractors risk their business if they do not have equity or receive payments on time, and they often rely on regular clients for repeat work. The administrative procedures of a small contractor might not be as robust as a medium- or large-sized business as investing in accounting and software management systems could be too expensive. The loan required for paying for a system and staff training may be seen as a luxury and only considered viable once a certain financial threshold is achieved. Until such time, the accounts and estimating system are managed with computer spreadsheets. However, for a trainee quantity surveyor or estimator's assistant engaged by a small-sized contractor, the experience can be rewarding as it may not be as formal as in a medium or large business. A quantity surveyor could therefore be invaluable to the business by creating procedures that help it to improve its efficiency. The small contractor has an advantage for its employees because it permits access to industrial practices at a grass root level and provides work variety instead of the

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fixed autonomous roles found with larger contractors. For example, a role may involve numerous tasks such as estimating, measurement and contract administration for a number of projects each valued up to, say, £250,000 running concurrently. For anybody wishing to learn the ropes of the industry, the smaller contractor can provide valuable experience that aids career progression.

Medium and large contractor Some medium and large companies may be floated on the Stock Exchange where investors buy shares in the business and reap handsome rewards if the company operates at a profit. These contractors may operate independently or under the umbrella of a number of satellite or regional head offices that report to a central office. Satellite or regional head offices usually operate independently from each other, with a board of directors, and the centrally-based office acts in an administrative capacity only. In this capacity, the central office is answerable to shareholders and does not involve itself in the day-to-day running of regional offices. Each regional office is usually established for a reason, e.g. marketing and managing project(s) when there is need for the contractor's presence, and reports on its profitability to the central office. Regional head offices may operate in the same type of business, such as national house building, or provide a range of services, such as civil engineering, infrastructure and demolition. Each regional office and the projects they undertake will usually have identical corporate identities, i.e. colours and logos, so their commercial identity is uniform and recognisable. Large contractors may also have offices based in more than one country.

Advantages for employees engaged by medium and large contractors include:

- Employment stability
- Opportunities to learn the working practices of other regional offices with the possibility of national and international travel
- Exposure to projects of high value
- Project variety
- Interaction with other professionals
- Possibility of carrying out Joint Venture (JV) schemes for projects worth millions of pounds with another company and/or company within their own group
- Recognition as being part of an established and reputable business
- Receiving benefits including bonus schemes and supply of a company vehicle
- Chances for career progression including promotion
- Exposure to a variety of procurement routes for acquiring buildings.

Disadvantages include:

- More restricted role
- Competition to find employment and obtain promotion

- Being part of a business that can literally change overnight due to company takeover or change in business policy
- Vulnerability of the business at times of economic recession with compulsory redundancies.

Generally, these companies are made up of three departments: *Technical*, including quantity surveying, procurement and estimating; *Construction*, including quality assurance, health and safety, site personnel and procurement (if not part of the technical department); and *Accounts*, encompassing payable and receivable transactions, IT systems, reception and marketing. Each department (or division) is usually under the control of a manager and each manager usually reports to a general manager or operations manager who oversees the business. Hierarchy above this role is at director level. However, some businesses may not engage general or operation managers with department managers responsible to the board of directors. The job and position titles that a company creates are cultural and arrangements are made by directors to suit the type of work undertaken and size of the business. To demonstrate, Figure 3.1 shows an organisational chart of a large building contracting company.

3.1.1 Premises and assets

In general, a contractor's premises provides offices to accommodate staff and amenities as well as assets it owns or is purchasing with a loan. The offices are usually equipped to function efficiently and must comply with legislation for occupied buildings and employment law. Where premises are on large areas of land, storage yards may be built and equipped to store the contractor's assets, such as scaffolding, site accommodation, access equipment and items of plant. As with any business, contractors incur company overheads, which are sums of money to pay for running and operating the business. These are known as *off site overheads* and are different to *on site overheads* which are the contractor's preliminaries and are the direct costs for running a project. It is important for the quantity surveyor to distinguish between these two items as they are vital for estimating purposes.

Like most businesses, contractors have a financial year set to dates they consider appropriate. At the end of each financial year, it is necessary for the company accountant and directors to review company turnover (income received during the financial year) and forecast a cost for the off site overheads for the forthcoming year. Items to include are:

- Salaries and benefits
  - Director's salaries
  - Office staff salaries
  - Employer's national insurance contributions for office staff
  - Medical private health cover for staff
  - Contributions to staff retirement schemes

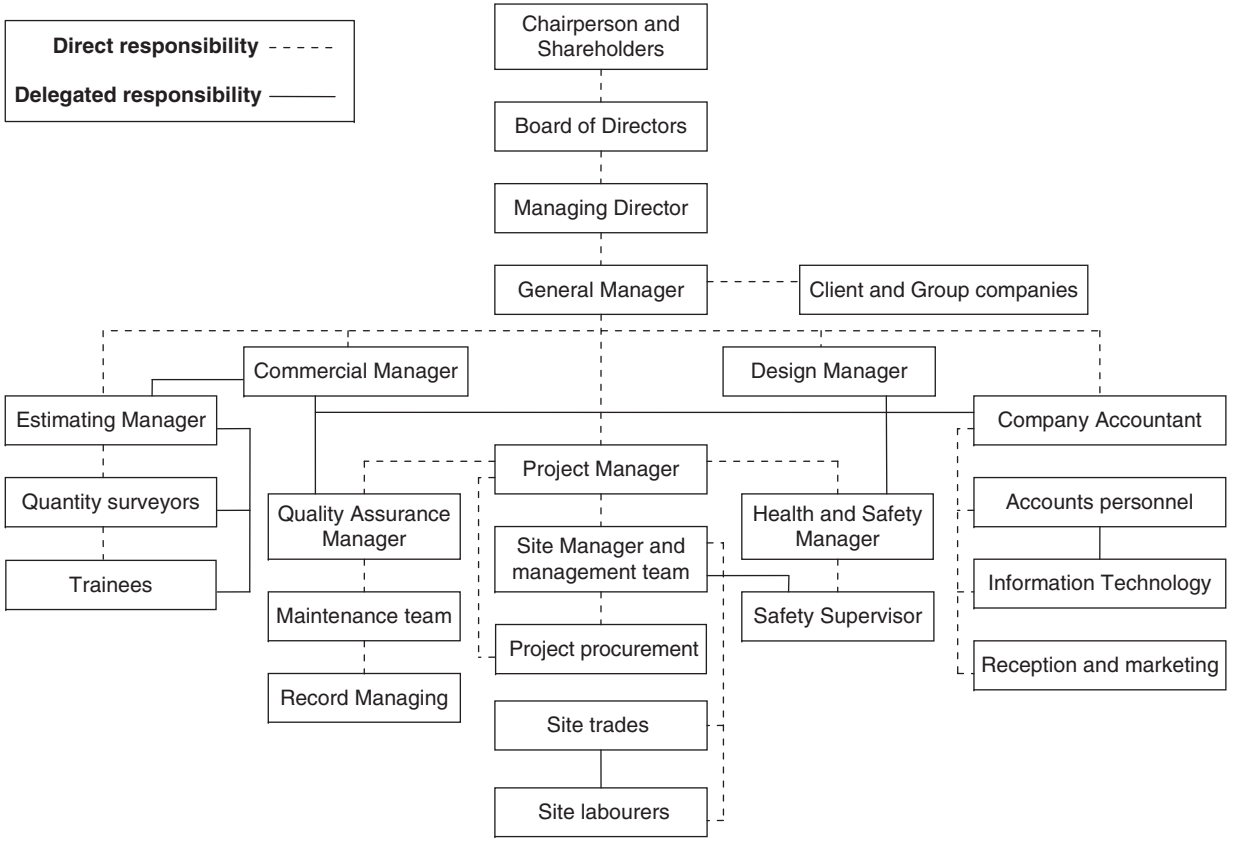
Direct responsibility
Delegated responsibility
Chairperson and Shareholders
Board of Directors
Managing Director
General Manager
Client and Group companies
Commercial Manager
Design Manager
Estimating Manager
Company Accountant
Project Manager
Quantity surveyors
Quality Assurance Manager
Health and Safety Manager
Accounts personnel
Site Manager and management team
Trainees
Information Technology
Maintenance team
Safety Supervisor
Project procurement
Reception and marketing
Record Managing
Site trades
Site labourers

Figure 3.1

  - The cost of insurance protection for staff including third parties if not an on-site overhead
  - Staff training workshops
  - Entertainment expenses.
- Office building
  - Building/business rates, council tax payments and building/office rent
  - Building maintenance, i.e. cleaning, painting and repairs
  - Storage fees for assets
  - Building improvements, including amended office layouts, extensions, etc
  - Garbage removal
  - Utility charges, i.e. water, telephone, etc
  - Testing of office equipment, including maintenance contracts
  - Information technology upgrades (software only) and cloud computing fees
  - Environmental certification
  - Facilities management or corporate body payments for lift maintenance and mechanical plant
  - Security alarm contract fee and/or static guards
  - Building contents and fire insurance
  - Professional subscriptions
  - Audit fees
  - Solicitors/legal fees for business advice
  - Stationery purchase and printing costs when not for a project
  - Clothing purchases and any hired plant items when not for a project
  - The cost of any debentures or security bonds that are not project specific.
- Vehicles
  - Vehicle insurance, tax and registration
  - The price of vehicle leasing and fuel consumption if not a fringe staff cost and an on-site charge
  - Yard and workshop maintenance of vehicles and plant if not an on-site overhead.
- Write downs and write offs
  - Depreciation of office furniture, including computer hardware
  - Depreciation of owned cars and/or vans including fuel consumption
  - Depreciation of purchased site engineering equipment
  - Loss of financial interest on overdue debts
  - Unrecoverable fees, e.g. fines, write offs through client insolvency or lost claims
  - Legal costs incurred for disputed sums considered high risk
  - Tender costs for lost projects, i.e. design modelling and PQS charges for BOQ preparation.
- Promotional
  - Business promotions, including travel fairs and roadshows
  - Marketing costs, i.e. press and media advertisements, portfolios, etc

- Photography and sponsorships
- Copyright purchasing for designs
- Corporate signs if not specific to a project.

These sums may be mitigated by income received from the sale or rental of assets and offsets from tax allowances and rules under VAT legislation as determined by the company accountant. Once the amount is ascertained and mitigating circumstances considered, the off-site overheads are calculated and expressed as a percentage of the turnover. Let us say, for a company's operating year the off-site overheads are assessed at £2.50 million and the income received from projects is £50 million. Assuming income for the following year is envisaged to be the same, the percentage to apply to any base charge for off-site overheads for the coming year is calculated as follows:

$$\frac{£50\,\mathrm{m}}{£50\,\mathrm{m} - £2.5\,\mathrm{m}} \times 100 = 105.3\%$$

The combination of off-site overheads and an allowance for profit is the contractor's margin and a percentage is added to a contractor's base cost estimate when submitting tenders for projects. In other words (and in the case of the example given here), for every £1 spent as a purchase for a project, the project must return £1.053 as a contribution for the business to remain solvent before it makes a profit.

Fixed assets are items that a contractor owns (or is purchasing with a loan) that are considered of economic value to a business and charged out as on- or off-site overheads. In order to keep track of assets, it is necessary to create records. The simplest type of record is an inventory, a document used to record small items such as scaffolding tubes, boards and fittings usually kept in a contractor's yard. The inventory records quantities of each asset and locates their whereabouts as long as they remain in the ownership of the contractor. An Asset Register is used to record larger asset items, usually involving mechanical plant, and is likely to be administered by a plant manager who is responsible for insurance, repairs, coordinating and logging of routine maintenance for each asset. The Register is required as an integral part of effective business accounting, stocktaking and tax planning, and is an essential management support document that provides the basis for asset definition. This means it provides positive proof of ownership and forms a structured assessment of capital allowance write offs and capital gains tax assessments. Quantity surveyors and estimators need to be aware of these registers as they record the accumulation of assets for site use that need to be included for estimating purposes and how the cost of their running is to be recovered. Furthermore, if an item is under consideration for purchase as an asset, there will be a requirement to advise senior management whether it is viable and, to ascertain this, it is

necessary to carry out a financial appraisal. In order to carry out the appraisal, answers to these questions are required:

- What is the purchase price?
- What is the estimated useful life of the asset?
- What are the units of production during the useful life and how are they measured?
- What will the disposal cost be?

Consider a scenario where a contractor is in the business of building houses, and purchases bricks and roof trusses for labour-only contractors to construct walls and roofs. As part of an agreement, the contractor transports materials from store and lifts them into place for constructing, using a hired forklift truck. The contractor is considering purchasing a truck instead of hiring. A characteristic of plant as an asset is that it depreciates in value with time which must be considered in a financial appraisal. Table 3.1 demonstrates a method for assessing a write down depreciation of a forklift truck during its working life, together with items of expense for its operation.

From reviewing the table, the contractor will need to yield £1,853 per month over the investment period to break even. Income derived from preliminaries charged to clients on projects under construction would contribute to this as there is usually an allowance under the plant hire section for a forklift if it is a project requirement. When considering an asset purchase, it is worth considering the alternative, which is to hire from companies in the equipment hire market. These companies offer attractive and competitive hire rates for long-term agreements. The drawback is that rates might attract insurance cover as hire companies are often reluctant to rely solely on a contractor's insurance and prefer to deal with their own broker in the event of a claim.

3.2 Management systems

The management systems of a contractor's business are the backbone of its internal functions and operations. Large companies usually provide policies and procedures manuals that describe the culture of the company, the standards expected from employees and how the business operates, and distribute copies to each department. Manuals are updated from time to time by senior management to comply with internal policy and legislation affecting the business. The structure of a building company's business is usually regulated internally and a set of policies and procedures promotes standards in order for the business to run efficiently and to retain the reputation it has acquired with its clients. The manual usually addresses business activities applicable to the office and possibly provides a supplement or separate manual for construction sites. A typical manual will include the following:

Table 3.1

Forklift truck purchase price			£ 100,000
Investment period 5 years			
Depreciation Year 0–1 (35%)			–£ 35,000
Depreciation Year 1–2 (15%)			–£ 9,750
Depreciation Year 2–3 (15%)			–£ 8,288
Depreciation Year 3–4 (15%)			–£ 7,044
Depreciation Year 4–5 (15%)			–£ 6,000
Total depreciation:			£ 66,082
Net worth @ resale/disposal			£ 33,918
Running costs			
1. A site labourer with a license will operate and mange the forklift. No costs incurred for the labourer as wages and employment costs are included with the preliminaries.			**NIL**
2. Operating life 12 months × 5 years = 60 months Service every 6 months = 10 Nr @ £750			**£7,500**
3. Replacement of worn parts.	Years 0–1	NIL	
	Years 1–2	£1,500	
	Years 2–5	£7,500	
		£9,000	**£9,000**
4. Loss of interest on investment, 3% per annum			**£15,000**
5. Fuel, average 30 litres per week × 48 operating weeks per year × 5 years @ £1.25 litre. This allows for times when the forklift is idle and the consumption reduced			**£9,000**
6. Insurance, 1.5% of the value			
Year 0–1	£ 1,500		
Year 1–2	£ 975		
Year 2–3	£ 828		
Year 3–4	£ 704		
Year 4–5	£ 600		
	£ 4,607		**£ 4,607**
Total items 1 – 6			**£ 45,107**
Summary of expense:			
Total depreciation:			£ 66,082
Total running cost:			£ 45,107
Total expenditure for 60 months investment:			**£111,189**
Therefore, £111,189/60 months = £1,853 monthly cost			

- Business structure
  - A flowchart showing management organisational structure
  - Office plan layout and emergency escape routes
  - Management structure of each department, including function and job titles
  - Management review procedure for changing policies and method of notification
  - Recruitment and employment selection methods.
- Client-focusing policies with Mission Statements outlining objectives and intentions
  - Quality assurance
  - Health and safety
  - Environmental policies.
- In-house policies
  - Procedures regarding use of information technology for reporting faults
  - Electronic filing and document control procedures
  - Use of the internet
  - Coding reference system for project identification
  - Employees responsibilities with their contracts of employment
  - Periods for salary review
  - Personnel/people management, i.e. sick leave, expenses forms, discipline and grievance, etc
  - Alcohol and drugs policy
  - Motor vehicles policy and the use of company assets
  - Behaviour and codes of conduct between employees
  - Confidentiality of projects with third parties and the media
  - Archiving procedures for completed projects
  - Methods for business promotion
  - Training procedures
  - Evacuation procedures in the event of fire, etc, applicable to the office and construction sites.

Employees should refer to the manuals from time to time to become familiar with the contents and must pay particular attention to any changes.

3.2.1 Health and safety management

Health and safety legislation enforces a contractor to act responsibly with regard to health and safety management and to recognise its roles and responsibilities if a project falls under the rules of CDM 2007. The Health and Safety Executive provides statistics on the number of fatalities and major injuries attributed to the construction industry and in 2010/2011 there was a decline in the numbers compared with the average for the five previous years. Whilst these figures show improvements over time, a contractor must be vigilant in its planning to minimise risk. This is possible with a health and safety management system that demonstrates the contractor's commitment to safe working practices enforced by legislation and corporate policy and applies to the contractor's operational office and

any project it undertakes. The growth in this field of management since the introduction of CDM has seen the cultivation of management tools and mannerisms that are characteristic in the construction industry with the common goal of promoting a safe working environment. Any change to CDM 2007 and internal matters of a contractor's business structure regarding health and safety are reflected in the manual for action by the Health and Safety Manager. In turn, it is the responsibility of anyone engaged on a project to be aware of the existence of the manual and recognise any changes that come into force. The use of a health and safety management system is separate to that required under CDM 2007 when the principal contractor must provide a site-specific health and safety file, which includes relevant extracts from the system which must be suitable for the project.

3.2.2 Environmental management

A building contractor must recognise its legal requirement to comply with environmental legislation when carrying out construction works because otherwise it will be prosecuted for non-compliance, with ignorance of the legislation inexcusable. Broadly, the following legislation must not be infringed:

- Polluting rivers by allowing silt deposits to travel, which is contravention of the Water Industry Acts 1991 and 1999 and the Water Act 2003
- Contravening planning permission for not mitigating noise and dust control
- Failing to comply with the Site Waste Management Regulations
- Failing to show Display Energy Certificates.

Separate to the legal obligations, a contractor must make a conscious decision about its attitude towards the environment for projects it undertakes. This may be influenced if a client issues a statement or environmental management plan with a tender enquiry, outlining its policy in favour of environmental protection and possibly making it a condition of tender for any engaged contractor to do likewise. A fortunate contractor may already have taken the initiative by creating a policy to promote its corporate identity and demonstrate its commitment to the environment which generally complements the client's policies. As part of a tender enquiry, a client might include an Environmental Impact Assessment, a statement describing the impact the building process and completed structure could have on a locality, and which might be a requirement for obtaining planning permission. If applicable, the contractor is responsible for delivering a scheme in accordance with the document, which might become contractual and would bind the contractor to the obligations. Estimators and quantity surveyors need to be aware of a contractor's and client's policies and any separate assessment as it may involve risk and cost to a project under tender.

By adopting an environmental management plan, a contractor is demonstrating its concern for the environment. It is therefore necessary for a contractor's project team tasked with delivering a building to be cognisant with the environmental issues the plan promotes. The plan is usually divided into sections that include:

- Waste management planning
- Air quality management
- Storm and waste water management
- Noise reduction management
- Site clearance, i.e. dealing with demolition, contaminated waste removal and land remediation.

Each section usually has an explanation about why a topic is included in the plan, as well as a scope of the works and active measures to be implemented to control the process. For example, the section on waste management planning might include reasons for its inclusion in the plan, which is to comply with legislation. It may also describe methods the contractor will adopt to minimise waste generated whilst works are under construction, and its policy for promoting the use of recycled materials to manufacture new products for installation into a new building.

3.2.3 Quality management

A quality management system is of benefit to a contractor because it implements procedures to ensure the contractor delivers the services it is offering. To be effective, the system should include a quality management policy and statement endorsed by a managing director stating it is certified independently by an authorised body that complies with ISO 9001-2008. This is the international standard which focuses on meeting the needs of a client and delivering satisfaction. ISO 9001-2008 evaluates a quality management system to ensure it is appropriate and effective whilst committing a contractor to identifying and implementing improvements. With this system in place and the procedures active, a contractor may enjoy the following benefits:

- Better job performance that enhances the portfolio of projects
- Improves morale of staff for a 'job well done'
- Creates opportunities for new clients
- Sets a benchmark to retain clients
- Reduces building defects
- Meets regulatory, contractual and legal requirements
- Helps to avoid disputes and claims.

Furthermore, ISO 9001-2008 assists the contractor to achieve consistent results and to continually improve the quality control process. It does not define the actual quality of the final product or service but aims to mitigate the possibility of flaws in the final product or service.

For quantity surveyors and estimators, a quality management plan is one that embraces good service. This arguably comes at a cost, because the high quality of anything incurs some additional expense. This may affect the price of a product and service to a client because of the way a contractor manages

its production either in the office or on a construction site. For example, an estimating manager may oversee the function of an estimating department in an office which includes methods of dealing with a tender enquiry from receipt of documents through to submitting a tender. This might be driven by the use of a quality management system with the following contents:

- Recording the date of receipt of the documents
- A method in place for obtaining trade prices
- Take off procedure for BOQ production
- Pricing the works on the BOQ
- Checking prices in order to achieve the deadline for submitting a tender.

For this to be effective, items need to be recorded, which involves listing the operational processes and resources needed to meet the objectives. The use of a quality management system in this scenario could mean the contractor employs additional staff, thus incurring additional off-site overheads. In turn, a contractor will have to decide if it will offer tenders only for projects above a certain value to justify the quality management plan, as the additional costs will become minor as the value of a project rises. Outside the office, a contractor may implement a separate quality management system. This is useful for assessing the quality of work carried out by site trades and can be achieved by using templates that introduces quality control measures to provide quality assurance through a checklist. Table 3.2 shows a quality control checklist for use with any task in a contractor's office or construction site.

Quality management plans should be strategic and structured yet flexible to permit improvements in order to sustain success. ISO 9004-2009 is the international standard which is part of the ISO 9000 family of standards focusing on the long-term economic survival of a business. It states that an organisation must develop a strategy which is supported by other parties, i.e. stakeholders, to sustain success. To achieve this, a contractor must have a systems approach, which means it must have a system that integrates the processes. An example is a template for use on a construction site, such as that demonstrated in Table 3.2, which is updated and monitored by a competent person who may be either a site

Table 3.2

Quality Control Checklist						
Project Nr:		**Project Title**:			**Subject**:	
Item	Reference	Work activity	Complete (Yes/No)	Assessor (initial)	Date	Comments

or quality control manager. To be effective, the system must undergo a validation process which uses evidence that confirms the requirements of the intended use are met. This is one part of a design and development system that uses objective evidence, such as the use of templates, to confirm the end result meets the requirements. This verification leads to vision and value that a contractor can set as a target, thus helping the business to progress, and to an understanding of how it is perceived by clients, which hopefully creates repeat business.

3.3 Marketing for contracts

As with any business, a contractor's company will only survive if payments received enable it to pay creditors and cover business overheads, with anything more becoming a profit. To enable this, a contractor must secure work from clients, which is generally obtained by winning tenders. A contractor might compete for work in an open market, where clients advertise for tenders freely and issue documents with little or no background checking. This has an obvious advantage to a contractor because it is pricing for work in the hope of receiving an award, which is better than pricing nothing. However, a disadvantage is the number of tendering companies involved, meaning competition can be fierce especially during an economic downturn when markets are suppressed. The alternative to open market tendering is selective tendering, where a list of contractors is selected by a client or client's agent for their appropriateness for a project. Prerequisites for selection include the contractor's financial turnover, capability to deliver, project value, relative experience and the sector of the industry the contractor operates in. In order to obtain a tender enquiry, it is necessary for the contractor to be included on the tender list. This may be achieved by repeat performance and maintaining working relationships with existing clients and/or branching out with a business development plan and seeking new ones. To find new business opportunities, it is necessary to instigate the business development plan by preparing a list of sources as potential leads. This includes creating a list of contacts and sources and dividing them into two categories: those that have an awareness of the contractor's business and those that don't.

There are a number of avenues for obtaining contacts, and they include the following:

- Existing clients' accounts with the contractor that are not more than 12 months old
- Referrals
- Trade shows and magazines
- Social or business functions
- Competitors who decline work for fear of over-commitment
- Attending business invitations, including workshop presentations
- Neighbours and friends

- Affiliations and recommendations
- Advertisements by the media and billboards
- Involvement with charities
- On-line tender notices

Whether or not branching out, the contractor must have the qualities a client is seeking. One such quality a client may seek from a contractor is the offer of alternative procurement routes to develop a project, in particular design and build. With this option, a contractor provides a design and build package to relieve the client of the responsibility of appointing design consultants, giving the client a passive role in the process. Since the 1980s, when design and build surged in popularity, contractors have become closely linked to their clients. Contractors in this position are in the driving seat, where they (or an architect who may have provided the client with a concept/sketch design) interpret the client's brief, outlining the requirements and developing the design to the parameters of cost, i.e. designing to a cost instead of costing the design. They may also provide life-cycle cost options and the provision of fitting out a building with loose and/or fixed furnishings. Design and build procurement places the onus on the contractor to manage the whole process, meaning the client's quantity surveyor (PQS) and/or agent provide input during the initial stages with one or more design consultants. This includes cost advice for budgeting purposes and budget control prior to contractor involvement. Contractors wishing to expand their portfolio of works under tender are encouraged to embrace design and build as well as traditional procurement, and to target different sectors of the industry. To be effective, of course, a contractor must have the resources and negotiation skills to engage consultants to develop the design and to be able to bargain with subcontractors and other resources to construct the works.

3.4 Estimating and the contractor's quantity surveyor

A contractor's quantity surveyor is most likely to be involved with the commercial activities of a project during the post-contract period, carrying out project and contract administration duties for the delivery of a scheme. However, large contractors may also engage quantity surveyors for their measurement skills to assist the estimating function of the business during the pre-contract period. This is when a contractor offers a lump sum price based upon a specification and set of drawings or a design and build service when it is responsible for quantities. Alternatively, the quantity surveyor may assist with pricing a bill of quantities provided with an invitation to tender.

A quantity surveyor has the traits and skills to become an estimator because the training overlaps with educational studies. In fact, an individual with a career as an estimator could also be a quantity surveyor. They may also be commercial managers or tradesmen who have diversified their

careers into management. Smaller contractors and subcontractors often employ estimators from a trade background because of their 'hands on' experience gained over the years whilst working 'on the tools'. This is often highly regarded by a company because the experience is considered important when preparing prices for works under tender. However, larger contractors involved with competitive bidding schemes worth millions of pounds usually make no preference and leave the complexity of the tender process and tasks to any professional competent enough to carry out a tendering service.

An undergraduate would find working within an estimating department a valuable experience because it provides insight into the working practices of a business and an understanding of the process for submitting a tender. The remainder of this chapter focuses on the role a quantity surveyor could play as part of an estimating team in a medium- or large-sized contractor's office when preparing a tender.

3.4.1 Activity on receipt of tender documents

The date a set of tender documents is received by a contractor until the date the tender is to be submitted is known as the tender period. The documents are usually accompanied by a cover letter from the client's agent stating the consignment as an invitation to tender and advising of a date when the tender is to be submitted. The date on the cover letter and date the documents are received by the contractor might be different, and if there is an abnormally long period between the two, the client's agent should be notified as, in effect, it could mean a shortened tender period. This would put the contractor at a disadvantage and an extension of time to the tender period should be requested, providing of course there is no error on the contractor's part. Influencing factors for the length of a tender period include:

- The choice of the client or client agent's
- Size, value and complexity of the project
- Quality of documentation provided
- Contractor's required input into the design
- Start date on site
- Whether or not a bill of quantities is provided.

A typical tender period is usually four to eight weeks and it is important for the contractor to have a planned timeframe in order to meet the tender submission date. Usually, the contractor's commercial or estimating manager will implement a strategic plan to ensure the process is monitored. A usual first task for the manager in charge is to review the documents and delegate responsibilities to quantity surveyors and other team members to assist the process. Delegation methods may be outlined in the policies and procedures

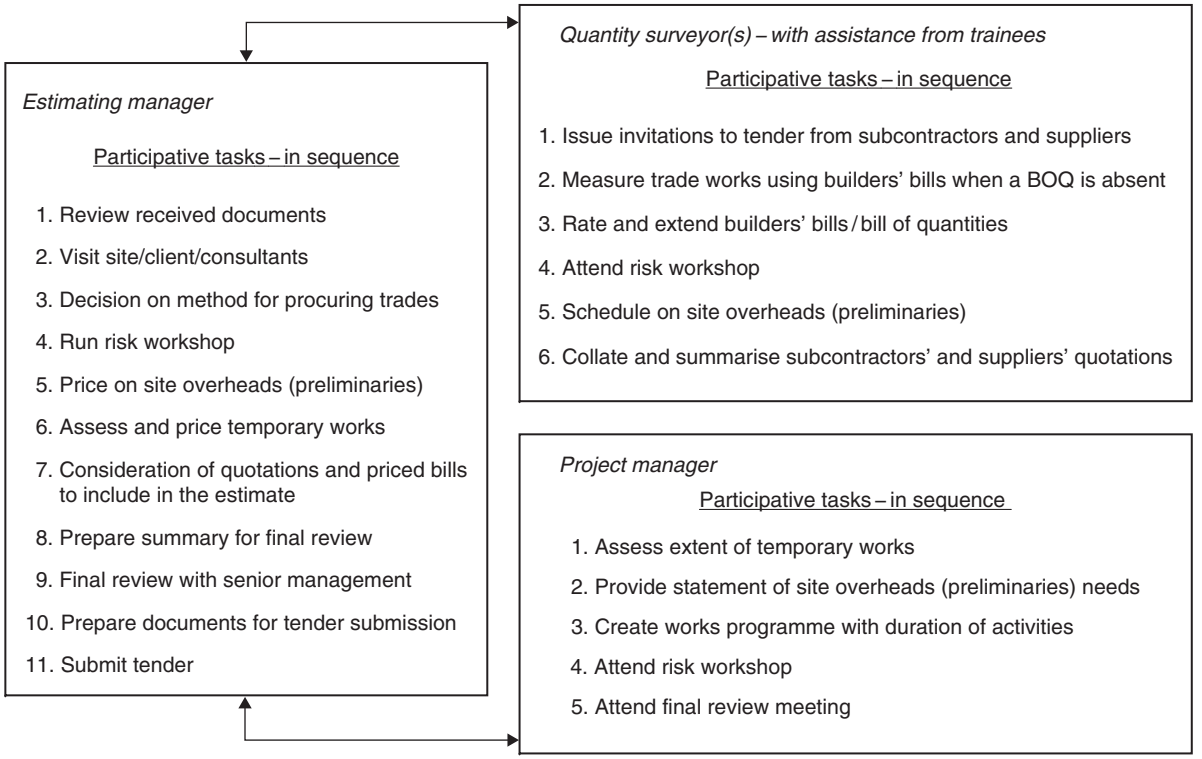
Estimating manager
Participative tasks – in sequence
1. Review received documents
2. Visit site/client/consultants
3. Decision on method for procuring trades
4. Run risk workshop
5. Price on site overheads (preliminaries)
6. Assess and price temporary works
7. Consideration of quotations and priced bills to include in the estimate
8. Prepare summary for final review
9. Final review with senior management
10. Prepare documents for tender submission
11. Submit tender
Quantity surveyor(s) – with assistance from trainees
Participative tasks – in sequence
1. Issue invitations to tender from subcontractors and suppliers
2. Measure trade works using builders' bills when a BOQ is absent
3. Rate and extend builders' bills / bill of quantities
4. Attend risk workshop
5. Schedule on site overheads (preliminaries)
6. Collate and summarise subcontractors' and suppliers' quotations
Project manager
Participative tasks – in sequence
1. Assess extent of temporary works
2. Provide statement of site overheads (preliminaries) needs
3. Create works programme with duration of activities
4. Attend risk workshop
5. Attend final review meeting

Figure 3.2

manual of the contractor's quality management plan or be created by the manager to suit the tender period. Effective management involves achieving an adequate contribution from team members by using participative and delegation styles. Figure 3.2 demonstrates a suitable style of activities for a project under tender.

Each participative task must have a start and finish date. This is necessary because the start of one task may be dependent on the completion of another. For example (and as shown in Figure 3.2), the last responsibility for the quantity surveyor is to collate and summarise quotations received from subcontractors and suppliers so the estimator can finalise the price to be included in the estimate. The estimator requires time to calculate suitable prices and would be unable to proceed until quotations were verified as suitable to include in the estimate. It is therefore important for the team to adhere to stated timeframes and follow the structured path as a rush towards the end of a tender period can lead to errors, incorrect judgement and parts of a tender under- or over-stated.

3.4.2 Subcontractor pricing

If the contractor does not intend to carry out certain works itself, it will be necessary to obtain quotations from subcontractors for the works. Subcontractors carry out most of the works on a construction project and, if it wishes to offer a competitive tender, the contractor must test current market prices instead of 'guesstimating' a price. A price can be obtained by issuing invitations to tender from domestic subcontractors for the works under tender. The term 'domestic' suggests that the scope of trade contractors is limited to residential projects. This is not the case: the term is used to describe a contractual arrangement for any project between a contractor and subcontractor that does not contractually involve the client. The selection of these subcontractors is influenced by the following:

- An open tender approach where a contractor has no preferred subcontracting companies and seeks competition with all trades. This might apply when a contractor is in short supply of certain trades
- Subcontractors who have a partnering agreement in place with the contractor
- Subcontractors already engaged on one phase of a project with further phases imminent
- Those who offer a partial design and construct service to the contractor
- Those with the capability of servicing a project with adequate labour, material and plant resources
- Those who are financially stable and reliable
- The contractor's experience of a subcontractor's performance on current and past projects
- Companies named in the tender documents.

As there may be up to 15 or 20 trades for a project, issuing an invitation to tender to three or four companies could result in 60–80 issues, and this will absorb time. Effective communication with the estimating manager will streamline the requirement to avoid an overwhelming issue of invitations. When a subcontractor is named in the contract documents, the quantity surveyor must oblige the requirement by ensuring they receive an invitation to tender, as it would do the contractor no favour to overlook the request. It requires effective management to organise the number of invitations sent out which, as a minimum, needs to include the trades that the contractor would award as total trade package if it were successful in winning the project. This applies to building services, civil engineering, etc, where a subcontractor supplies and fixes materials, including any items of plant, to carry out the operations as well as testing and commissioning the works. Prior to issuing the invitations, it would be wise for the quantity surveyor to contact preferred subcontractors to discuss the project and ask if they are prepared to submit a quotation within a timeframe which must be within the tender period. This prior discussion will avoid later disappointment if the design and documentation is issued and the subcontractor(s) declines to provide a quotation because of existing commitments that could have been known earlier in the process.

If a contractor is tendering for three or more projects simultaneously for different clients with tender submission dates around the same time, it would be unwise to burden each subcontractor with all of the projects. Here, a suitable approach would be to submit multiple enquiries to an abundance of subcontractors to increase the chance of obtaining a number of prices for each trade. The invitation to tender must be formal and include:

- A cover letter or email request addressed to the person who confirmed they would accept the invitation
- A list of design drawings and documents and a date the tender is required
- The appropriate trade section of a bill of quantities if provided as a tender document.

Where a bill of quantities is not a tender document and the contractor has produced a builder's bill, it is discretional if this bill is issued as it is for the builder's purpose only and should only be provided as a last resort. An example is whether there is a limited chance of receiving prices because of time deadlines, when the builder's bill can be provided as a guide. Once invitations to tender are issued, it would be wise to create a register listing the trades that have agreed to submit prices together with their contact details and the date when the tender is to be received. Notwithstanding this, it would also be wise to remind tendering companies a few days before their tenders are due to ensure they will be submitting a price. It is surprising how lax the system can become if prices are allowed to 'trickle through' as and when they become available, which does not help the contractor's position.

After tenders are received and the tender period closed, the quantity surveyor usually prepares a tender return analysis for each trade as a price comparison

that can be created on a computerised spreadsheet. This involves assessing the quantities and rates that form the basis of the quotation. When a contract bill of quantities is issued, it is a straightforward process because the subcontractors are bound by the quantities. When subcontractors are responsible for quantities, quantified and rated schedules should be submitted for checking. Some subcontractors might be reluctant to provide this information and state they are quoting a lump sum price based upon the invitation to tender. This is a fair statement and the decision must be respected because their quantities will not usually form part of any pending contract. However, to assess competition, quoted prices require breaking down for comparison, especially if the works are of a high value. For the quantity surveyor to be satisfied that tenders are comparable with the scope, some form of a breakdown should be submitted. Table 3.3 demonstrates a tender return analysis from civil engineering contractors that have provided quantities and rates for the construction of an estate road with drainage to serve a number of residential properties.

With building services trades, the various consultants engaged to prepare the design and documentation may include a tender return form within the specification. If included, the form usually lists a breakdown of the trade, requesting a price for each element, and might also include a schedule of works that require rates which should be completed, signed and returned by each subcontractor. It may be a condition of the project under tender that the contractor submits such forms for vetting by the client's agent who would delegate responsibility for the vetting to appropriate consultants as part of their service to the client.

When comparing tenders, it is important to note any tender qualifications. Tender qualifications are specific notes included in a priced tender that bring matters to the attention of the contractor. It may be a list of items that are stated as included or excluded in the price, or assumptions made by the subcontractor trying to clarify vague or ambiguous matters. The subcontractor may change the title of a quotation from 'tender' and call it an 'offer', which is a price submission to carry out the works subject to a list of terms and conditions it wishes to apply – basically a set of tender qualifications under an alternative guise. If left to chance, these can pose risk to a contractor and in order to comply with the works under tender, the following requires consideration in the analysis:

- All works should be priced in accordance with the documents provided and a priced bill will verify inclusion. Where a bill is not part of the enquiry, the scope on the quotation should reflect the requirements. If a price appears low and there is scope missing, the estimator requires alerting to make due allowance.
- Subcontractors' quotations should comply with the contractual requirements and not depart from clauses.
- Any site-specific and client's requirements should be acknowledged as inclusive.
- Prices need to be realistic and reflect market conditions.

Table 3.3

Tender return analysis							*Project Nr: 1600*		
Description	**Company 1**			**Company 2**			**Company 3**		
TRADE: CIVIL ENGINEERING	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**
Site mobilisation and demobilisation	**Item**	Incl	Incl	**Item**	2,500.00	2,500	**Item**	Incl	Incl
Preliminaries including supervision	**Item**	Incl	Incl	**Item**	22,500.00	22,500	**Item**	Incl	Incl
Site clearance - topsoil strip	**650 m²**	2.00	1,300	**620 m²**	1.75	1,085	**670 m²**	2.00	1,340
Road excavation including compaction	**395 m³**	10.00	3,950	**375 m³**	9.00	3,375	**400 m³**	11.00	4,400
Road stone sub base - 250 mm th	**680 m²**	13.00	8,840	**630 m²**	11.00	6,930	**690 m²**	13.00	8,970
Road temporary kerb	**260 m**	25.00	6,500	**240 m**	22.00	5,280	**270 m**	26.00	7,020
Road bitumen base and base course	**590 m²**	35.00	20,650	**550 m²**	32.00	17,600	**600 m²**	35.00	21,000
Road asphalt surface - 40 mm th	**590 m²**	27.00	15,930	**550 m²**	22.00	12,100	**600 m²**	28.00	16,800
Foul sewer trench F1–F2 with backfill	**90 m³**	100.00	9,000	**90 m³**	90.00	8,100	**95 m³**	100.00	9,500
Foul sewer trench F2–F3 with backfill	**75 m³**	100.00	7,500	**75 m³**	90.00	6,750	**80 m³**	100.00	8,000

Foul sewer trench F3-exstg with backfill	**75 m³**	100.00	7,500	**75 m³**	90.00	6,750	**80 m³**	100.00	8,000
Foul sewer drainage pipe F1–F2	**45 m**	112.00	4,950	**45 m**	100.00	4,500	**45 m**	115.00	5,175
Foul sewer drainage pipe F2–F3	**35 m**	112.00	5,040	**35 m**	100.00	3,500	**35 m**	115.00	4,025
Foul sewer drainage pipe F3-existing	**35 m**	112.00	3,920	**35 m**	100.00	3,500	**35 m**	115.00	4,025
Storm water trench S1–S2 with backfill	**55 m³**	78.00	4,290	**55 m³**	70.00	3,850	**58 m³**	80.00	4,640
Storm water trench S2–S3 with backfill	**55 m³**	78.00	4,290	**55 m³**	70.00	3,850	**58 m³**	80.00	4,640
Storm water trench S3-exstg with backfill	**35 m³**	78.00	2,730	**35 m³**	70.00	2,450	**38 m³**	80.00	4,640
Storm water drainage pipe S1–S2	**40 m**	70.00	2,800	**40 m**	65.00	2,600	**42 m**	72.00	3,040
Storm water drainage pipe S2–S3	**40 m**	70.00	2,800	**40 m**	65.00	2,600	**42 m**	72.00	3,024
Storm water drainage pipe S3-existing	**30 m**	70.00	2,100	**30 m**	65.00	1,950	**30 m**	72.00	2,160
Foul sewer inspection chambers 2–3 m deep	**3 Nr**	3150.00	9,450	**3 Nr**	2750.00	8,250	**3 Nr**	3300.00	9,900
Storm water inspection chambers 1-2 m deep	**3 Nr**	1900.00	5,700	**3 Nr**	1700.00	5,100	**3 Nr**	1950.00	5,850
Road gully connections into drainage	**45 m**	105.00	4,725	**43 m**	92.00	3,956	**48 m**	110.00	5,280

(continued)

Table 3.3 (*cont'd*)

Tender return analysis							*Project Nr: 1600*		
Description	**Company 1**			**Company 2**			**Company 3**		
TRADE: CIVIL ENGINEERING	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**	**Qty**	**Rate**	**Total**
Road gulley's including frame and cover	**9 Nr**	450.00	4,050	**9 Nr**	400.00	3,600	**9 Nr**	450.00	4,050
Disposal of excavated spoil off site	**790 m³**	55.00	43,450	**800 m³**	50.00	40,000	**810 m³**	55.00	44,550
TOTAL Lump Sum (Excluding VAT)			**£180,435**			**£182,676**			**£188,413**

- Consider any works a subcontractor has excluded that requires input from other trades or the contractor, as builders' work in addition as this will add to the base price.
- Prices should be fixed for the duration of the works or in accordance with a fluctuation clause in the contract that permits reimbursement for prices that may rise and fall.

Once quotations are summarised, the estimator will make due consideration for risk as part of the calculations for an anticipated price for the works. Assessing risk to the contractor is not the responsibility of the quantity surveyor; however, their role in collating the information helps the estimator to arrive at a decision and include a suitable allowance.

3.4.3 Builder's schedules

A commercial or estimating manager may elect for the contractor itself to price certain trade works that will not be procured with domestic subcontractors, which involves the contractor purchasing materials for installation by labour-only contractors. Here, the advantage to the contractor is that it is generally a cheaper option, thus making trade prices competitive, and may be a deciding factor when preparing a tender. When selecting this strategy, the quantity surveyor will need to produce a schedule of labour, materials and plant requirements for the chosen trades. This may be scheduled as separate components or a builder's bill of quantities that has rates applied which include labour, plant and materials. However, producing a builder's bill may be time consuming and a tender expense if it is outsourced from a PQS, and a contractor may streamline the process by producing bills itself. Here, rates are sourced from current projects or through market research and a contractor must ensure it is in a position to accept the risk involved and have access to reputable prices.

Trades that would be procured as separate labour and material packages generally apply to those that pose low risk to a contractor, including:

- Brick and block laying
- Steel mesh and bar reinforcement
- Carpentry (excluding joinery such as benches and furnishings which involves higher risk)
- In situ concrete
- Certain types of formwork (except large projects or when a patent product is to be used).

When it is a contractor's policy to procure these trades separately, builder's bills should be produced as they can be updated for final production and used to target trade prices if the contractor is successful with the tender.

A decision on the trades to schedule and rate is usually made upon receipt of documents by the commercial or estimating manager. Even after a decision is

made, the quantity surveyor might be requested to produce quantities for price checking when domestic subcontractors' quotations show excessive prices or considerable variances. For example, if three lump sum prices are received for the supply, pour and placement of concrete to foundations and floors that are £200,000, £300,000 and £400,000 without errors and appear consistent with scope and tender qualifications, there is uncertainty about the actual price.

Subcontractors' prices may vary for a number of reasons, such as:

- Current market conditions which dictate there is demand for a trade with low supply, meaning subcontractors are overstretched and not pricing competitively
- The gradual shift by some subcontractors from one sector of the industry to another, e.g. a move away from residential into commercial with the subcontractor only pricing residential works at a premium
- Cartels existing where businesses agree not to compete with each other.

Cartels are where the sellers of goods and services agree to price fix, apply the same discounts, fix credit terms and agree between themselves who they will supply and to where, and is known as bid rigging. Article 101 of the Treaty on the Functioning of the European Union prohibits cartels and other agreements that could disrupt free competition between member states. In the United Kingdom, the Enterprise Act 2002 empowers the Office of Fair Trading to address cartels. In general, the Act has a range of measures to replace any monopoly scheme by strengthening the competitive legal framework and introduces criminal sanctions for individuals who involve themselves with hard-core cartels. If high tenders indicate that a cartel is looming, commercial and estimating managers may already be aware or should be alerted. They will ensure builder's bills for particular trades are prepared and rated, thus disregarding the current economic climate.

3.4.4 Resources costing

One of the skills of a quantity surveyor is to understand the constituents of a price in a bill of quantities. Assessing the quantity is one part of the equation and the other is the unit rate to apply. The unit rate is derived from an assessment of resources costing and comprises of the cost to employ labour, the purchase cost of materials and the hire of plant items. The contractor requires this information so it can calculate a rate to a given quantity if wishing to carry out the work itself, or for assessing subcontractors' prices for assurance if there are anomalies in received quotations.

Labour

Labour refers to the human resources required to produce, install, test and commission the works that involve working, cutting, fixing, placing, handling and

installing materials. To assess an amount to charge in a bill, it is necessary to calculate or be advised of an hourly rate for employing labour. The basic hourly rate payable by a contractor for labour is known as the 'flat rate'. The basic cost to charge out for works is the flat rate plus the cost to employ to create an 'all in rate'. Labour rates vary and depend on the skill of the operative, and are either for trade labour charged in a trade bill of quantities/builder's bill or general labour assistance to the trade labour which is included in the contractor's preliminaries. The basis of any calculation for an 'all in rate' must recognise certain criteria, i.e. the number of productive hours worked per annum, basic payable rate, statutory provisions and incentive schemes. The basic rate payable in the construction industry is via a regulated Working Rule Agreement, with rates published annually by the Building and Allied Trades Joint Industrial Council (BATJIC). BATJIC also provides extra over rates for working at height, exposed work, detached work and schedules for intermittent and consolidated rates of pay for skill. The contractor can record each of these allowances and build up a library of hourly rates for a range of operations which can be used for estimating. Table 3.4 shows a format for calculating a rate which recognises incentives, supervision and options an employer may pay together with statutory requirements. This excludes site-specific allowances such as travel and lodging and site-conditional pay, as well as other working rule agreements that are assessed on an ad hoc basis and are specific to a project. The base rate used in the example is for a skilled operative who is qualified with an S/NVQ3: City and Guilds London Institute Advanced Craft pay award at an agreed wage rate for 2011/2012.

Materials

It would assist the contractor if the purchase price for all materials is available in a database and updated regularly. This would provide the advantage that the contractor is aware of price trends which may not be stated on subcontractors' quotations. However, with literally thousands of products available, this may be impractical. Time would therefore be well spent in obtaining quotations for those goods that would be procured by a contractor if it is successful with the project under tender.

Selecting companies to provide material quotations is no different than choosing subcontractors. However, some suppliers might have fixed price agreements with a contractor – perhaps because of repeat business – for the supply of materials which are effective to certain dates and subject to negotiation thereafter. If applicable, these prices should be collated as part of the estimate as they probably offer the lowest rates and are competitive. The quantity surveyor will assist the estimating process by issuing enquiries and a bill of quantities/builder's bill if it is available. Rarely will suppliers agree to a fixed price based upon firmed quantities as they are generally not responsible for damage and waste of materials after delivery to site. However, issuing a quantified bill has advantages because it provides suppliers with an indication of the approximate

Table 3.4

Productive hours	*Calculation*		*Notes*
Total days per year		365	Saturday and Sunday are not workable days
LESS weekends		–104	
Total weekdays		261	
LESS Annual holidays	–21 days		Number of days in an Employment contract
Bank holidays	– 9 days		Statutory days off
Sick leave with pay (estimate)	–10 days		Loss of production
Wet days with pay (estimate)	–10 days		Loss of production
	–50 days	–50	
Total productive days:		211	
Production is based on a 39 hour week over 5 working days after allowing for a lunch break which equates to 7.80 payable hours per day. However, allow 0.25 hour (15 minutes) break, twice daily, = 7.30 hours productive time	7.30 hrs × 211 days =1540 productive hours		
Labour costing	***Calculation***		***Notes***
Award wages per day			
Award hourly rate		£10.73	BATJIC hourly rate
ADD Site allowances		NIL	Site specific
× Hours per day		7.80	
Base daily rate		£83.69	
Daily fares (travel – 25 Km)		£5.80	BATJIC rates are scaled 1 – 50 Kms
Lodging allowance		NIL	Site specific
Site conditional pay		NIL	Site specific or in accordance with BATJIC
Tool money – Contractor's incentive (daily)		£9.00	Other incentives are included here
Daily pay		£98.49	
Allow non productive overtime, 1 hour per day @ time and a half rate 1.5 × £10.73		£15.93	This is a contractor's risk allowance for overtime not authorised by a client

Award wages per annum Daily pay × Total working days £114.59×211 Plus lost productive days £83.69×20 Total wages per annum	£114.59 £24,178.49 £1,673.80 £25,852.29	Sick leave and wet days payable to employee
Statutory and overheads costs	***Calculation***	***Notes***
Employer's National Insurance Contributions 13.8% of total wages per annum BATJIC Retirement benefit scheme £3.00/week BATJIC Stakeholder scheme £6.75/week BATJIC holidays with pay 12.6% Severance pay 261 days×£5.00 Workers insurances 5% Training levy 0.5% Death benefit scheme 261 days×£2.00 Total statutory and overheads costs	£ 3,567.62 £ 156.00 £ 351.00 £ 3,257.39 £ 1,305.00 £ 1,292.61 £ 129.26 £ 522.00 £ 10,580.88	Payable to BATJIC for 30 days pay
Total labour cost and hourly rates	***Calculation***	***Notes***
Total wages per annum Total statutory costs Total cost to employ	£25,852.29 £10,580.88 £36,433.17	
Hourly rate to charge to projects as an on site cost: £36,433.17/1540 productive hours	**£ 23.66**	This rate excludes off site overheads and profit

quantities required. This can attract handsome discounts and suppliers may submit quotations based upon a schedule of rates or to an approximate value based upon the quantities.

Material prices must comply with the specification, as the contractor cannot usually depart from the requirements during a tender period. A supplier may wish to offer their own brand as an alternative and term the product as 'equal and approved'. This means there is an assumption by the supplier that their product is equal and is seeking approval by the contractor to alter the choice. Indeed, the alternative could be cheaper and on par with quality to the specified product. However, the supplier must be made aware that the contractor has no authority to amend the specification without permission from the client's agent. The exception is if a product is obsolete, whereupon the contractor should alert the agent and seek a tender amendment. Deviation from the documents can create havoc for the quantity surveyor and estimator, and the golden rule is to follow the specification until instructed otherwise. If a supplier (or subcontractor) is keen to amend the product specification, there is no harm in directing them to the client's agent to request a change because this is the entity that has the final say. With design and build procurement, any referral should be to the estimating manager as, in effect, the builder is driving the quality of the specification.

When assessing a price for materials, it is necessary to make appropriate allowances for waste. The Standard Method of Measurement requires works to be measured in a bill of quantities 'nett as fixed in position', which means quantities make no allowance for product waste, and this is also usual when measuring builder's bills. A quantity surveyor will be expected to understand wastage allowances and apply logic to the base cost which varies with the type of material. Waste allowance covers materials that are surplus or lost in the production process due to cutting, trimming, working, shrinking, compacting and absorbing by mixing with water. It also includes residual material purchased to the nearest quantity from stock lengths. Examples include:

- Cutting and trimming timber to length from standard stock sizes
- Laps for working such as mesh reinforcement and membrane sheeting
- Hardcore purchased in bulk that is compacted in place
- Transporting and disposing excavated material that bulks in size after excavation
- Mixing water with sand, cement and lime to produce mortar
- Purchase of facing bricks.

The term 'wastage' also encompasses allowances an estimator must consider for site breakages, damages beyond repair not recoverable from an insurance claim, vandalism and theft. Allowance for waste varies considerably and can be as low as 1% for singular items such as sanitary ware, to 15% for facing bricks

and 50% for compaction of hardcore and the bulking of excavated material. It can therefore be seen that ranges are extreme and pose a risk to a contractor. Feedback from past projects to the estimator will act as an indicator to realistic allowances in order for the price to remain competitive.

Some materials are purchased by units that differ from the method of measurement in a bill of quantities or builder's bill. For example, bricks are sold per thousand whereas they are billed in m^2. A further example is hardcore which is sold per tonne and billed as either m^2 stating the thickness or m^3 where the thickness is unspecified. The quantity surveyor needs to be aware of conversion factors that convert purchase units to units of measurement. For example, the size of a standard brick is 215 × 65 mm, and with a 10 mm mortar bed and surround it becomes 225 × 75 mm. The method of measurement is based upon square metres and a conversion factor is calculated as:

$$\textbf{Brick and mortar bed area } 225 \times 75\,\text{mm} = 0.16875\,\text{m}^2/1 = 59 \text{ Nr bricks}/\text{m}^2$$

When dealing with products that are purchased by weight and rated in a bill by volume, it is necessary to allow for their relative density, i.e. the weight of the material per cubic metre. Once the relative density of a material is known, it is possible to convert it to a volume.

$$\textbf{The bulk density of dry sand is } \frac{1600 \text{ Kg}/\text{m}^3}{1000} = 1.60 \text{ tonnes}/\text{m}^3$$

$$\textbf{The bulk density of dry excavated clay is } \frac{1100 \text{ Kg}/\text{m}^3}{1000} = 1.10 \text{ tonnes}/\text{m}^3$$

Conversion factors exclude wastage which is added as a percentage. Say, for example, a bill of quantities calls for a 50 mm bed of sand to an area of 1000 m^2 and a supplier issues a quotation for the supply and delivery of dry sand at £20.00 per tonne. The rate is calculated as follows:

$$\begin{aligned} 1000\,\text{m}^2 \times 0.050 &= 50\,\text{m}^3 \times 1.60 \text{ tonnes}/\text{m}^3 \\ &= 80 \text{ tonnes} + 50\% \text{ waste for compaction} \end{aligned}$$

$$\begin{aligned} \textbf{Therefore, quantity required} &= 120 \text{ tonnes @£20.00} \\ &= £2{,}400.00 \text{ or } \underline{£2.40\,\text{m}^2} \end{aligned}$$

Upon receipt of suppliers' quotations, the information needs to be collated on a tender return analysis with notification of any items that affect the base price for the estimator's consideration. Suppliers will rarely visit a site for tendering purposes and may apply generic or specific qualifications to a quotation. Factors to consider, whether qualified or not, include:

- The cost of any samples
- Indications of pending price increases in the short term
- Trade discounts and payment terms
- Prompt payment discounts, i.e. within 7 or 14 days after receiving an invoice
- Warranties and guarantees
- Inclusion or exclusion of Value Added Tax
- Testing prices (as with concrete)
- Specific attendance requirements by the contractor such as a forklift truck to offload materials
- Delivery charges
- Special charges
- Part load charges, e.g. a quotation may state it is for a single delivery which might not be suitable.

The quantity surveyor's assessment should include a calculation of a rate showing conversion factors and waste together with items not quantifiable but noted on received quotations as items of extra cost.

Plant

A construction site may require mechanical or non-mechanical plant to service the operations of a project. Plant is hired and charged to a contractor by time or as a fixed cost and, in general, there are four ways of resourcing the charges:

- By obtaining hourly/daily/weekly rates from plant hire companies
- By obtaining fixed unit rates from plant hire companies
- By obtaining subcontractor quotations whose works include the use of plant
- By seeking advice from a company accountant when a contractor has owned assets.

Rates from hire companies include plant generally required for the contractor's preliminaries, i.e. skips, forklift trucks, security fencing, etc, which is managed and operated by site management and labour-only operatives under the control of the contractor. Heavy items of plant requiring skilled operation require maintenance and insurance that a contractor does not usually provide and includes machines for demolition work, excavations, cranes, piling and scaffolding. For estimating purposes, these items are usually treated as domestic subcontractors.

The quantity surveyor assists the estimating process by obtaining a schedule of rates and/or subcontract quotations. Instead of hiring, a contractor may elect to purchase plant for productive work where an hourly rate is required. This is different than purchasing an asset as an attendance item, such as a forklift truck, as demonstrated earlier in Table 3.1, which is deemed non-productive plant because it only assists a trade operation. The purchase of productive plant is

strategic and influences procurement decisions with trade packages on projects because, in effect, a contractor is substituting subcontract works to carry out the works itself. To demonstrate, consider a contractor who wishes to purchase a second-hand two tonne mini-excavator to excavate trenches for laying service ducts. An hourly rate for assessed output of this excavator is shown in Table 3.5.

Table 3.5

2.0 tonne mini excavator purchase price		£ 30,000	
Investment period – 3 years			
Depreciation Year 0 – 1 (50%)		– £ 15,000	
Depreciation Year 1 – 2 (15%)		– £ 2,250	
Depreciation Year 2 – 3 (15%)		– £ 1,912	
Total depreciation:		£ 19,238	
Which equates to £ 6,413 per year			
Net worth @ resale/disposal		£ 10,762	
Depreciation costs			
Operating life per year:			
Days in a year	365		
LESS weekends	–104		
LESS Bank holidays	– 8		
Maximum productive days	253 days		
× 8 hrs per day	2024 hours		
Down time, maintenance time and wet weather (25%)	– 506 hours		
Annual productive hours	1518		
Cost per hour, = £ 6,413/1518			£ 4.22
Loss of interest on investment, 3% per annum £ 30,000/3 years × 3%/1518			£ 0.19
Plant Operator			
Hourly rate including BATJIC Working Rule Agreement for plant operator. Rate built up following format on Table 3.4			£19.00
Maintenance repairs and insurance			
Allow sum of £1,500.00 per annum for replacement parts as there are no warranties and materials for servicing plus insurance			
Cost per hour, £1,500/1518 Say,			£ 1.00
Fuel consumption			
Allow 40 litres per week × 52 operating weeks per year 2080 litres @ £1.25 litre = £2,600/1518 = £1.71, plus an allowance for lubricants consumables and oil Say,			£ 2.00
Therefore, totally hourly rate for production charges = £26.41			

From Table 3.5, it can be seen the excavator needs to be operable for circa 1,500 hours per year over the investment period and charged at the stated hourly rate, including operative, for it to be viable.

Consultants

When a project is to be procured as design and build, the contractor needs to include consultants' costs for preparing and issuing the design and documentation. This is hard to quantify and clarify during a tender period as it depends on the level of information prepared by the initial consultants and whether they will be retained by the contractor to complete the criteria. Consultants engaged by a client to prepare concept or sketch drawings may provide competing contractors with a fee proposal for their services to develop the design and documentation as well as an advisory service during the construction phase. With this procurement route, a budget must be recognised in the estimate to cover fees, which are usually expressed as a percentage of the contract value and vary with each discipline. A leaner method is to assess submitted fee proposals or gain advice from the commercial manager or manager involved with the design process. The anticipated expense may form part of the preliminaries under the contract conditions or be a separate fee provision within the estimate.

3.4.5 Unit rate calculations

The resources cost of labour, plant and materials is used to assess a unit rate calculation and is prepared by the estimator. It is necessary for the quantity surveyor to understand the calculation because there may be a requirement to prepare a price on a project under construction if the works change without rates available. The calculation of a unit rate from scratch is referred to as 'first principles', a term used to describe the methods for calculating a unit rate. To arrive at a rate to charge, it is necessary to apply output for each item of productive work, which is known as a 'labour constant'. A labour constant is the estimated length of time it takes an operative to commence and complete a described works task that forms the labour component of a unit rate which has a relationship with the unit of measurement in a bill of quantities or builder's bill. By default, a labour constant or output becomes linked with any item of plant required to assist.

For example:

- An excavator with an operator will excavate foundation trenches up to 600 mm wide and 1 metre deep at an output of 15 minutes or 0.25 per hour per cubic metre
- A bricklayer will place mortar and flush point 45 facing bricks per hour to one side of a cavity wall, 102.5 mm thick
- A carpenter/joiner will cut, place and nail 10 metres of 20×120 mm softwood skirting board through plasterboard to studwork in 30 minutes, or 0.50 of an hour (0.05/hour per metre).

In addition to the labour and plant assessment, the cost of materials (including wastage) is added to create a build up of a unit rate. To demonstrate, Table 3.6 shows a number of unit rate calculations for a range of work descriptions that may be included in a bill of quantities or builder's bill.

As there are many work items for construction operations, a database of output for each trade description would aid the estimating process. However, output for a generic description captured in a database should not be seen as suitable for every project under tender as there may be variables that influence production. Outputs are influenced by buildability, i.e., site conditions, access to the area to carry out the task, the working environment, working at height, etc, and the quantity surveyor and estimator need to be open minded in their approach to labour constants. Here, knowledge of construction and appreciation of the time it takes to commence and complete a task will assist. For example, a contractor may have information in a database stating a carpenter's output is 0.05 hours per metre for nail fixing skirting up to 200 mm wide which is based upon softwood material. So, what happens on a project under tender if the request is for hardwood skirting of the same size screwed to walls without that information being in the database? A fair assessment is that the process will take longer and the allowance should be 0.10 of an hour per metre and the material cost reassessed.

If a contractor creates a library of trade descriptions and captures unit rate calculations, the rates will alter over time. This is because of increases in payable labour and the cost of purchasing materials and hiring plant as well as any changes to waste allowances and adjustments of labour constants gained from experience on completed projects. To manage such a vast database could well be unrealistic and a compromise is to log labour constants as a benchmark. These can be adjusted if necessary, and the unit rate reassessed based upon rates relevant to a project under tender with costs based upon received quotations. The estimating team may only need to calculate unit rates for those trades a contractor procures as labour-only when it purchases materials itself. The contractor will also need to rely on unit rates supplied by domestic subcontractors for other trades if a priced bill of quantities is to be submitted with a tender.

An alternative to a database is to seek rates through published building price books produced by advisors who collect data continuously. These publications are primarily used by the PQS and provide rates suitable for floor areas and building elements as well as detailed construction pricing for cost planning. They also consider regional variance allowances, industrial trends and marketing conditions. A prominent source of cost data in the United Kingdom is the BCIS (Build Cost Information Service) which has information available for subscribers available online. In addition, Spon's and Laxton's publish reference books that provide information used for assessing the cost of constructing buildings. In Australia, Rawlinson's publish an annual manual price guide that provides information on cost matters. A comparable source in Australia is Reeds Construction Data, powered by Cordell products that issue a range of rates and frequently update data. Whatever the source of information, the assessment of rates must be appropriate and relevant to a project under tender and the use of building price books should only be considered where a client is seeking an indicative price only.

Table 3.6

Excavations	*Excavate trenches not exceeding 1.0 m deep, working around piles (150 m³)*	LABOUR		PLANT		MATERIALS	**TOTAL UNIT RATE**
		£6.60		**£10.56**		**£0**	**£17.16 m³**
	Description	***Quant***	***Unit***	***Rate***	***Total***	***Comments***	
LABOUR	Banksman	0.33	hrs	20.00	6.60	A banksman is a labouring assistant to the operations.	
Total labour rate					**£6.60**		
PLANT	Mobilisation to site		Item		0	The excavator is assessed to carry out detailed excavations to an output of 0.33 hrs/m³ using a rate that includes the operator. The cost of mobilising and demobilising plant is included in preliminaries.	
	Excavate trench for foundations	0.33	hrs	32.00	10.56		
	Demobilisation from site		Item		0		
Total plant rate					**£10.56**		
MATERIALS							
Total materials rate					**£0**		

Earthwork support	*Earthwork support, max depth not exceeding 1.0 m and distance not exceeding 2.0 m (250 m²)*	LABOUR		PLANT		MATERIALS	**TOTAL UNIT RATE**
		£7.50		**£0**		**£6.81**	**£14.31 m²**
	Description	***Quant***	***Unit***	***Rate***	***Total***	***Comments***	
LABOUR	Carpenter to fix	0.20	hrs	23.43	4.69	Output is derived from information on completed projects.	
	Allow repairs (10%)	0.02	hrs	23.43	0.47		
	Carpenter to remove	0.10	hrs	23.43	2.34		
Total labour rate	Total				**£7.50**		
PLANT							
Total plant rate					**£0**		

MATERIALS	20 x 200 mm softwood boards	60	m	5.00	300.00	Assessment is made allowing for a 10 m length of trench, 1.0 m deep for both sides = 20 m² in stable ground. It is safe to assume 3nr horizontal timber boards to each face with strut supports spanning every 5 m are required. Rates include for delivery of timber in stock lengths that can be reused and the number of uses divides the cost.
	50 x 50 mm softwood struts	18	m	3.00	54.00	
	Sundry fixing, wedges, nails, 5%		Item		17.70	
	Add for waste/repairs, 10%		Item		37.17	
	Total				408.87	
	Divide by number of uses / 3 nr				**£136.29**	
Total materials rate	Total - £136.29 based on 20 m²				**£6.81**	

Filling	*Imported hardcore filling beds not exceeding 0.25 m thick, compacted in layers 175 mm thick (100 m³)*	LABOUR		PLANT		MATERIALS	**TOTAL UNIT RATE**
		£0		**£15.25**		**£40.50**	**£55.75 m³**
	Description	***Quant***	***Unit***	***Rate***	***Total***	***Comments***	
LABOUR						Labour is included as a 'gang rate' with the plant and a term used to describe numerous operatives.	
Total labour rate					**£0**		
PLANT	Excavate from stockpile and fill	0.25	hrs	52.00	13.00	Hardcore is excavated from the delivery stockpile and filled by the excavator. A 'gang rate' is used with an output of 0.25 m³/hr and a vibrating roller will be hired to compact the material in a single layer with the operative included in the rate.	
	Mobilisation to site		Item		0		
	4 tonne vibrating roller	0.15	hrs	15.00	2.25		
	Demobilisation from site		Item		0		
Total plant rate					**£15.25 m³**		
MATERIALS	Hardcore - convert as 1800 Kg/m³	1.80	t	15.00	27.00	The rate is per tonne based upon 20 tonne loads delivered and tipped on site. Shrinkage from rainwater and waste is included in the factor.	
	Compaction and waste + 50%	0.90	t	15.00	13.50		
Total materials rate					**£40.50 m³**		

(continued)

Table 3.6 (*cont'd*)

Carpentry	*Softwood skirting 20 x 120 nailed to plasterboard and stud partition (550 m)*	LABOUR		PLANT		MATERIALS	**TOTAL UNIT RATE**
		£1.17		**£0**		**£3.33**	**£4.50 m**
	Description	***Quant***	***Unit***	***Rate***	***Total***	***Comments***	
LABOUR	Carpenter to fix	0.05	hrs	23.43	1.17		
Total labour rate	Total				**£1.17**		
PLANT							
Total plant rate					**£0**		
MATERIALS	Skirting board supplied/delivered	1	m	3.00	3.00	Nails can be assessed as 2.5 kg/m^3 of timber. So, for 100 lm, 100 x 0.02 x 0.12 x 2.5 = 0.60 kg	
	Waste from cutting +10%	0.10	m	3.00	0.30		
	Nails	0.006	Kg/m	5.00	0.03		
Total materials rate	Total				**£3.33**		

Bar reinforcement	*Bar reinforcement, straight 24 mm nominal diameter (8.45 t)*	LABOUR		PLANT		MATERIALS	**TOTAL UNIT RATE**
		£445.00		**£0**		**£945.00**	**£1390.00 t**
	Description	***Quant***	***Unit***	***Rate***	***Total***	***Comments***	
LABOUR	Unloading materials and position	2	hrs	22.50	45.00	This output is specific for the specified steel and will vary with each nominal diameter.	
	Fixing	18	hrs	22.50	405.00		
Total labour rate	Total				**£445.00**		
PLANT						Plant for unloading and placing the material for fixing is included within preliminaries.	
Total plant rate					**£0**		
MATERIALS	Supplied and delivered	1	t	850.00	850.00	Tying wire and accessories is gained from experience of past projects or as guided by the supplier.	
	Damage/Waste +3%	0.03	t	850.00	25.50		
	Tying wire	12	kg	2.50	30.00		
	Spacer accessories	60	Nr	0.75	40.00		
Total materials rate	Total				**£945.00**		

Advantages of publications and cost sources include:

- Reputable source of information that has been tried and tested with time
- Inexpensive
- Updated regularly.

Disadvantages include:

- Generic and not site specific
- Not suitable as a market testing source for a tender and should only be used as a last resort
- Rates are geographically centrally based and locality factors for corrections may be considered too general.

Assessing output and calculating a unit rate is an interesting exercise. When estimating the cost of a project under tender, there is need for the estimating team to be collaborative and open to suggestions. Team members will have experiences from past and current projects and may be able to throw light on any subject if there is doubt about the extent of any works. When assessing a rate, those involved may develop a competitive edge as the goal, of course, is for the contractor to submit the lowest tender and secure an award. However, it would be wise for team members not to stray from reality, as there may be surprises in store that only come to light once a contractor is committed to the project. The Chartered Institute of Building provides an authoritative guide to essential principles and good practices for estimating, including the calculation of unit rates, estimating strategies, procedures and best practice in its publication *CIOB Code of Estimating Practice* (COEP). The principles and guidelines produced in the book are theoretical as also is the information provided in this book. However, the aims are to ensure those involved with estimating understand the skills involved when pricing construction projects.

3.4.6 Preliminaries pricing

Preliminaries pricing generally represent 8 – 15% of the cost of a project. However, this rule-of-thumb assessment is not suitable for estimating when a project is under tender and the pricing needs to be broken down into components to reflect real cost. It is therefore necessary to create a defined list of items for pricing purposes. Established contractors may have a list of standard items based upon the Standard Method of Measurement, CIOB COEP or their own templates that separate fixed- and time-related charges. On large projects, it is normal to invite tenders for items such as scaffolding, temporary facilities, cranes and hoists as their cost is considerable. In addition to a standard list, it is necessary to include any specific requests stated in the tender documents, e.g. employer's requirements. The quantity surveyor must have an appreciation of the constituents of preliminaries and, during the tender period, will aid the process by scheduling the scope so they can be rated and priced. Table 3.7 provides

Table 3.7

Code and description	***Time related expense***	***Fixed expense***
P100 **Pre commencement charges**	Support services prior to site establishment; temporary physical site presence including associated works; design manager's input for consultants' coordination (design and build); consultant fees for client advice for site amenities; legal advice; charges associated with specific training.	Initial construction programme.
P101 **Management and staff**	On site project staff; visiting management staff; updates of construction programme; extraordinary support staff including recruitment costs, living accommodation and out-of-hours working expenses; staff travel expenses; labour hire or directly employed labour when not part of production work; and employed site apprentices.	
P102 **Site establishment and main contractor's presence**		Mobilisation/demobilisation of offices including furniture and accommodation; site compound fencing including painting; fitting out offices and other accommodation; computer commissioning/ decommissioning; paving and paths; car parking; temporary service connections/disconnections; relocation expenses if facilities are to be moved during the construction phase; and adapting an existing building to facilitate contractor's presence including reinstatement.

(continued)

Table 3.7 (*cont'd*)

Code and description	***Time related expense***	***Fixed expense***
P103 **Main contractor's running costs**	Hire of offices, furniture and accommodation; computer hire; utility service consumption including drainage disposal; regular testing of portable appliances; mobile phone expenses; radio communications; project operating supplies such as beverages, postage, printing, courier, office equipment and any sundries.	
P104 **Temporary services**	Utility service consumption by the building operations and drainage disposal.	Temporary service connections / disconnections for the building works.
P105 **Temporary works**	Maintenance of all temporary works.	Haulage roads; hardstands for material storage; contractor's notice board; traffic control; and shoring existing structures including design costs.
P106 **Security**	Security staff guards; site perimeter hoarding, fencing and gates including maintenance.	Security equipment installation and removal upon completion of the project.
P107 **Employer's requirements**	Specific accommodation and requirements as noted in the tender documents.	Specific accommodation and requirements as noted in the tender documents.
P108 **Contract conditions**	Rise and fall fluctuations in the contract price.	Special insurances.
P109 **Fees and charges**	Rates and licenses payable to the local authority for temporary site accommodation and security hoarding; licenses payable for permits including parking, police escorts for deliveries, etc,	Any voluntary best practice schemes including Constructor's Scheme. * See end of table for other consultant fees.

P110 **Insurance, warranties, guarantees and bonds**		Works insurances; public liability insurances; bonds; guarantees; professional indemnity insurance; and warranties
P111 **Safety and environmental protection**		CDM coordinator and health and safety management if not included in P100; safety programming including signage, barriers and equipment; environmental protection measures; traffic control; first aid supplies; personal and protective equipment.
P112 **Control and protection**	Maintenance of levels and datums and protected surfaces.	Setting out the building; providing grid points; marking levels; protection of new surfaces; supply of samples; temporary waterproofing.
P113 **Site records**	Reports, diaries and photography.	Supply of maintenance and operating manuals of installed components and 'As built' information.
P114 **Cleaning**	Site accommodation cleaning and maintenance; building early cleans and re-cleans; pest control; road sweeping and wheel washing facilities.	Building initial clean.
P115 **Non-mechanical plant**	External/internal scaffolding hire; mobile towers; scissor lifts; small hand tools and equipment; waste skips; chutes; waste compacters; and environmental waste control.	Mobilisation to site and demolisation of each item of plant; scaffolding erection and dismantle.

(continued)

Table 3.7 (*cont'd*)

Code and description	***Time related expense***	***Fixed expense***
P116 **Mechanical plant – major**	Crane including operator and labour hire; hoist hires.	Mobilisation/demoblisation of each item of plant; foundation support for the crane including design; and crane/hoist erecting and dismantle.
P117 **Mechanical plant – minor**	Forklift truck; mortar mixers; concrete surface treatment equipment; dewatering pump; compressor tools; fuel storage accommodation and purchase for consumption; environmental control of the building, i.e. drying out, temporary heating and cooling; and any other items of plant not included in production rates.	Mobilisation/demoblisation of each item of plant.
P118 **Post completion requirements**		Supervision within the defects liability period; minor materials supply; post construction staff; and insurance.

P109 – Consultant fees applying to design and build projects include:

- Design fees for architects, structural and civil engineers, landscaping and services engineers
- PQS services for bill of quantities production and life-cycle cost appraisals
- Building information modelling (BIM) or virtual design construction
- Dilapidation reports
- Topographical survey
- Site investigation report
- BREEAM advice
- Local authority approval for planning application
- Construction approvals from the local authority including permits
- Building control approval
- Independent appraisal of the architectural design for compliance with the Building Regulations
- Statutory undertakers' fees for temporary and permanent works
- Moreover, any specific requirements for the project.

a suggested list of standard items for a project valued at circa £10 m and includes a coding structure. Established contractors usually adopt an accounting and contract administration system that uses a coding structure similar to that shown in Table 3.7 for budget preparation which also acts as a checklist to ensure all relevant items are included.

To assess the preliminaries expense, input is required from the risk workshop instigated by the estimating manager and the recommendations of the project manager. The project manager usually issues advice about management staff required for the construction period and provides a list of site accommodation requirements and the project timeframe. To demonstrate, let us say a project under tender has been assessed to take one year to build and the project manager provides an indication of the accommodation and staff requirements. The project manager is not responsible for scheduling and rating the items as he/she will be preoccupied with existing projects and it is a responsibility of the estimator/quantity surveyor(s) to apply logic and determine the anticipated expense. Table 3.8 breaks down the preliminaries using the coding structure in Table 3.7 together with guidance notes on assessing the expenditure. After experiencing at least one project, a quantity surveyor will gain an understanding and should be able to appreciate the terminology and processes used in assessing the preliminaries forecast expenditure.

3.4.7 Estimating and quantity surveying software

Computer hardware and software play an important part in construction estimating and save time on manually preparing take offs and unit rate calculations using ink and paper. Methods of calculating unit rates may be created from first principles and stored in a database with some systems linked by algorithms. Algorithms can be described as a mathematical computer science that uses data input to express an infinite list of instructions in order to calculate a functional rate. They are used with Microsoft formats or other copyright software for estimating and can be used for preliminaries and trade work unit rate calculations. If copyright software is used, it is possible to initiate the process by creating a project title in a database and then inserting descriptions of each trade item as well as the preliminaries that are to be priced. Thereafter, a description of works under each item obtained from the contract documents can be entered as well as material purchase costs, discounts applicable, nominal waste allowance, sundry fixings, labour output and an hourly rate to calculate a unit rate. The rate is then extracted and put alongside a quantity to arrive at a price for the works. A critical factor when using algorithms is that the system requires monitoring and updating to reflect market conditions, which could be carried out by a database officer who is a trainee quantity surveyor. Care needs to be taken with linked data because changes to a unit rate will reverberate through the spreadsheet. For example, say a contractor receives a 25% discount for the supply of aggregates to its sites from a supplier and the percentage discount is included in a database as an algorithm. Due to increased business, the supplier

Table 3.8

Preliminaries – cost assessment

Project title: New medical centre – Salford **Project duration: 52 Weeks**

Date:

P100 **Pre commencement (6 weeks)**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Project manager	6	wks							This represents the time and work involved between the date of executing the contract and establishing the contractor's presence on site. This period does not form part of the construction phase and is lead-in time.
Site manager	6	wks							
Health and safety manager (25%)	1.5	wks							
Quantity surveyor (25%)	1.5	wks							
Student quantity surveyor (25%)	1.5	wks							
Design manager	6	wks							
Construction programme						item			
Consultant fee for site plan details						item			
Consultant fee for BIM/IT training						item			
Total									

P101 **Management and staff**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Site manager (100%)	52	wks							Weekly rates for site staff charges are assessed on a cost to employ basis usually provided by a contractor's accountant.
Structural foreman (50%)	26	wks							
Finishing foreman (50%)	26	wks							
Quantity surveyor (100%)	52	wks							

Student quantity surveyor (25%)	13	wks							
Project manager – visitor	5.2	wks							
Health and safety manager – visitor	5.2	wks							
Planning manager – visitor	1	wk							
Construction programme – updates	4	nr							
Site labourer – Nr 1 (100%)	52	wks							Calculated as a cost to employ per hour × 39 hrs/week as shown in Table 3.4.
Site labourer – Nr 2 (50%)	26	wks							
Apprentice carpenter (25%)	13	wks							
Total									

P102 **Site establishment and main contractor's presence**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Mobilisation*						item			Previous projects or current quotations will provide a source of cost
Demobilisation*						item			
*For a list, see P 103									
Compound perimeter hoarding							m		Posts, plywood sheeting and painting
Access gate					1	nr			
Temp service connection – water						item			Consider the distance from the source, and include scope in tender enquiries to service trades who price the contract works, including connection fees. Computer commission/decommission is provided by an IT specialist.
Temp service connection – electric						item			
Temp service connection – IT/other						item			
IT commission/decommission						item			
Drainage						m			
Disconnection of temp services						item			

(continued)

Table 3.8 (*cont'd*)

Excavate/stone up bases/car park						m^3			
Excavate & remove stoned areas						m^3			
Total									

P103 **Main contractor's running costs**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Site cabin & canteen	52	wks							Consider hire rates from suppliers or if a contractor's asset, apply a weekly rate calculation.
First aid room	52	wks							
Toilets	52	wks							
Storage containers (2 Nr)	52	wks							
Furniture/office equipment hire	52	wks							
Utility services usage	52	wks							Research past projects for average prices.
Test portable appliances (quarterly)	4	nr							
Operating supplies	52	wks							
Total									

P104 **Temporary services**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Temp service connection – water						item			Notes as per P 102 apply. Consider feed distribution to the new building including the number of floors.
Temp service connection – electric						item			
Temp service connection – gas						item			

Utility services usage – low	13	wks							Varies with site workforce. Where water is supplied instead of connected, consider the litres purchased.
Utility services usage – medium	13	wks							
Utility services usage – high	26	wks							
Temp services disconnections						item			
Total									

P105 **Temporary works**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Excavate/stone up haulage road						m^3			Form access route and material storage area. An excavator will maintain the areas for 50% of the contract period.
Excavate/stone up hardstand area						m^3			
Maintain areas (2 hrs/week × 50%)	52	hrs							
Excavate & remove stoned areas						m^3			
Contractor's notice board					1	nr			
Total									

P106 **Security**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Security guards @ weekends only	3120	hrs							Allow as required, 60 hrs × 52 weeks
Total									

(continued)

Table 3.8 (*cont'd*)

P107 **Employer's requirements**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Erection of employer's notice board					12	hrs			As noted in the tender documents. Employer to supply & deliver the board.
Sundry materials for fixing board						Item			
Total									

P108 **Contract conditions**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Fixed price contract – no rise & fall				0				0	Documents request an insurance policy for the value of goods installed by the employer's contractor until Practical Completion.
Insurance for laboratory equipment						Item			
Total									

P109 **Fees and charges**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Considerate Constructor's Scheme						Item			All design and consultants fees allowed for separately.
Construction licenses/permits									
Total									

P110 **Insurance, warranties, guarantees and bonds**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	Each type of insurance is expressed as a % of the contract sum or rated per £1000 of the estimated cost to insure. Rates will vary with the amount of policy excess required.
Contractor's 'All Risk' policy						Item			
Bank charges for issue of guarantee						Item			
Professional indemnity insurance						Item			
Total				**Total**				**Total**	

P111 **Safety and environmental protection**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Audit of health and safety file						Item			Research the cost of past projects and consider the amount expressed as % of the contract value.
Signage supply						Item			
First aid supplies						Item			
Protective purchases, clothing, etc						Item			
Total									

P112 **Control and protection**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Setting out building, datums/levels						Item			Surveyors quotation

(continued)

Table 3.8 (*cont'd*)

Protect surfaces						Item			Material expenses only. Site labourers to install and maintain.
Maintain datums/levels/surfaces		Item							
Material storage pallets 1.8 × 1.8 m					40	nr			Suppliers price.
Total									

P113 **Site records**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Supply operating manuals						Item			Manuals may be included in trade subcontract prices. If not, allow here.
Total									

P114 **Cleaning**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Site accommodation cleans	52	wks							Subcontractor costs.
Building early cleans/recleans		nr							
Building final clean						Item			
Road sweeps (1 per week)	52	nr							
Total									

P115 **Non mechanical plant**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Perimeter scaffold – erect/dismantle						Item			Subcontract quote. Consider suitability of the hire period.
Additional weekly hire		wks							
Small hand tools hire	52	wks							Research past projects. Consider control of the generated waste.
Waste skips						Nr			
Total									

P116 **Mechanical plant–major**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Crane – None				0				0	When required, source quotations with hourly labour rates & consider contractor's risk.
Hoist – None				0				0	
Labour hire to operate crane				0				0	
Labour hire to operate hoist				0				0	
Total									

(continued)

Table 3.8 (*cont'd*)

P117 **Mechanical plant–minor**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Mobilisation						Item			Consider hire rates plus an allowance for fuel consumption, or if a contractor's asset, charge as a time-related basis including fuel using a calculated rate as shown in Table 3.1.
Demobilisation						Item			
Forklift truck (75%)	39	wks							
Mortar mixers (3 nr) × 25%	13	wks							
Dewatering pump (1nr) × 25%	13	wks							
Fuel storage container (75%)	39	wks							
Drying out dehumidifier	4	wks							
Fuel supply on hired items		litre							
Total									

P118 **Post completion requirements**	*Time-related expense*				*Fixed expense*				
Description	***Quant***	***Unit***	***Rate***	***Total***	***Quant***	***Unit***	***Rate***	***Total***	***Comments***
Site manager					2	wks			Rectification period
Material purchase/Insurance cost						Item			
Total									

has agreed to increase the discount to 35% for all aggregates except drainage pipe bedding which the contractor seldom purchases. If the database entry is changed to 35% in the name of the supplier, it will reduce the base price of all aggregates and is obviously incorrect. The effective management of the system will involve regular updating to ensure correct discounts are applied for appropriate materials and help avoid errors with pricing. The training for and management of this type of software might be provided by members of the contractor's staff who are experienced with the software or the software provider might run regular workshops to ensure those involved with the bidding process are familiar with the system.

3.4.8 Cost planned tenders

With traditional tendering, an estimating team estimates the cost of a project from an advanced building design. However, contractors who offer a design and build service may offer a client a cost planned tender where they provide the service of taking control of the design and completing it for construction purposes and, whilst doing so, negotiate the terms and conditions of a design and build contract. A contractor offering this service needs to be established with professional staff and possibly have in-house design teams and the resources to create cost data. Quantity surveyors with experience of cost planning or from a PQS background assist the process considerably because they are aware of the importance of cost data and the recording of information on past projects. Cost planned tenders are a risk to a contractor because the market is not tested. However, with the design under the control of the contractor, the approach used is to design a project to a predetermined cost as opposed to costing a predetermined design because, in effect, the contractor is preparing itself to commit to a cost limit.

Advantages of cost planned tenders to a contractor are that they:

- Provide the contractor with the option to undertake a diverse range of projects
- Permit the contractor to take more control of the process
- Are relatively quick to calculate as market testing of prices is limited
- Reduce the possibility of contractual disputes with a client.

Disadvantages include:

- The transfer of risk from the client to the contractor
- The contractor must have adequate resources to accurately capture data of past projects
- Possible lengthy negotiations with the client after issue of a tender, i.e. inclusions/exclusions
- Possible complex arrangements for obtaining the initial design for developing by the contractor
- The initial tender may need updating to reflect client negotiations.

New works and cost planned tenders

Contractors offering cost planned tenders usually focus on types of projects they are familiar with based upon their experience and client testimonials. In order to cost plan effectively when there is no design, estimates are often based upon rates charged to a given gross internal floor areas (GIFA) of a building. In general, GIFA is the sum of all floor areas measured from the internal faces of external walls. Rates are obtained from projects completed by a contractor and stored as data which record the project specifications. These specifications are retained as a source of reference for a completed building that a contractor considers it can apply to a new project under tender and which can be modified to meet a client's needs. In order to apply these rates, a contractor will need to have a degree of certainty with the source as they become the starting point of a cost planned tender.

The triggering of the tender process is usually initiated by a client who prepares a written brief of project requirements and appoints consultants to prepare a concept design and outline proposals for structural and civil works and building services. At a particular stage when the design and proposals are sufficient, the client issues invitations to tender from a numbe of contractors to provide preliminary cost planned tenders. Invitations to tender are usually subject to negotiation or stated to be submitted to a maximum sum which becomes a target cost. Target cost plans may be provided where a guaranteed maximum price is explored on the understanding a client accepts the principle of a contractor's tender and remains inactive with the design, leaving the resourcing to the contractor. To demonstrate, consider a contractor with experience of medical centre construction that is approached by a client to provide a cost planned tender for a new medical centre. To assess the cost, the contractor must access the cost of a medical centre project it has completed or is currently building as a benchmark and break down the cost into elemental parts. Each element is then pro rata priced to the given GIFA of the building. Table 3.9 demonstrates this principle on a medical centre project already constructed with a total GIFA of 3000 m^2. Because the data record is the price of the building elements, the rate of each can be assessed as a benchmark for a project under tender.

To assess benchmark rates, the total cost of each element is divided by the GIFA to create a cost per m^2 of the element in relation to the GIFA. Once these rates are ascertained, they can be applied as the basis for the new project under tender. When selecting a benchmark project, the project must be consistent with that under tender, i.e. a medical centre for a medical centre and not an office block or industrial building as they are different functional buildings. An important factor here is that the GIFA for the new building must be provided which is usually included in the client's brief.

This is relatively straightforward for the quantity surveyor to assess. However, obtaining a price by this method is only part of the picture as, in effect, the process is using a building from a past project of the same or a different floor area and placing it elsewhere, which may not be ideal. Factors to consider for differences are:

Table 3.9

Project Description and Parameters		
Completed project: Site 'x'- New medical centre GIFA: 3000 m²		
Element	**Total Cost**	**Cost m²**
Substructure		
Foundations and substructure	***£ 215,864***	***£ 71.95***
Superstructure		
Columns	£ 30,556	£ 10.19
Upper floors	£ 261,110	£ 87.04
Staircases	£ 21,066	£ 7.02
Roof	£ 86,175	£ 28.73
External walls	£ 277,280	£ 92.43
Windows	£ 185,175	£ 61.73
External doors	£ 20,120	£ 6.71
Internal walls	£ 29,411	£ 9.80
Internal screens	£ 78,144	£ 26.05
Internal doors	£ 65,076	£ 21.69
Total	***£ 1,054,113***	***£ 351.39***
Internal finishes		
Wall finishes	£ 172,084	£ 57.36
Floor finishes	£ 125,008	£ 41.67
Ceiling finishes	£ 57,036	£ 19.01
Total	***£ 354,128***	***£ 118.04***
Fittings and equipment		
Fitments	***£ 322,188***	***£ 107.40***
Services		
Sanitary fixtures and plumbing	£ 225,079	£ 75.03
Water and gas supply	£ 58,122	£ 19.37
Space heating	£ 172,449	£ 57.48
Fire protection services	£ 28,514	£ 9.51
Mechanical services	£ 156,028	£ 52.01
Electrical power and lighting	£ 119,006	£ 39.67
Other services	£ 0	£ 0
Builders work with service trades	£ 12,795	£ 4.27
Total	***£ 771,993***	***£ 257.34***
Total contract sum	***£2,718,286***	***£906.12***
Excludes external works, design fees, preliminaries and margin		
Date of agreeing contract sum:		

- External works such as parking, roads, paved areas and landscaping
- Inflation, because the rates are based upon a project that is outdated
- Design and construction risk with the specification, especially with regards to quality
- Duration of the new project
- Any site-specific and abnormal requirements, such as demolition of existing structures
- Locality of the benchmarked project versus the new, e.g. the cost to build a project in London is generally more expensive than in Manchester.

The tender process can be up to six months or more after issue, with the contractor modifying its offer whilst the client's brief undergoes development. This involves mid-tender period reviews, with quantity surveyors reassessing the design as well as attending meetings with the client who provides items such as schedules of accommodation and specific project needs. The quantity surveyor aids the process by measuring the floor areas or building elements from designs provided by the client's agent that are rated accordingly. If there are 'financial blow outs' compared with the preliminary cost plan when costs increase, the estimating or commercial manager usually advises the client of elements that create the scenario. This is to allow the design to be amended or for the client to accept the consequences and increase the budget. Contractors in the business of submitting cost planned tenders are usually prepared to accept the consequences of early involvement and understand that effective working relationships are created in the process. A client usually makes no obligation of guaranteeing a project to a contractor once a cost planned tender is received. A client may also instruct a development team at any time to develop the design and reflect the client's proposals for retendering the works, usually including those contractors who provided a preliminary cost planned tender. Thus, it can be seen a contractor's tender expense in both time and money can be considerable with this type of procurement.

Refurbishment works and cost planned tenders

Contractors experienced in the refurbishment of buildings may offer solutions for a client's objectives if a broad scope and predetermined budget are known. For example, a client may state a budget and the requirement to convert two shops into one. Here, a contractor may elect to submit a cost planned tender that includes a scope of works to meet the budget and the quantity surveyor can assist the process by creating a scope and pricing accordingly. However, if a client has a limited budget with an extraordinary requirement, the contractor must advise if the budget is sufficient. Here, a quantity surveyor can prepare 'spot items' and rate them accordingly using rates from a database and advise what scope of works can be achieved for the budget. The client might get a pleasant surprise when surplus budget remains which can enhance the scope of works so the maximum budget can be spent. This could involve an increase in quality such as the type of wall or floor finishes. Where the refurbishment is

so expensive it means a budget cannot be met, the option may be to demolish and rebuild subject to planning approval and the cost for a new building could be advised based upon a GIFA with rates obtained from past projects. However, commonsense should apply because, if a client has a limited budget that would not pay for the refurbishment, it is unlikely the option to build new will happen and the exercise would be a waste of time. On no account should information be directed to a client by the quantity surveyor as it will need approval by the estimating manager. This is because there may be risk items that could go unnoticed, e.g. unknown presence of asbestos that is expensive to remove if disturbed because of the health and safety criteria involved.

For the trainee quantity surveyor, being involved with refurbishment and new works cost planning and the estimating function of a contractor's business can be a rewarding experience. It may suit certain individuals who prefer to be involved with estimating (or pre-contract) activities instead of contract administration of a project already secured by the contractor. Being part of an estimating team is advantageous because it provides an in-depth knowledge about the nature and risks of a project before commencing construction. It also provides an understanding about the assessment of prices and strategic methods adopted by a contractor in the process of trying to secure a project.

3.4.9 Value management

Value management (sometimes called value engineering when a project has a salient engineering theme) is a generic term that describes the collection and control of a set of principles and practices to produce best value for those concerned. With construction projects, the process seeks to satisfy the client's needs by ensuring all necessary functions and facilities of a building are achieved for the lowest possible cost whilst maximising their performance. This involves identifying aspects of the building design in terms of the cost to construct and considering benefits that might be gained through its life cycle. The general perception of value management in construction projects is one that aims to reduce cost in line with a budget. This is when a component, element or product is substituted or modified yet is still deemed suitable for the purpose. However, a bigger picture involves value managing a project that intentionally creates or modifies a design and specification. This occurs when a client considers the tendered sum incurs an acceptable financial premium that will be offset by benefits through the life cycle. An example is the inclusion of sustainable methods beyond minimum requirements to provide benefits when energy consumption is reduced during the occupancy, thus creating lower running costs over a defined period.

When a client drives the design and appoints consultants, any considered value management criteria are usually included in the design, and receipt of tenders from contractors should reflect expectations. However, with design and build procurement, a client may have a predetermined budget and be open to suggestions for ways to maintain the budget or explore the benefits of value management. With this type of procurement, contractors are often encouraged

to participate with stakeholders' intentions which are beneficial with cost plan styled tenders. Here, stakeholders hold discussions and provide opinions on what they consider is acceptable for a project regarding the expansion, removal, replacement, substitution, or amendment of any item. A method of addressing these issues is to run a workshop with the objectives being to:

- Bring the client and construction team members up to date with the status of the project
- Identify suggestions and contents of a value study if the study is available
- Foster teamwork towards achieving project goals
- Identify value-for-money solutions and cost savings that maintain the scope of works through the introduction of efficiencies with the alternative to reduce or defer the scope of works
- Identify scope reductions and/or savings to provide the opportunity for the project to be within the current budget
- Schedule all risks and opportunities
- Prompt the client to explore all opportunities
- Challenge the brief
- Apply rules in order to achieve objectives
- Seek a win–win outcome (client and team)
- Listen to others' points of view
- Consider constraints such as time, planning approval, topography, and items not subject to negotiation because the client insists on their inclusion without compromise.

From the offset, participants in a workshop should be advised by a team leader that no hierarchical attitude exists and subjects are open to discussion. An effective workshop is one that creates a relaxed atmosphere without defensive attitudes and prompts contributions from all team players with the common goal of meeting objectives. Upon completion of the workshop, a quantity surveyor or estimator will calculate cost variances and issue results.

Ideally, workshops should be carried out whilst the design is under development. Unfortunately, if value management is required and not addressed during this time, surprisingly high tenders may be submitted by contractors. This may result in a delay to the start date on site because the design goes back to the drawing board to produce cost savings much to the dissatisfaction of those involved. Contractors tendering on construct-only projects tend to have experience of this scenario and may be asked by a client's agent to resubmit tenders based upon modified designs and possibly participate with any cost-saving exercise. With design and build projects, contractors regularly run in-house value management workshops during the construction phase because the contractor has a strong influence and interest to modify a design to meet the budget.

4 Project Commencement

4.1 The project team

A contractor will usually initiate a project when its senior management is satisfied that an agreement to carry out the works exists with a client. This could be when the contractor has executed a formal contract or, alternatively, when it is in receipt of a preliminary agreement from the client. This is either a Letter of Acceptance accepting the contractor's tender, or a Letter of Intent stating the client's intention to formalise an agreement once the terms and conditions of a pending contract are agreed. The difference between these preliminary agreements is that the former is a confirmation of the conclusion of negotiations pending the formality, and the latter is subject to further negotiations. There are various reasons why negotiations take time to conclude, such as:

- Agreeing the contract sum or schedule of rates payable to the contractor
- Confirming the contractor's obligations for the scope of works
- Agreeing the timing of interim payments whilst works are in progress
- Agreeing the clauses of the contract, including construction start and finish dates
- Issue of negotiations or the form of contract to a contractor's or client's parent company for authorisation.

It would be ideal if a preliminary agreement is issued from the client to the contractor. However, it is up to the contractor to decide whether it wishes to initiate a project based upon a preliminary agreement issued by the client's agent. Recognition of the agreement triggers the contractor into organising a project team to manage and deliver the scheme. Ideally, this team comprises the job titles and appointed names included in the contractor's tender for the works, including the quantity surveyor. However, since submitting the tender, the contractor may have to substitute some names as a result of staff holidays,

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permanent departures from the company, or timing of the agreement which, under normal circumstances, is discussed with the client beforehand.

Under a normal arrangement, the contractor's project manager arranges an informal pre-start meeting with the project team, which acts as an icebreaker where personnel can be reacquainted with colleagues from a previous project or meet for the first time. A representative of the client may also be invited to attend, although this is discretional and depends on the nature of the scheme and client. The pre-start meeting is an excellent method for introducing team members because it promotes collaborative working and addresses key components to raise awareness of the project, including:

- The scope of works and duration of the project
- Client and consultant contact details
- Schedule of site accommodation and where the accommodation is to be located
- Specific issues, e.g. location of site boundary lines, tree protection orders from the council, the condition of existing buildings, site hazards, etc.

Ideally, the meeting is held on site as a walk over survey, which has the advantage of allowing personnel to acquire a feel for the physical presence of the scheme. Alternatively, the meeting may be held at the contractor's head office and is chaired by the project manager or another member of senior management. At the meeting, the manager may issue a construction programme to advise the team members of project activities as well as early work requirements, e.g. site accommodation, and the trades required early in the programme which requires input from the quantity surveyor who procures the trades. The date from when the contractor is satisfied an agreement exists to the date when it possesses the site is known as the pre-commencement period. This is an important time as it permits the contractor to arrange the mobilisation of accommodation to site, and to create administration requirements which are usually discussed at the meeting. A characteristic of a pre-start meeting is that it should be exactly as the name suggests, i.e. a meeting before works start. This is because the date the contractor takes possession is the date that triggers the start of the construction programme and is usually part of the agreement with the client.

The project team will require information from the project manager about the resources available for managing the project. This will enable them to understand the management structure of the contractor's organisation and is best demonstrated in a flow chart. The flow chart could be included within the contractor's tender as it demonstrates to the client the hierarchical arrangement for the delivery of a scheme and how back-up resources from head office assist the project team. It also benefits a project team member who may be a new employee and unfamiliar with the arrangement. Figure 4.1 demonstrates a flow chart where the project team stands independently from its head office to deliver a scheme. In this scenario, head office resources comprise of personnel

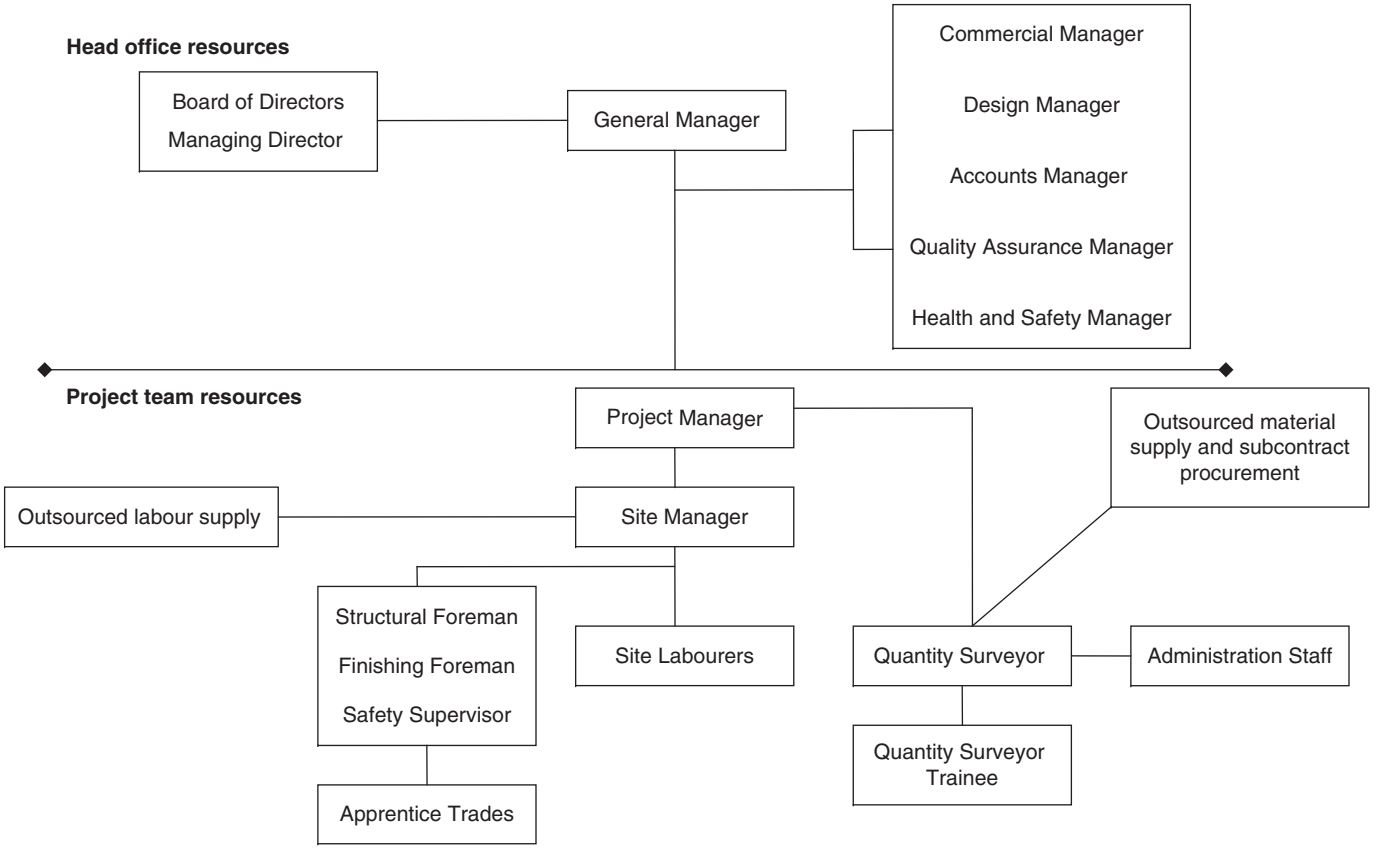

Head office resources
Board of Directors
Managing Director
General Manager
Commercial Manager
Design Manager
Accounts Manager
Quality Assurance Manager
Health and Safety Manager
Project team resources
Project Manager
Outsourced material supply and subcontract procurement
Outsourced labour supply
Site Manager
Structural Foreman
Finishing Foreman
Safety Supervisor
Site Labourers
Quantity Surveyor
Administration Staff
Quantity Surveyor Trainee
Apprentice Trades

Figure 4.1

who may visit the site and assist the project team with supplementary and supportive roles but do not play a direct role in the day-to-day running of the project.

Once the project team is briefed, it is customary for members of the client's team, the client's agent and stakeholders to become acquainted with the project team. This may be achieved by inviting parties to meet the project team; it is usually arranged by the project manager and may be at the client or client agent's offices or at the first formal site meeting once the site accommodation is established.

4.2 Pre-construction handover

At the pre-start meeting or on a date soon after, the contractor's estimator will normally produce a set of files comprised of contract documents and a compilation of items used to prepare the estimate. This file is issued to the project manager and includes commercial and contractual information that the quantity surveyor usually copies for his/her own use. The contract documents could differ from the tender documents if they reflect amendments after a tender is submitted, e.g. if value management is carried out involving the issue of amended designs and documents that drive the contract sum or schedule of rates if the price is not fixed. The estimator is the most suitable person to compile this file as he/she will be aware of the negotiations and changes since issuing the tender and will ensure the documents issued reflect the binding agreement.

It is important for the project team to refer to these as contract documents and not tender or construction documents as they represent an agreement frozen in time and a focal point from which changes are assessed. For example, architectural drawing number A100 revision 'A' might be a tender drawing that underwent change to become revision 'B'. The contract price has been agreed based upon that change, making revision 'B' the contract document. If a further and final issue, entitled revision 'C', is released as a construction drawing, the basis of any change is the comparison between revisions 'C' and 'B' and possibly a contract variation. The issue of contract documents is for administrative purposes only. They must not be considered suitable documents for construction purposes as it is customary for consultants to provide a set of working documents when they become available.

The amount of design and documentation in a contract issue can be considerable, especially if the project is valued at, say, £2 million or more. The information included in the handover files is usually hard copy of information stored electronically in a site file created within the contractor's computer server and a typical issue of contract documents comprises the following:

- Bill of quantities (if applicable)
- Document register with a list of revision numbers that form part of the contract

- Construction programme
- Contractor's proposals
- Copy of the executed contract (if available)
- Negotiation letters, forms or correspondence that form part of the agreement
- Clarifications and qualifications if not appended to the agreement
- List of subcontractors named in the documents by the client
- Contract sum breakdown.

In addition, the estimator may provide supplementary information used to prepare the estimate to aid the project team's understanding of any financial allowances included in the contract sum. These are of no interest to the client and do not form part of the contract and are primarily for the benefit of the project manager and quantity surveyor. This information includes:

- Builder's bills of quantities
- Copies of subcontractors' and suppliers' quotations
- Analysis of the quotations
- Cost plan allowances
- Cost coding structure
- Information received from the client after tender
- Temporary works designs
- Minutes of meetings
- Site visit reports.

Because the contract issue is generally of a commercial nature, it is for the project manager and quantity surveyor, with no action necessary until receipt of 'for construction' information. This will free up the site manager and foremen's time to arrange planning and the management of resources. A site manager's time is best spent driving the project instead of being tied up with commercial matters such as percentage allowances for material wastage and material suppliers' priced rates. Naturally, the site manager and foremen will be concerned with budgets and the commercial side of a project, and act in the best interests of the contractor. However, it is the quantity surveyor and project manager that drive commercial and contractual aspects for a project. Therefore, collaboration between the project team is certainly one aspect leading to the successful delivery of a scheme.

4.3 Office- and site-based roles

The decision about whether a delegated quantity surveyor should be based on site or at head office is influenced by the contractor's policy, the project's value, complexity of the works and sector of the construction industry. For example, national house builders usually have a number of regional offices around the country, each constructing possibly 200–500 dwellings per year on a number of

sites. Each office usually engages a team of quantity surveyors to concurrently manage three to five projects, each of varying value. These businesses have established resources, with buying departments that purchase materials leaving the quantity surveyor to focus on cost managing projects and procuring subcontract trades. National house builders generally rely on income from speculative selling to the public. This occasionally makes the business free from having to contract with a corporate client and, as a result, there is seldom a main contract to administer, releasing some of the quantity surveyor's time. Quantity surveyors engaged by national house builders are helped by bonus surveyors who measure and value works completed by labour-only subcontractors and process their payments, usually on a weekly basis.

The nature of contracting is somewhat different than speculative house building. Small- to mid-sized contractors executing projects to a threshold of, say, £2 million may have a policy of not basing a quantity surveyor on site. Here, they exclude the cost to employ from the preliminaries and consider the expense as an off-site overhead included in the contractor's margin. In some ways, this means the contractor is competitive with its prices when tendering because the preliminaries charges are reduced. However, some clients may perceive the margin as abnormally high if it is part of the tender breakdown, and query the amount with the contractor after it submits its tender.

Larger contracting organisations constructing projects in excess of £2 million may have an established head office to assist the project team running a project. Head office departments could include:

- A material buying department to purchase materials upon site requests
- A plant department that stores, maintains and delivers contractor-owned equipment to a project
- Design managers who drive the consultant's criteria for design and build projects.

This is an integrated style of business where a head office is fundamental to the running of a project. Where this exists, the quantity surveyor may be a visitor to site and not based permanently on the project. However, this is not set in stone and will vary between contractors and the projects undertaken. With this type of contractor, a qualified quantity surveyor based in a head office could be capable of concurrently administering two projects valued at £2–£5 million each or a single project valued at £5–£10 million. To enable this, the contractor will need to be established with suitable information technology, a material buying department, effective quality assurance and quality control procedures with the projects undertaken uncomplicated in nature. However, a quantity surveyor's full-time role could be absorbed by a single project worth £2 million if it is complicated or the contractor is new in business or becoming established in new sectors of the industry and going through the process of introducing management systems.

Projects in excess of £10 million usually require a quantity surveyor to have a permanent presence during the construction period and he/she may receive assistance from support staff and junior surveyors to suit the demands of the project. The reason to include a quantity surveyor permanently is that a commercially-aware individual is present who has knowledge of the contractor's workings and management systems and is considered by the contractor as an asset and an integrated member of the project team.

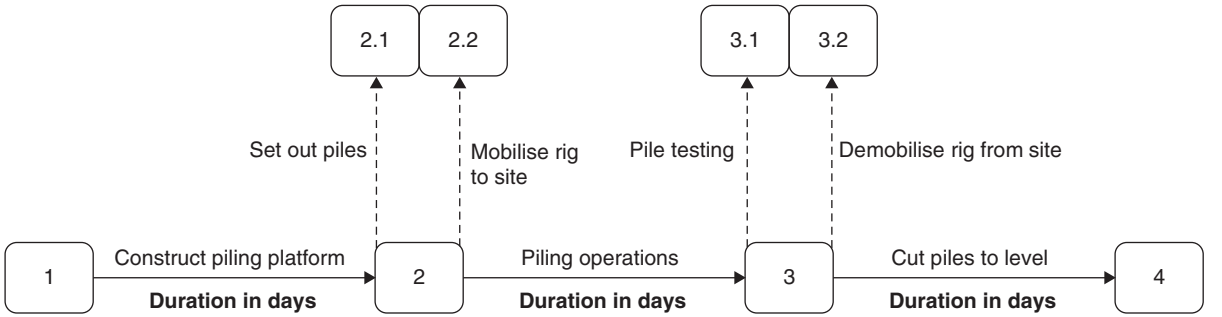
4.4 The construction programme

The construction programme is a document created by the contractor's project or planning manager that describes the working activities of a project by duration. In general, the client gives possession of a site on or before a date written into the contract. The contractor then commences the works and agrees to complete them by a specified date known as the date of practical completion. The time between the date of possession of the site and date of practical completion is the construction period, for which working activities are planned in a programme. When assessing this period as part of a tender, a contractor can do either of the following:

(a) Assess the length of each activity starting from the commencement date with the sequence of activities dictating the date of practical completion to create a construction period; or
(b) Take into account the client's preferred construction period and plot the working activities to see if the completion date can be achieved.

Once a construction period is agreed and included in the programme, it is common to make the programmed document part of the contract as it binds the parties for the delivery of a scheme. The document is of interest to the quantity surveyor because, generally, any changes that alter the construction period could influence cost, which a contractor must recognise as being its own or the client's responsibility.

With the growth of information technology, programmes may be produced in a number of formats with the choice possibly stated in the tender documents. The common types used in the construction industry are PERT (Programme Evaluation and Review Technique) charts or Gantt charts. In general, PERT charts display critical path sequences displaying what task must finish before the next can start. These are shown as numbers in a circle or shaped indicator with links that describe the works and their duration. Gantt charts display activities by duration with a series of lines or bars measured along a horizontal axis displaying each work activity and duration. Figure 4.2 demonstrates a PERT chart for piling operations with explanations of the network arrangement. For comparison, Table 4.1 demonstrates a Gantt chart for the same works created from Microsoft Project software that shows 'finish to start' processes which create a number of critical paths.

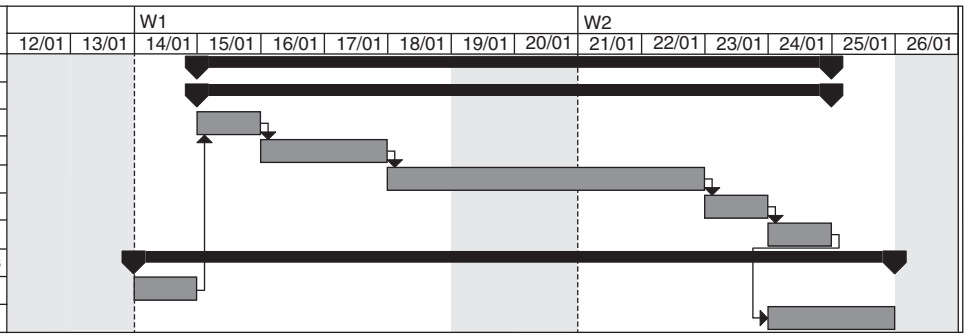


The numbered rectangles are networks that represent the commencement of the critical path and the milestones at each stage. The directional arrows are dependent tasks that require completing in sequence and are secondary to each network milestone. Any concurrent works separate to the piling operations will splinter off the appropriate milestone network.

Figure 4.2

Table 4.1

ID	Task Name	Duration
1	**PILING PROGRAMME**	**8 days**
2	**PILING OPERATIONS**	**8 days**
3	Mobilise rig	1 day
4	Set out piles	2 days
5	Bore and construct piles	3 days
6	Pile testing	1 day
7	Demobilisation of rig	1 day
8	**BUILDERS WORKS**	**10 days**
9	Construct piling platform	1 day
10	Cut piles to level	2 days



There are pros and cons for each which are summarised as follows:

- In general, Gantt charts are used more often than PERT charts and are preferred by contractors and clients. This mutual understanding thus aids the flow of communication when addressing time issues as there is a common knowledge of the format.
- Gantt charts are more suitable than PERT for small projects as every detail is possible to reproduce. However, this can be overwhelming on a large project, costing time and money to produce, and can be simplified by a PERT chart that summarises works as a network.
- In order to produce a Gantt chart, the activities must be known in detail. This is suitable for a construction programme but inappropriate for early programmes such as cost planning that are best demonstrated as a network and does not need to be as detailed.
- Updating Gantt charts means having to access all existing written details, possibly meaning it is better to start again, whereas PERT charts are effectively converted. However, with Microsoft Project, Gantt bar charts can be updated in a dynamic and controllable manner. The downside of this control is that it requires an intimate knowledge of the software in order to exploit the benefits and may be best managed by a consultant.
- PERT charts explicitly define visible activities and dependencies with shorter lists than Gantt charts.
- For those unfamiliar with PERT charts, details of tasks and their duration may not be obvious because information is less detailed than on Gantt charts.
- Gantt charts demonstrate time to scale, whereas PERT networks are not to scale.

A well-prepared construction programme will outline both client and contractor responsibilities. Experienced contractors and clients may agree to include a programme in a contract to reflect both parties' responsibilities with the shared goal of completing the project on time. However, there may be a misconception by either party that the programme is an arrangement of construction activities and the responsibility of the contractor only. This is inaccurate because the programme should be considered a statement about the order of construction activities as well as the duties and responsibilities of the parties. Whilst construction activities are at the core of a programme, it is the administration of and responsibility for acquiring the information to permit those activities that are often omitted. An omission can create the basis for disputes related to time that by default become linked to cost. For example, let us say a contractor is constructing an apartment block which has a provisional sum allowance for supplying and installing bathroom sanitary ware and fittings because product selection by the client was unknown when the works were tendered for. Here, the programme should include a schedule stating the latest date when selection must be made as well as a date for commencing installation. Let us say the sanitary ware and fittings are

programmed for installation to commence on week 40 yet the statement is silent on the date for selection. If the selection is made one week before the date for commencing installation, it is hardly likely the materials will be scheduled, purchased and delivered to meet the programmed requirements. A well-prepared programme will state a date for the issue of sanitary ware and fittings selection as well as a date for commencing installation. With a scenario like this, a contractor may fail in its claim for an extension of time to prolong the construction period because the programme has no provisions for a date of issuing sanitary ware and fitting choices. This is because, in general, extensions of time can only be granted upon information included in the programme. Therefore, an elaborated programme that includes a scheduled date for selection criteria would address the client's responsibility and help avoid this situation. It is far better for a contractor and client to agree on the adoption of an elaborated programme instead of one that merely states the construction operations.

During the construction phase, it is the contractor's responsibility to update and monitor the document because it becomes a guide to the performance of works. However, a contractor needs only to comply with a request to update a programme if it is an obligation written into the contract. If updates are not part of a contract, a vigilant contractor will measure project performance by updating the document regularly, say every three months, to take into account works completed as well as works yet to be finished. This is of interest to the quantity surveyor because it is important to understand if a project will complete on time as time is linked with cost and involves the contractor's preliminaries. The information the statement provides prompts a contractor to act, as it may have been unaware whether a project was ahead or behind schedule and requires the information for appropriate action to avoid any delay to the agreed end date.

A characteristic of a programme in a construction project involving buildings is that there is a lesser degree of involvement and control by the client's agent over the contractor than there is with an engineering project involving civil works. With a construction project, the client's agent cannot tell a contractor how to build and it is up to the contractor to demonstrate how it can procure a project in a manner to meet the completion date by way of a programme. With an engineering project, the engineer is generally empowered with some discretion into the activities and has more of a say in the matter. All of this assumes, of course, that the programme is part of a contract as it cannot be enforced if introduced after the works commence.

A construction programme as a contractual document is vital because it provides evidence when assessing delays and any financial claim. A benefit of the programme for the quantity surveyor is that it aids the timing for the issue of trade package awards because it states the commencement date(s), thus permitting the quantity surveyor to plan ahead. It also assists subcontractors who may be given the master programme so that they can prepare their programme to suit the contractor's requirements. Subcontractors providing

this information usually limit their services to large projects where trade packages have a high financial value because they need to employ staff with programming knowledge in order to meet the contractor's expectations.

4.4.1 Programme float

'Float' is the term used to describe a period caused at any time in a programme by the early completion of an activity on a critical path that releases time. This 'floating' time may be absorbed or used to prolong the duration of the next activity, causing no overall harm to the sequence of events and not jeopardising the end date. In reality, and without contractual provisions stating otherwise, a contractor owns the float. A client does not usually benefit from time created from float as it may only be temporary and the term is usually excluded from a contract to dispel assumptions it means an early finish.

Float becomes available through effective construction management. It may also be included in a programme as a risk contingency that may become mitigated when risk expectations have less impact than envisaged. Furthermore, it may occur naturally and is subject to change due to the ongoing activity of a project. For example, say a contractor envisages that, if it performs to plan, it could have 2 weeks' float available at the end of month 6 of a 12-month project, i.e. by the end of month 6 it could be 2 weeks ahead and finish early. However, if this float is lost between months 7 and 12, there is no harm to the end date and the contractor would still be able to complete on time. The golden rule for the quantity surveyor and project manager is not to ignore any justified request for an extension of the end date because float is available as in reality it may not happen. Float is for information only; any extension of time request should be treated as if the float did not exist and applies even if a client is aware of the float. For example, let us say a natural flood occurs during a project. Repairs are anticipated to delay the end date by one month and one month float is envisaged by the programme. The contractor must still request an extension of time of one month (which may also be a condition of contract). This is because if the float is absorbed by other means after the repairs are complete and the extension of time request has not been issued, it may mean the project will complete late. Whether or not the contractor could claim a retrospective extension of time after the flood repairs are complete is a matter for the client and conditions of contract.

4.4.2 Programme acceleration

If an updated programme is showing the project as lagging behind schedule, works causing the delay may need to be accelerated to put the programme back on track. In effect, acceleration is the opposite of float because no surplus time is available and the programme is in time deficit. A lagging programme is of concern to a client and contractor because the end date could be in jeopardy, so it requires remedial action. Acceleration will involve a contractor addressing

methods of recovering lost time to achieve the end date. If a contractor considers that works are behind schedule with the float absorbed and no extension of time to claim, it becomes its responsibility. In this scenario, the site and project managers will state the requirements to recover lost time and the quantity surveyor will need to calculate the costs. This is often referred to as 'crash costing' and includes a method of detailing the expense to cover additional labour, plant, out-of-hours working and extra supervision to put the programme back in the position it needs to be so it can complete on time.

Acceleration clauses may be included in a contract. This is more likely for an engineering project, although it is not unheard of in a construction project. It gives the client's agent the right to request an increase in productivity if they want to reduce the project duration. However, the request may have some limitations and will be defined in the agreement.When programme acceleration is a condition of contract, a contractor must demonstrate methods it will use and issue a revised programme for approval. In general, this is usually accepted if it demonstrates the end date is achievable. At worse, it could be rejected if the end date cannot be met, which could lead to the client losing confidence in the contractor and even be grounds for terminating the contract if the contractor is responsible for the delay. It is therefore in the contractor's interest to ensure any lost time for which it is responsible is made up and the client made aware. By contrast, if works are delayed because of a fault of the client, the contractor is only obliged to accelerate the programme if there is a clause in a contract stating so, and it should advise of the additional costs. Here, the quantity surveyor will advise the project manager of the 'crash costing' for inclusion in the advice. Without an acceleration clause, a contractor can only oblige a client by accelerating the programme if requested to do so and issue advice on the cost. If the client cannot agree to the cost, the contractor must seek an extension of time to the end date.

4.5 Project administration

The quantity surveyor would be wise to take advantage of time available during the pre-commencement period to create project administration management tools. If project administration is not dealt with before a permanent site presence is established, it may result in inefficient administration when the project is under construction. Permanent site presence means the physical presence of the contractor's accommodation during the construction phase which is usually removed prior to occupation of the building. It can also mean a permanent presence after section(s) of a project are handed over to the client whilst other sections are in progress until completion of the last phase of work.

The pre-commencement period is usually an active time for the quantity surveyor, who might be preparing a final account for a client and subcontractors on a completed (or near complete) project and has the dual task of being involved with a new project. During this period, the project and site managers

will manage numerous activities involving administration for the site establishment and the quantity surveyor usually assists in the process. The administration involves:

- Obtaining appropriate project insurance policies, usually from the contractor's accountant, financial controller or business development manager
- Obtaining bank guarantees and security bonds for the client, usually from the same sources as project insurance
- Applying for permits/licenses from authorities, e.g. Heritage, local authority, building control, etc
- Obtaining proof of planning permission from the client, including any conditions
- Attending to the client's site accommodation requirements if applicable
- Arranging for mobilisation of the contractor's site accommodation and equipment
- Disconnecting building services supplies if demolition of existing buildings is required
- Applying for temporary service connections to the site accommodation from statutory authorities
- Arranging collection of keys to gain access to land or existing buildings
- Ensuring the initial construction programme is updated
- Compiling the health and safety file
- Registering the project with the Health and Safety Executive if it falls under the rules of CDM
- Ordering site administration materials and consumables, i.e. document files, stationery, etc
- Confirming the site welfare/amenities plan with client approval if required
- Reconfiguring the site office plan to suit the project requirements
- Arranging a meeting with the CDM coordinator
- Completing a scaffolding plan showing building perimeter requirements and shade cloth areas
- Creating a material handling plan and method statement of working operations
- Issuing courtesy notices of intention to construct, e.g. informing neighbours
- Arranging for a new geotechnical report if necessary
- Obtaining dilapidation reports into the condition of any surrounding properties, preferably signed off by the local authority and property owners. These identify the condition of the land or buildings prior to a start on site and safeguard the contractor if there is a nuisance claim from owners that site construction activities have caused damage.
- Where applicable, and in England and Wales only, ensuring notice of intent to carry out works is in accordance with the Party Wall Act 1996 and concluded with adjoining owners. This is legislation coming into force as a result of a contractor's intention to carry out works where a party wall exists. It applies if the works include modifications to the wall, construction of a

party or boundary wall between properties and excavations within certain distance(s) of a neighbour's structure that are to a lower depth than the existing foundations. Any disputes with the adjoining owners need to be resolved prior to commencement, which is usually a matter for the client.

- Creating a Waste Management Plan with the cooperation of the client
- Obtaining hazardous materials reports
- Obtaining an environmental report/management plan
- Compiling a quality assurance manual
- Creating a traffic management plan if applicable on how road traffic will be controlled
- Obtaining temporary work design and permits if required for early works, e.g. façade supports
- Applying for permits for a hoarding/construction zone, scaffolding, gantries, parking, etc
- Lodging a voluntary Considerate Construction Scheme or a local authority alternative when applying initiatives for Site and Company Considerate Codes of Practice aimed at improving industrial image
- Organising information technology for the site accommodation
- Liaising with the Health and Safety Officer for safety measures, first aid, signage, clothing, etc
- When the project is a design and build contract, confirming the appointment of a Building Control Body (BCB) that has authority to approve the design as complying with the Building Regulations. This can be a local authority, Approved Inspector or competent person who can provide self certification
- Creating a list of design consultants including contact details
- Collating 'for construction' working documents.

Depending on the scheme, some projects require temporary site accommodation, usually for a predetermined period before the permanent presence is established, which may be off the site at a nearby location. Temporary accommodation could be required to oversee early works such as the demolition of existing structures that require removing because they are on an area where the new contractor's site presence is to be established. Creating temporary accommodation is usually part of the pre-commencement activities; it is separate to the construction period as it is not a requirement for the duration of the project and usually is minor in comparison.

During the pre-commencement period it is important that the contractor is supplied 'for construction' design and documentation in a timely manner, i.e. information detailing what the contractor is to build to, as the details might differ from the tender and contract issues. The responsibility for their issue depends on the procurement route and who appoints the consultants to produce the information. In general, under a traditionally procured project, information is supplied from the client's consultants, and with a design and build project, the contractor's design manager will source the information from consultants appointed by the contractor. With design and build contracts, consultants who

provided an initial design for a client may have their design and/or services *novated* (which in general means 'transferred') to the contractor. When this occurs, the design manager 'marks up' the initial design to reflect the contractor's proposals for the final building which is then issued to the contractor's engaged consultants for completion. These consultants may have prepared the initial design for the client and agreed to novate their design and services to the contractor to develop the design. In this situation, the original consultants are retained for the project, albeit under a new agreement with the contractor. Alternatively, the contractor may engage new consultants to complete the design. With a design and build contract, in general, design managers tend to negotiate and appoint consultants where novation takes place because the process can be complex, and leave the responsibility for engaging new or supplementary consultants to the project manager. The project manager will then tender the design works and may take a view that the procurement is part of the quantity surveyor's task and seek suitable input.

The quantity surveyor must be aware of administrative requirements for a project during the pre-commencement period, even if he/she does not have a direct role in all of them, because they can affect the timing for the issue of 'for construction' information that influences the start date on site. Needless to say, a contractor cannot be expected to start works if it does not have the information. If the process is slow and delays a start date, it could prolong the construction period; this must be recognised by the quantity surveyor and where the burden of responsibility for the delay rests. For example, if there is a delay with the supply of information on a design and build contract, it is generally a contractor's responsibility. However, if negotiations are not concluded associated with, for example, the Party Wall Act and adjoining neighbours, it is generally a client's responsibility. A team approach will help to identify any of these matters to ensure the project gets off to a good start.

4.5.1 Cash flow

As with any business, a contractor requires an expenditure report to demonstrate the movement of cash (or bank deposits) as a business activity statement showing income, expense and profit during a defined period. For a construction project, this information is collated by the quantity surveyor in a cash flow report produced at various times during the construction period. The report shows the status of payments received from the client, payments made to the contractor's supply chain and the margin retained by the contractor. Cash flow reporting has the following benefits to a contractor:

- It evaluates the amount and timing of income in order to pay creditors
- It aids the process of understanding a rate of return and whether a project is running to programme, i.e. the timing of income received compared to that envisaged in the programme
- It determines any problems with the liquidity of the business

- It is a measure of received business profits that can be used for purchasing assets and paying loans
- It is a measure to evaluate risks, i.e. if income generated is sufficient
- It aids advanced planning for any financial draw down from reserves or loans to fund a project.

A favourable cash flow is positive, i.e. income received exceeds outgoings with the difference being the contractor's security as a contribution to off-site overheads and profit. Cash flow becomes negative when income is less than expenditure. This can be due to late payments which can put a strain on a business as it may then need to rely on a loan to remain solvent. However, negative cash flow can be used by the type of business accustomed to spending capital over a defined period before it receives any income. Planned negative cash flow occurs with developers who purchase land and then engage and pay contractors to carry out building works. Income is earned after completion stages when purchasers occupy or lease new buildings. When this applies, developers usually express the negative cash flow as capital expense because it represents a loss of interest on reserves it would generate as income from bank interest. Contractors, however, often work to competitive margins and require income each month that must exceed outgoings for the business to remain solvent, making it financially positive at all times. Contractors generally consider positive cash flow as a 'king' over profit. This is because the value and duration of projects undertaken may be in excess of a contractor's annual turnover when a contractor cannot financially underpin a project with a loan because of the risk of late payments.

At the beginning of a project, it is necessary for a contractor to forecast its monthly income and expense in line with the construction programme. This can be achieved by breaking down the contract sum and assessing a value of works that will be completed each month the project is running that can be claimed for payment. An example is shown in Table 4.2. In this example, a project is to be constructed over six months valued at £3m including a £273,000 margin and payments will be received by the contractor at the end of each month. The payment due each month is ascertained by calculating a percentage of each trade that will be completed for every month of the project which is obtained from the construction programme. To this amount, a pro rata sum is added for the margin to produce an amount due. These monthly payments permit the contractor to positively cash flow a project and be in a better position to pay its supply chain and retain a margin.

Table 4.2 is an estimated value of works used as the base for demonstrating cash flow in a chart which can be produced from either construction industry software or the Microsoft suite. The basis for creating a chart is to plot a suitably scaled horizontal 'X' and vertical 'Y' axis and insert financial information in a spreadsheet designed to drive the information on each axis. The information for the project in Table 4.2 is demonstrated as a chart in Table 4.3 that creates an 'S' curve. The contractor's margin is the difference between the broken line representing the Contractor's Income and the solid line representing the

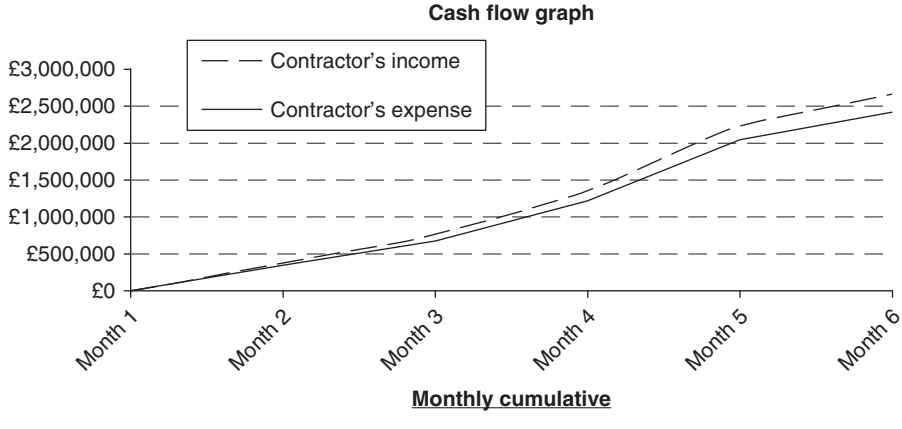
Table 4.2

Project cash flow								
Description	*Sum*	**Month number and envisaged status of completed works**						
		Allocation	*1*	*2*	*3*	*4*	*5*	*6*
Substructure	£138,000	**100%**	50%	25%	25%	–	–	–
Columns	£27,000	**100%**	–	100%	–	–	–	–
Upper floors	£207,000	**100%**	–	25%	40%	35%	–	–
Staircases	£21,000	**100%**	–	100%	–	–	–	–
Roof structure	£69,000	**100%**	–	–	50%	50%	–	–
Roof finishes	£28,000	**100%**	–	–	–	100%	–	–
External walls	£167,000	**100%**	–	25%	25%	25%	25%	–
Windows	£108,000	**100%**	–	80%	10%	10%	–	–
External doors	£15,000	**100%**	–	100%	–	–	–	–
Internal walls	£15,000	**100%**	–	–	80%	20%	–	–
Internal screens	£48,000	**100%**	–	–	25%	75%	–	–
Internal doors	£41,000	**100%**	–	–	–	50%	50%	–
Wall finishes	£83,000	**100%**	–	–	25%	25%	25%	25%
Floor finishes	£108,000	**100%**	–	–	25%	25%	25%	25%
Ceiling finishes	£87,000	**100%**	–	–	–	40%	30%	30%
Fitments	£231,000	**100%**	–	–	25%	50%	12%	13%

Sanitary fixtures/plumbing	£174,000	**100%**	–	–	25%	50%	12%	13%
Water and gas supply	£39,000	**100%**	–	–	25%	50%	12%	13%
Gas and electric heating	£153,000	**100%**	–	–	25%	50%	12%	13%
Fire protection services	£18,000	**100%**	–	–	25%	50%	25%	–
Mechanical and ventilation	£135,000	**100%**	–	–	25%	50%	–	25%
Electrical power and lighting	£111,000	**100%**	–	50%	–	50%	–	–
Builders work with services	£21,000	**100%**	–	–	–	–	50%	50%
Site preparation and clearance	£35,000	**100%**	100%	–	–	–	–	–
Paved and hard surfaces	£68,000	**100%**	–	–	–	–	80%	20%
Boundary fences and walls	£28,000	**100%**	10%	–	–	–	90%	–
Soft and hard landscaping	£28,000	**100%**	–	–	–	–	–	100%
External services and connections	£52,000	**100%**	–	–	10%	90%	–	–
Roads and external drainage	£45,000	**100%**	90%	–	–	–	–	10%
Design fees	£190,000	**100%**	80%	–	–	–	10%	10%
Preliminaries	£237,000	**100%**	20%	20%	15%	15%	15%	15%
Contractor's margin	£273,000	**100%**	12%	12%	23%	23%	15%	15%
TOTAL	**£3,000,000**							

Table 4.3

PROJECT CASH FLOW			
Envisaged cash flow			
	Value	Cash receipt	Cumulative
Month 1	£380,000	£0	£0
Month 2	£360,000	£380,000	£380,000
Month 3	£600,000	£360,000	£740,000
Month 4	£910,000	£600,000	£1,340,000
Month 5	£410,000	£910,000	£2,250,000
Month 6	£340,000	£410,000	£2,660,000
Month 7	£0	£340,000	£3,000,000
Contract sum	**£3,000,000**	**£3,000,000**	



Contractor's Expense, which is clearly shown. The contractor is usually one month behind with the value of works because of credit terms with one month being usual with a construction contract. The information on a chart is normally issued to the contractor's financial controller who may be an accountant and will possibly use the information for financial arrangements for draw down purposes to pay creditors, including lenders. The creation of templates shown in Tables 4.2 and 4.3 during the pre-commencement period can be used to assess cash flow and can be updated during the construction phase. For this

reason, it serves a purpose if the quantity surveyor prepares these management tools as early as possible and ideally before the works commence.

In the absence of a construction programme, it may be possible to produce a cash flow chart using a general rule of thumb when the project value, contract period and contractor's margin are known. Construction projects will usually produce an 'S' curve on a cash flow chart and a theoretical rule of thumb to produce this is based on the following:

- ¼ of the cost of a project will be incurred during the first third of the contract period;
- ½ of the cost of a project will be incurred during the second third of the contract period; and
- ¼ of the cost of a project will be incurred in the last third of the contract period.

If a cash flow chart does not resemble an 'S' curve there is usually something wrong with the input and the data should be verified.

Once a project commences, it will be necessary to monitor income and expenditure regularly and relevant information given to the contractor's financial controller. This is because cash flow will be influenced by the rate of progress which may be different from the initial programme. When updating information, income and expenditure incurred is used as a base in conjunction with works yet to go in order to reassess cash flow predictions for the remainder of the project. For example, Table 4.2 shows the roof finishes as 100% complete during month 4 on the initial programme. If these works are complete by month 3, it will mean the contractor can claim and be paid 100% of the roof one month early. This in effect increases the cash flow amount for month 3 and conversely reduces the same amount for month 4. It can be seen, therefore, that changes to construction activities seriously influence the periodic rate of cash flow.

4.5.2 Cost targets

Cost targets are an assessed sum a contractor can afford to pay for trade works so that expenditure does not exceed the amount payable to the contractor and are usually assessed in a range of 70–90% of the maximum allowance. This is to ensure the contractor has adequate contingencies to cover risk for items such as material wastage and factors associated with trades procured with separate labour-only and material packages. Cost targets usually apply when the labour-only component of a trade is not tendered and the targets are used for negotiations with labour-only contractors by the site and project managers responsible for their appointment. These managers play an active role with labour-only procurement because they usually possess general knowledge with regards to labour resources available in the locality of the project under construction. They may also possess knowledge of existing projects run by a

Table 4.4

Bill Nr 6 Brick and block walling								
Description	***Quant***	***Labour***	***Plant***	***Materials***	***S/contract***	***Total***	***Factor***	***Target Rate***
a. Block walls, 100 mm thick	**950 m²**	**25.00**	**3.00**	**30.00**	**0**	**£58.00 m²**	**85%**	**£49.30 m²**
b. Form cavity 50 mm wide incl ties	**510 m²**	**3.00**	**0**	**2.00**	**0**	**£5.00 m²**	**85%**	**£4.25 m²**
c. Partial cavity fill rigid insulation	**510 m²**	**10.00**	**0**	**10.00**	**0**	**£20.00 m²**	**85%**	**£17.00 m²**
d. Proprietary lintels 200 × 150 mm	**56 m**	**35.00**	**0**	**65.00**	**0**	**£100.00 m**	**85%**	**£85.00 m**
e. Proprietary lintels 200 × 250 mm	**16 m**	**40.00**	**0**	**100.00**	**0**	**£140.00 m**	**85%**	**£119.00 m**
f. DPC horizontal cavity tray	**28 m²**	**20.00**	**0**	**55.00**	**0**	**£75.00 m²**	**85%**	**£63.75 m²**
g. Adjustable stop ends to DPC	**72 nr**	**5.00**	**0**	**2.50**	**0**	**£7.50 each**	**85%**	**£6.38 each**

Block walls, 100 mm thick	- Labour contingency allowed in the rate,	10% (10/110 × 25.00)	**£2.27 m²**
	- Plant contingency allowed in the rate -	allowed in preliminaries	**£0**
	- Materials wastage allowed in the rate,	15% (15/115 × 30.00)	**£3.91 m²**
			£6.18 m²/ £55.00 = 11.2%
Form cavity 50 mm wide incl ties	- Labour contingency allowed in the rate,	10% (10/110 × 3.00)	**£0.27 m²**
	- Plant contingency allowed in the rate,	not applicable	**£0**
	- Materials wastage allowed in the rate,	15% (15/115 × 2.00)	**£0.26 m²**
			£0.53 m²/ £5.00 = 10.6%
Partial cavity fill rigid insulation	- Labour contingency allowed in the rate,	10% (10/110 × 10.00)	**£0.91 m²**
	- Plant contingency allowed in the rate,	not applicable	**£0**
	- Materials wastage allowed in the rate,	20% (20/120 × 10.00)	**£1.67 m²**
			£2.58 m²/ £20.00 = 12.9%

Etc…

In this example, the maximum a contractor should target to pay for the brick and block walling trade is 87.1–89.4% of the unit rate depending on the component of the trade. To simplify this, the factor is set at 85% to err on the safe side. With this factor, the contractor has a risk allowance of 15% that places the construction operations in a marginally better position to complete the works than the contract allowance.

contractor and the availability of labour and are in the position to negotiate fair prices to attract a workforce at short notice.

Cost targets are created by the quantity surveyor or estimator who may include them with the pre-construction handover documents. They are obtained from quantities in a bill of quantities charged at affordable rates. These targets usually apply to trades such as brick and block laying, concrete pouring and carpentry where a contractor can provide adequate supervision and has suitable labour resources available to service a project. To assess an affordable rate, the unit rate payable to a contractor in a bill of quantities is divided into components, i.e. labour, plant, materials, and subcontractor charges if these apply. Each component has its risk contingency identified which is expressed as a percentage of the unit rate. The maximum a contractor can afford to pay as a cost target is the unit rate less the contingency allowance because anything more could mean the contractor operates at a loss. Table 4.4 demonstrates the assessment of a cost target in tabular form when the quantity surveyor wishes to cost target a labour price for the block laying trade.

From the information provided in Table 4.4, it can be seen that a rate of £58.00 m^2 will be paid to the contractor for the block wall construction. Of this amount, £25.00 m^2 is for the cost of labour for which the quantity surveyor sets a cost target rate of £21.25 m^2 allowing for contractor's risk. The cost target is therefore:

950 m^2@ £21.25 m^2 = £20,188.00

Once assessed, each cost target is relayed to the project and site managers for reference when sourcing labour-only subcontractors and sets the basis to discuss prices. The cost targets for the materials and plant components of a trade are for information only and the quantity surveyor will procure the goods and equipment at agreed prices with suppliers and hire companies.

When cost targets for labour-only works are considerable amounts as shown in this example, it is prudent for the site or project manager to negotiate a rate only to a maximum amount. This is because the same labour-only subcontractors might not both start and complete the works because the works involve many block laying gangs so it would be wise to pay for works progressively at an agreed rate. Some of the advantages of cost targets are that they:

- Identify affordable expense to avoid over-expenditure by the contractor
- Are a useful monitoring tool to aid the financial management of resources for a project
- Allow a degree of flexibility for payable rates
- Allow site management to plan the work as the labour force becomes available
- Act as a guide for providing incentives, bonuses and disincentives for late completion
- Permit labour-only subcontractors to be aware of a contractor's culture and working practices.

The quantity surveyor normally issues cost targets to a site manager before the site is established, as it then sets the basis for procuring trades early. The issue of cost targets entrusts a site manager with a degree of commercial awareness with labour-only appointments and provides a positive working culture. Furthermore, it permits a site manager to have an input into commercial activities which are normally reliant on the quantity surveyor and project manager.

4.5.3 Procurement scheduling

Procurement is a generic word used to describe the method of obtaining something. For a contractor tasked with the responsibility of constructing and delivering a project, it refers to the methods adopted for the appointment of subcontractors, material suppliers and plant hire companies needed to carry out the works. It may also include the appointment of consultants where the contractor is responsible for design and supplementary services that involves consultants who provide designs, reports and advice on matters relevant to a project. Procurement is usually initiated by the quantity surveyor with the final decision on selection resting with the project manager. However, the contract may name or nominate certain suppliers or subcontractors who must receive awards from the contractor because, if they don't, the contractor will be in breach of contract. A project can warrant scores of procurement awards depending on the value and complexity of a scheme. Because of the number of suppliers and service providers to be engaged, the contractor needs to keep track of procurement activity. This is made possible with a letting schedule, a document that schedules major trade and material suppliers and consultant appointments where required in a logical format. Alternatively, consultants may be outsourced by a design or project manager and their inclusion on the letting schedule is optional.

A letting schedule breaks down major trade works into a list of works requiring awards. This can involve procuring one or a number of awards for each trade on a bill of quantities. For example, if a project has a requirement to build a structure on a green field (or virgin site), the excavations and filling bill will include an item for stripping back topsoil and depositing it in heaps on site for later reuse. The programme for this operation may state the following:

Subcontractor 1 – Slash and remove overgrowth to the whole site
Subcontractor 2 – Strip topsoil within new road areas and deposit on site
Subcontractor 3 – Strip topsoil to any remaining area and deposit on site

From this example, it can be seen that a trade bill description can be split into a number of procurement awards involving more than one subcontractor. This is because (as in this example) overgrowth removal may be carried out by a landscape contractor who does not possess mechanical plant to strip the topsoil.

Stripping of topsoil to road areas could be carried out by a civil engineering contractor who will also construct the roads, with the balance carried out by an earthworks contractor who will excavate the foundation trenches for the building.

The construction programme describes a sequence of works and is a good starting point for the quantity surveyor to identify the trade works for a project. A well-prepared programme will also state timing for appointments to ensure subcontractors and suppliers are engaged before works commence. However, a programme is not a procurement tool and only assists to identify scope and the timing of operations which should be tracked on the letting schedule. Ideally, trade descriptions on the letting schedule should resemble the project manager's preferred procurement route and include those trades to be split as separate labour-only and material supply awards if known. For example, the concrete trade on a project may involve formwork, steel reinforcement, poured in situ and precast concrete which can involve a number of subcontractors or suppliers to carry out the works. Awards may also be referred to as trade packages, although this phrase usually refers to the placement of subcontract awards and not the supply of materials only. Where the division of trade procurement is unknown or a programme is unavailable, the quantity surveyor should use the bill of quantities as a starting point. If a bill of quantities is unavailable, the form of tender may provide a trade breakdown that also drives the contract sum. A letting schedule should be considered a flexible management tool because procurement selection may alter from time to time during the construction phase. A reason for this is because trade availability could fluctuate or domestic subcontractors' quotations might exceed the budget which means the contractor may have to alter plans in order to preserve the budget. The format of a letting schedule for a new build project is shown in part on Table 4.5.

From Table 4.5, it can be seen that a part of the schedule is preserved to distinguish items procured by either the builder or client. The inclusion of this item is discretional and of use where the client is responsible for the placement of awards excluded from the contract with the contractor. In general, the contractor has a responsibility to supervise and deliver a scheme on time and it would be wise to include both client and contractor's procurement responsibilities in the schedule for issue to the client as advice. However, because the letting schedule is not a contractual document, a client may consider it a best practice guide only and not feel compelled to adhere to the recommended dates. Alongside each trade listing is a start date obtained from the construction programme. Prior to a stated start date, it is necessary to consider lead time. This is the time required to permit mobilisation to site (in the case of plant) as well as the organisation of a labour force, material supplies, product manufacturing times and delivery periods required. To understand this concept, it is necessary to appreciate the sequence of construction activities and follow an order of precedence for the project requirements that will vary with each trade. For example, at the beginning of a new build project the floor finishes package would not usually be awarded, as this work will be required later in the

Table 4.5

Project: **Letting schedule**

Date of last update:

Commencement Date:

Date of Practical Completion:

TRADE Bill Nr	TRADE PACKAGE Works Description	PROCUREMENT B (Builder) C (Client)	START DATE ON SITE	LEAD TIME (Calender days)	TARGET AWARD DATE*	ACTUAL AWARD DATE
	Remove overgrowth	B				
	Topsoil strip - roads	B				
	Topsoil strip - buildings	B				
	Site establishment	B				
	Project sign board	C				
	Excavations - Building	B				
	Concrete works	B				

***=Start Date On Site LESS Lead Time**

programme. In order to prioritise lead time towards the issue of awards, answers to the following questions may aid decisions:

- What early trades are required and when are they to start on site?
- Is there a design and specification available for the early trades to work to?
- If there is no design/specification supplied for the later trades, when will they become available?
- Is the final colour/product selection available for the materials?
- If it is not possible to place a fixed price award because of lack of design, will a schedule of rates be suitable and acceptable?
- Are there any samples that need approving before placing an award?
- Are there any products to be sourced overseas with long delivery periods?
- Are there any materials that are purpose-made and on long delivery periods?
- Which trades have long lead times because they provide design input and need to coordinate with the contractor?
- Are the names of any subcontractors written into the contract that must have an award placing by a certain date as part of the main contractor's agreement?

Lead times are for the benefit of material suppliers and subcontractors and is an assessment of the duration (in days) required before the start date and a latest date by which an award must be placed. Because the duration is an estimate, the self-calculating award date should be seen as a target date. The quantity surveyor must be aware that any material supplier/subcontractor is not bound to process materials, gather a workforce or arrange for the delivery of plant until they are in receipt of an award from the contractor. This factor must be considered in the lead time assessment. Say, for example, a programme states a start date for the removal of site overgrowth on 1 June and the quantity surveyor consults a subcontractor and site/project managers and concludes that 14 days is a suitable lead time. The target award date is therefore calculated as:

Start date on site :

1 June Less lead time of 14 days = Target award date by 17 May

For flexibility, lead times may be on the cautious side which is to be commended as it safeguards any delay in the process. Prior to the target award date, the quantity surveyor will need to set procurement motions in place for the contractor's benefit and make due allowance for time which can be included in the lead time. This includes:

- The number of suppliers/subcontractor available who will price the work
- The negotiation time required to agree a price for the works
- The contractor's vetting process of subcontractors and suppliers
- The length of time it will take to process and execute an agreement.

Once each award is made, it needs to be logged on the schedule to demonstrate the matter as concluded. A golden rule for the quantity surveyor and project team is to ensure no trades are overlooked as it would cause embarrassment to a project team if a trade award were missed and this only became apparent when there is a need on site.

Early works and procurement scheduling

Certain trade works, e.g. demolition or bulk earthworks, may be required on site before the contractor has a site presence. If a project falls under the rules of the CDM Regulations 2007, a principal contractor must be appointed to oversee the working operations. This may present the contractor with a problem if it cannot create a site presence because an existing building requires demolishing or the ground needs levelling beforehand. To comply with the CDM Regulations 2007, an applicable project must be registered with the HSE naming the principal contractor which must be approved prior to any works starting. This is carried out by filling in an F10 Form, which can be completed in ink or on line on the HSE UK Government website and issuing it to a local HSE office. A main contractor cannot complete and submit an F10 form, accept the role of principal contractor and then assign the duties to a subcontractor if it elects not to or cannot have a site presence to oversee the works. Here, a selected early works subcontractor must make an application to the HSE on an F10 form and, once approved, accept the role of principal contractor whilst works are in progress. If more than one subcontractor is to carry out works before the main contractor's presence, only one will be requested to register for the role of principal contractor and provide the duties. Where this applies, the quantity surveyor must ensure awards are issued in a timely manner and include a condition that the selected subcontractor tasked with providing the duties of a principal contractor issues proof from the HSE. Once works are complete and the main contractor is satisfied the subcontractor has completed its duties, the main contractor establishes the site and acquires the role of principal contractor with the subcontractor's duties as principal contractor discharged.

Once the site clearance works are complete and the main contractor acquires the role of principal contractor, the creation of a site presence commences. This usually involves a field surveyor who sets out the site accommodation and subcontractors to carry out essential works including:

- Electricians to wire for power to the accommodation
- Plumbers to provide pipework for a water supply and drainage system to the accommodation
- Earthworks contractors to provide foundation bases, service and drainage trenches, paved areas and haulage roads for access and hardstand areas for the storage of materials.

The requirement to place awards for these works puts the quantity surveyor in a precarious position because the only awards requiring issue on a letting

schedule at this time may be for demolition works or other site clearance operations. There is light at the end of the tunnel here, as contractors could have working relationships with domestic subcontractors that are aware of a contractor's position during the early stages. Here, appropriate subcontractors may submit quotations for a project manager or quantity surveyor to authorise as a minor works contract. Alternatively, they may be engaged based upon a schedule of rates where completed works are measured, quantified and valued by the quantity surveyor or reimbursed as daywork. These subcontractors may also have priced the contract works at tender stage for the contractor's estimator and provided separate quotations or a schedule of rates for the site establishment. These quotations/schedules would usually be included in the handover file provided by the estimator prior to the works commencing. When placing awards for site establishment works, it does not automatically mean each subcontractor will be awarded the contract works, which an experienced subcontractor will understand. If the contractor is a new client to a subcontractor that carries out early works, a well-performed site establishment will certainly provide an indication to performance and their offer for the contract works should be seriously considered.

4.5.4 Material supply and plant hire registers

Once procurement methods are identified, they will probably include trades to be procured with labour-only subcontractors and material purchases by the contractor, and this triggers a level of responsibility for the contractor to award orders for the timely delivery of materials. Contractors vary in their approach and the delegation of duties for the placement of material supply orders which depends on the size of the project and company policy. Materials purchased by the contractor might include steel bar reinforcement, concrete, bricks and blocks, where cost management and surety of competitive prices are required for which the quantity surveyor is deemed competent. The contractor may also purchase materials for the contractor's preliminaries to be installed by site operatives.

When placing material supply orders, some products may be ordered in bulk on a master order. Bulk orders are single purchase orders for materials issued to individual suppliers for a given quantity of materials. Once an order is placed, materials are supplied and delivered to site over a defined period in accordance with the sequence of works, e.g. 100 tonnes of steel bar reinforcement in a number of consignments to a maximum of 100 tonnes. When this arrangement applies, a register for each material is required that ideally is created at the pre-commencement stage by the quantity surveyor. In general, material supply registers are created as electronic spreadsheets and stored in the project file on the contractor's server. The information they provide lists the supplier's name(s), description of goods, quantity, date of each call off, delivery date(s), docket or delivery note number(s), quantity delivered and whereabouts of the

building the materials are for. They are usually managed by the site manager or foremen making the call off from the master order.

A similar register needs to be created for any items of hired plant, recording the name of the hire company, item(s) hired as well as commencement and off hire dates with note of any date(s) when mechanical plant is idle. It is important to note dates of idle plant because a hire company might need to supply replacement parts and could charge for ongoing hire whilst the plant is idle and of no use to the contractor with the hire company responsible for maintenance. The register should also record the quantity and dates of hiring skips that hold waste and the dates they are removed from site because charges are usually per skip and include hire for a limited period as well as delivery and collection charges and waste disposal fees.

The quantity surveyor is not usually responsible for updating the registers; this is usually carried out by site management who schedule material deliveries and requests for plant whilst a project is running. However, it is important to ensure these registers are created as early as possible as they form a part of project administration for recording and monitoring and the details may need to be referred to by the quantity surveyor whilst the project is under construction.

4.5.5 Document distribution and registers

A document register is a record created by a contractor that displays the title of each design drawing and document prepared by consultants for a project. Generally, the register states the title of each, reference number, revision, date of revision and distribution list. Optionally, it may also include the date a contractor receives a document consignment. The register is usually created by the quantity surveyor and is a replica of the document transmittal notice issued by the document controller to the contractor. Under a traditionally procured project, the document controller is usually the client's agent and contract administrator. With a design and build contract, the responsibility of document control rests with the contractor and the document transmittal notice is usually prepared by the design manager who coordinates the design with consultants.

When new information becomes available or existing is revised and issued to the contractor, the document register is updated to clearly demonstrate the current working information. The contractor then has a responsibility to distribute the information to the appropriate supply chain members to ensure they receive the current details. The issue of the information to each supply chain member should be accompanied by a copy of the document register to clearly show the contents of the consignment. Characteristics of a document register include:

- It must resemble the issue of the document transmittal notice prepared by the document controller
- It reflects the latest 'for construction' information

- It is evidence of amendments that trigger a variation or a claim from the contractor
- It is used as a formal issue to subcontractors as a record of the consignment.

A project may possibly involve hundreds of drawings and scores of specifications and, for effective project administration, the contractor must include a system of document control in the event of a dispute or there being confusion with the working documents. A document register must show each discipline, i.e. architectural, civil engineering, etc. and be logical in format. From a quantity surveyor's viewpoint, the register should state the contract revisions even though they are not working documents and it is normal practice to include this information for reference. The register should be partitioned to distinguish contract revision issues from 'for construction' issues. It should also show current revisions in bold or highlighted in colour to ensure the contractor's personnel, suppliers and subcontractors understand which documents are the current issues and the ones they are to work to. Emboldening or colour highlighting the contract issue is not a good idea as this might give the impression it is a drawing or specification that takes precedent with the construction process, which of course it does not. Table 4.6 shows a part sample of a document register created from computer software that would serve the purpose.

A duty of care is required with the creation of this document when the contractor undertakes a design and build project. This is because a number of drawings and specifications could be undergoing design and documentation development and must not be released to the project team until they are suitable 'for construction'. To aid this, design managers might keep their own register which is not issued to the project team. When the design and specifications are suitable for construction purposes, they are issued to the project team with a document transmittal and usually the quantity surveyor will update the document register on behalf of the project team.

4.5.6 Progress claim scheduling

Rarely will a contractor be paid a single payment upon completion of the works unless the works start and complete within one month when payment can be made under a monthly credit term arrangement. In general, construction contracts make provisions for progressive payments until the agreed sum is paid to comply with the requirements of the Housing Grants, Construction and Regeneration Act 1996. This Act is omnibus legislation that addresses a number of issues associated with housing grants for the private sector, amendments to law in relation to construction contracts and regeneration schemes involving grants for development and relocation. Part II of the Act entitled Construction Contracts is widely referred to as the Construction Act, and

Table 4.6

Document Register											
Project title:			Project Nr:								
			Day	01	05	10	15				
Project address:			Month	05	05	05	05				
			Year								
Distribution: 1. 2. 3.			Discipline: ARCHITECTURAL								
Drawing title	***Drawing Nr***	***Current***	***Contract***	***For construction***							
Site plan	A100	**A**	A	**A**							
Ground floor plan	A101	**B**	A	A	**B**						
First floor plan	A102	**C**	A	A	B	**C**					
Document title	***Document Nr***										
Architectural specification	AS100	**2**	1	1			**2**				

Section 110 (1) relating to construction contract reform states that every construction contract shall:

(a) provide an adequate mechanism for determining what payments become due under the contract and when, and
(b) provide for a final date for payment in relation to any sum that becomes due.

Building contracts are generally worded to comply with the Construction Act and subsequent changes in legislation changing parts of the Act. Because of this, a contractor will normally seek interim payments for works in progress which is usually on a monthly basis known as 'on account' payments. This broadly means that payments are issued in a timely manner until the agreement of a final account. When a contract is a lump sum price, it requires breaking down in accordance with the agreement for progress claim purposes, and is usually in a form appended to the contract. If a contract is silent on the breakdown by only stating a contract sum and the client's commitment to issue timely payments, the contractor is at a disadvantage because there is no agreement for assessing the works for payment. Where this happens, it is important during the pre-commencement stage that the quantity surveyor provides the client's agent with a proposed detailed breakdown known as a progress claim schedule. This is to show clearly how progress claims for interim payments will be submitted. It will also be necessary to ask who the progress claims are to be submitted to. This is usually the client's quantity surveyor (PQS) or other as advised by the client's agent who has a responsibility to assess the value of works for payment purposes. When a bill of quantities is part of a contract, the progress claim schedule should be formatted to suit the trade bills arrangement. This is because a PQS will assess each progress claim from the bill which is a common document for the project that the parties are bound to. The contractor's quantity surveyor must not divert from this requirement by creating an alternative format using building elements such as floors, walls, etc as the PQS may reject it. Table 4.7 demonstrates a progress claim schedule that could be submitted for approval where a bill of quantities is a contractual document and demonstrates contract clauses that entitle the contractor to payment.

When a bill of quantities is not part of a contract, the breakdown should be logical and the contractor normally drives the choice. Ideally, the format should be similar to that shown in Table 4.7 as though a bill of quantities is part of a contract. This can be created by referring to a builder's bill or other method of breaking down the costs created during the tender period, such as a tender sum priced schedule. Key factors to consider when creating a progress claim schedule include:

- The total of the trade bills, preliminaries and margin must not exceed the contract sum
- Provisional Sums and PC Sums must be recognised as part of the contract sum where applicable

Table 4.7

Progress Claim Schedule

Project nr:
Project title:
Commencement date:
Date of Practical completion:
Client:
Date of issue of Interim Certificate, (Clause 3.1): 25th
This progress claim nr: Date:

				A		B		A–B
BOQ Collection page	**Trade**	**Contract Sum**	**%**	**Cumulative progress claim**	**%**	**Less previous progress claim(s)**	**%**	**This progress claim**
	Site clearance							
	Excavating and filling							
	In situ concrete - Concrete							
	In situ concrete - Formwork							
	In situ concrete - Reinforcement							
	Brick and block walling							
	Carpentry first fixing and roofing							
	Roof tiling							
	Plasterboard linings							
	Windows and external doors							
	Internal doors							

	Fitments							
	Door ironmongery							
	Rendered surfaces							
	Ceramic tiling							
	Carpets							
	Painting							
	Furniture and equipment							
	Sanitary fixtures							
	Fire protection services							
	Paving, planting and fencing							
	Rainwater disposal systems							
	Sewerage disposal							
	Pipe supply systems							
	Air conditioning							
	Electrical power and lighting							
	Peliminaries							
	Margin							

(continued)

Table 4.7 *(cont'd)*

BOQ Collection page	Trade	Contract Sum	%	Cumulative progress claim	%	Less previous progress claim(s)	%	This progress claim
Clause 5.1	**Total (Excluding Value Added Tax)**	£		£		£		£
	Other payment clauses							
Clause 5.2	Construction Industry Scheme							
Clause 5.3	Advanced payment							
Clause 5.4	On site stored materials							
Clause 5.5	Interest in percentage withheld							
Clause 5.6	Contractor's right of suspension							
Clause 5.7	Off site stored materials							
Clause 5.8	Adjustment of the contract sum - Variations							
Clause 5.9	Fluctuations - Deleted, Fixed price applies	Not applicable		**0**		**0**		**0**
Clause 5.10	Loss and Expense							
Clause 5.11	Relevent Matters							
Clause 5.12	Retention - Deleted, Bank Guarantee in lieu	Not applicable		**0**		**0**		**0**
Clause 5.13	Value Added Tax			£		£		£
	Total (Including Value Added Tax)	£		£		£		£

- Clauses must be specific to the contract and project
- The date of interim payment certificates must be noted, usually obtainable from the contract.

A characteristic of traditional procurement is that payments are usually assessed monthly. With a design and build project, however, the contract may include a schedule of the works as milestones of physical completion for payment purposes irrespective of time, known as Activity Schedules. Where applicable, Activity Schedules are defined in the contract schedule with a price for each, e.g. design fees, substructure, roof, etc, the total sum of which must equal the contract sum. A disadvantage of this system for the contractor is that the schedule might not permit the part payment of a milestone when part complete, with entitlement to payment only possible when each activity is complete when it becomes a stage payment. If the quantity surveyor is involved with a design and build contract where stage payments apply, creating the progress claim schedule simply means preparing a schedule from the Activity Schedule in the contract. The stage payment procedure might appear draconian from a contractor's perspective as months could pass without payment, placing stress on cash flow. For this reason, a contract may include provisions stating a contractor will be paid a proportion of the works on an Activity Schedule if the same proportions of works are complete. Alternatively, the contract may stipulate monthly payments in lieu. When payments are by time, the format of the progress claim is usually at the contractor's discretion which may be by trade as shown in Table 4.7 or by breaking down the contract sum into elements as Activity Schedules and submitting the information to the client's agent for approval.

With design and build projects there is no contract bill of quantities and the PQS is absent, and the contractor will submit progress claims to the client or client's agent. However, because these projects vary in size and complexity, the client/client's agent could elect to appoint a PQS to act on its behalf to assess the value of works in progress for payment purposes and instruct the contractor to submit progress claims to the PQS.

4.5.7 Cost management systems (CMS)

Once a contractor has initiated a project, the financial controller sets up a computer databse and assigns the project a job or project number. This sets the basis for financial control and a method of recording project expenditure which is possible with a cost management system (CMS). The type and style of CMS used by a contractor varies between businesses and is influenced by the company's financial turnover, number of staff employed, value of projects undertaken, frequency of use and amount of detailed information it is to provide. Characteristics of an effective CMS include:

- Logical coding that is a clear definition of each description of work
- It is easily serviceable

- It is reliable to self run and able to produce a variety of reports
- Processing times are rapid without problems involving computer memory capability
- Operating manuals are available from software writers
- Training for use of the system is available through workshops
- The system identifies financial project risk
- Methods are available for accessing data in relation to subcontractors, suppliers and project activity
- Data produced is environmentally friendly, i.e. has paperless options
- There is back-up support for dealing with technical problems.

The quantity surveyor is not usually responsible for selecting a project number or creating project information and relies on the advice of the financial controller who will say when the project is 'live' and accessible on the CMS. Once it is activated, the quantity surveyor is usually responsible for setting parameters of the project budget into the system. The first task is to enter trade budgets against cost codes. Having a cost code structure creates a system where codes abbreviate word descriptions that may be too long to produce on reports. Coding is usually a mixture of numbers and letters and is written into a database by a software provider. For example, a primary code may be prefixed with 'A' as an abbreviation for the substructure. Under this primary code, a series of sub-codes can be used, e.g. 'A100' might be a code for excavating and filling. This could be followed by a series of secondary codes to the sub-code, e.g. 'A100-1' represents trade work descriptions falling under the category of excavating and filling. The sum of all budgets entered into each sub-code must equal the primary code, thus for 'A100', a total budget will be set for the excavations and filling when all secondary code entries are entered. The codes then repeat for each trade, i.e. 'A200 – Concrete', 'A300' – Steel reinforcement', etc so all sub-codes prefixed with the letter 'A' are the composition of the substructure element. This process then continues with other elements that make up the project budget.

When setting a budget, the coding structure may have been pre-set by the estimator. However, this may have been done on separate software designed specifically for estimating that does not form part of the CMS, and the quantity surveyor will need to manually input budgets. It requires noting here that coding is a database for use on any project a contractor may undertake and listings may not be suitable for every project. The use of selected codes should suit the method of procuring each trade and considered suitable for managing once a project is running. To demonstrate, Table 4.8 shows options for budget entry for the excavating and filling works.

The estimator's allowances against the codes are inserted into Option 1. If selecting Option 2, the approach is streamlined to produce fewer codes that closely resemble the procurement selection. This option is effective because it will aid the payment process to the supply chain which will have fewer codes than used for Option 1.

Table 4.8

Project Nr: 1888			
CMS Code series:	**Budget - A100 - Excavations and filling**		
Cost centre	***Standard Description***	***OPTION 1 input***	***OPTION 2 input***
A100-1	Remove overgrowth	£2,000	£0
A100-2	Topsoil strip	£5,000	£ 7,000
A100-3	Ground excavations to 1m deep	£5,000	£0
A100-4	Ground excavations over 1m deep	£10,000	£15,000
A100-5	Filling to level to 1m deep	£5,000	£0
A100-6	Filling to level over 1m deep	£5,000	£10,000
A100-7	Basement excavations	£0	£0
A100-8	Detailed trench excavations	£10,000	£18,000
A100-9	Detailed pad excavations	£5,000	£0
A100-10	Detailed lift pit excavations	£3,000	£0
A100-11	Service trenches	£5,000	£5,000
A100-12	Deposit spoil on site	£0	£0
A100-13	Deposit spoil off site	£50,000	£60,000
A100-14	Land fill tax	£10,000	£0
TOTAL	**A100 - Excavating and filling**	**£115,000**	**£115,000**

An important factor to consider is that the sum of the cost codes must equal the contract sum. A well-designed CMS might request the contract sum inputting prior to entering the budgets, which aids the checking process as it ensures the total of all budgets does not exceed the allowance. If the system does not have this facility, a manual check is required to ensure the contract sum is not exceeded.

4.6 Site establishment

The pre-commencement period involves the project team organising the site establishment and the quantity surveyor will need to become familiar with

the general administration arrangement. This is because the quantity surveyor is not responsible for managing all administrative tasks as they are under the control of various project team members. However, because the quantity surveyor is responsible for project and contract administration, he/she must know of the existence and whereabouts of the information as there may be need to access information to resolve matters at any time. A completion check list will aid the project team to ensure administrative matters are implemented and managed and Table 4.9 shows a suitable format. This table is not exhaustive and covers many of the administration requirements included in this chapter. However, it is up to the project team to create a suitable checklist to assist the smooth running of a project to reflect the requirements of the contractor's policy and procedures manual for quality control.

Creating the site establishment is rewarding and gives a sense of achievement for the project team as it means site operations can develop under their direct observation giving them control of the day-to-day running of the project. The completed physical establishment should be comparable with the plan included in the agreement with the contractor because any deviation might incur additional expense which the quantity surveyor must recognise as part of cost management. Hopefully, the site accommodation should be comparable with the agreement and the costs incurred within the realms of expectations. If the layout has changed and increases the anticipated cost, the quantity surveyor will need to understand the reasons and decipher whether it is a contractor's decision. It would be wise to deal with this matter at the earliest stage instead of leaving it until the project is up and running.

4.7 Review of the main contract

A main contract agreement is the documented conclusion of negotiations signed by the parties which sets out the rights, obligations and risks each party confers in a construction project. The contractor's representative executing the contract is usually a director and, once executed, the original is retained by the contractor's head office with a copy issued to the project manager and/or quantity surveyor. In general, the contractor's quantity surveyor is responsible to a project manager for administering the contract and the project manager is responsible for contract administration and delivery of a project on a contractor's behalf to a client. For the contractor, the project manager is responsible for deliverables and the programming of works to ensure the project runs smoothly and delegates the responsibility for administration of the contract to the quantity surveyor. This can be rewarding for the quantity surveyor as a project manager's training background may not be contract administration and he/she will welcome advice on contractual and administrative matters during the construction phase. The quantity surveyor will need to become familiar with the form of contract as well as the existence of contract drawings

Table 4.9

Site establishment administration checklist			
Project title:		*Project Nr:*	
Date of possession of the site:		*Client:*	
Project team: Project manager: Site manager: Structural foreman: Finishing foreman: Quantity surveyor: Quantity surveyor trainee:		Secretary: Leading Hand 1: Leading Hand 2: Site labourer 1: Site labourer 2: Apprentice carpenter:	
Description		**Completed (Y/N)**	**Action**
1.0	**Estimating handover - Issued to the team**:		
1.1	Contract drawings		
1.2	BOQ /Builder's bills		
1.3	Specification issued		
1.4	Main contract		
1.5	Subcontract/supplier quotations		
1.6	Cost plan allowances		
1.7	Contractor's proposals to client		
1.8	Document transmittal receipts		
1.9	Contract negotiations		
1.10	Other - specify		
2.0	**Site planning**		
2.1	Material registers created:		
	i) Bar and mesh reinforcement		
	ii) Concrete		
	iii) Skips		
	iv) Sundry mechanical plant hire		
2.2	Scaffolding plan		

(continued)

2.3	Materials handling plan		
2.4	Crane and hoist location plan		
2.5	Construction programme		
2.6	Waste Management plan		
2.7	Health and Safety file		
2.8	Other - specify		
3.0	**Authorities and Notices**		
3.1	Insurances obtained		
3.2	i) Contractor's 'All Risk'		
3.3	ii) Professional indemnity		
3.4	iii) Other - specify		
3.5	iv) Licenses and permits - specify		
3.6	Bank guarantee obtained		
4.0	**Administration - QS**		
4.1	Cash flow chart created		
4.2	Cost targets set		
4.3	Contract sum entered in CMS		
4.4	Letting schedule created		
4.5	Document distribution register compiled		
4.6	Site drawing racks in place		
4.7	Progress claims scheduled		
4.8	Main contract conditions reviewed		
4.9	Electronic and hard files created		
4.10	'For Construction' documents on site		
5.0	**Administration - Other**		
5.1	Correspondence to/from files (QS/PM/SM)		
	i) Client		
	ii) Consultants		
	iii) Subcontractors and suppliers		

5.2	Books to site		
	i) Site diary and Site Instruction pads		
	ii) Requisition and Dayworks sheet pad		
	iii) OHS and safety induction pads		
	iv) Other - specify		
6.0	**Corporate site notice board erected**		

and documents that drive the contract sum or schedule of rates prior to a start on site. Where the contract is not concluded prior to the start, the Letter of Acceptance or Letter of Intent and draft contract should be reviewed and a check made upon receipt of the executed contract for changes. The quantity surveyor would be wise to spend time before the project commences in understanding the contract and what it means for the contractor, which does not mean memorising the details of clauses, schedules, etc as this is unrealistic. The role warrants the quantity surveyor to acknowledge the existence and importance of the contract form together with understanding the obligations a contractor must comply with and the rights it is entitled to. The contract should not be merely placed in the back of the drawer and temporarily forgotten, because it sets the pathway for administration procedures and provides answers to many questions that may arise during the construction phase of a project.

In the United Kingdom, the most widely used standard form of building contracts are produced by The Joint Contracts Tribunal Limited, abbreviated as JCT. The JCT is the foremost body providing contract forms and comprises of council members with industrial expertise and those with an interest in ownership and investment of the built environment. The JCT is made up of the:

- British Property Federations Limited
- Contractors Legal Grp Limited
- Local Government Association
- National Specialist Contractors Council Limited
- RICS
- RIBA
- Scottish Building Contract Committee Limited.

The RICS has produced a survey entitled *Contracts in Use – A Survey of Contracts in Use during 2007* which found that JCT contracts were favoured in 79% of captured projects, representing 62% of the total value. This is comparable with earlier RICS surveys of contracts in use, demonstrating that

these forms stand the test of time as the industry's preferred selection. Therefore, it is likely a quantity surveyor involved with the administration of building contracts will encounter them at some time in their career.

JCT forms have been used extensively since 1931 and were radically overhauled with the release of a suite of documents in 2005. The suite was reviewed to reflect legislative changes dealing primarily with payment provisions of the Local Democracy, Economic and Development Construction Act 2009 effective in 2011 and republished as JCT Contracts 2011. The discussion for the remainder of this chapter is an introduction to JCT Contracts to enable the reader to gain an understanding of the agreement in a building project where these forms are adopted.

By default, JCT forms address the professional title of members involved on a project and for this section these titles will be used, i.e.

- 'Employer': the client
- 'Contractor': the builder/main contractor
- 'Architect': the Employer's agent and administers the contract on behalf of the 'Employer'
- 'Quantity Surveyor': the 'Architect's' appointed representative (the PQS) dealing with the financial valuation of works

'Architect' could be substituted by 'Contract Administrator' because the 'Architect' may be a designer only, leaving the pathway open for other professionals to administer the contract. The representative administering the contract on behalf of the 'Contractor' is not mentioned by title as the responsibility is generally viewed as one that applies to the 'Contractor' in name only. For the purpose of this book, the representative is, of course, the contractor's quantity surveyor.

4.7.1 Articles of the Agreement

The Articles of the Agreement is the introductory part of the form and precursor to the body of the contract. It is a basis to the agreement and, in general, is made up of the following parts.

Agreement

This is the date of the agreement between the employer and the contractor that states their names, company registration numbers and addresses of their registered offices.

Recitals

Recitals are the explanation of those matters or facts that exist in the Agreement. As the form is a standard contract, clauses may not fully reflect expectations of the Agreement and may be cross-referenced to the Recitals that clarify

intentions and scope. For example, a Recital may state that the employer has provided the contractor with a bill of quantities. Recitals also include an explanation of the works to be carried out that umbrellas the scope, i.e.

> '… the construction of 10 nr two storey 3 bedroom properties each to occupy up to 4 persons of timber frame construction with brick veneer and tiled roof complete with partitions, utilities, fitments and external works including the provision of a fully serviced estate road to service the properties.'

This is a dynamic description that defines the employer's intentions for the project. Recitals may also confirm negotiations and clarifications and what the employer and contractor have agreed when executing the contract, i.e.

> 'The Employer has supplied the documents and the Contractor has priced the work in accordance with the documents as well as supplementary information supplied after the tender period.'

Articles

Articles are a confirmation of the nature of the agreement and include the names of stakeholders who will interact with the contractor and employer for the delivery of a project. As the contract is between the contractor and, employer, stakeholders are not bound by the agreement and are included in the Articles for fiduciary reasons, i.e. 'Quantity Surveyor', 'Architect', etc, with each probably having a separate agreement with the employer. The contractor's quantity surveyor must be aware of this difference and recognise that the contractor has no contract with any stakeholders except the employer. In effect, this means a contractor's role with anyone other than the employer is for collaboration only and if wishing to seek remedy for a stakeholders default other than the employer's, it must make contact with the employer.

In general, Articles set out obligations in a basic manner simplified in single sentences, i.e.

> 'The Contractor will carry out and complete works in accordance with the documents and the Employer shall pay the Contractor the sum of £xxxx for execution of the Works in accordance with the documents.'

The Articles include reference to the proper law of contract and legal proceedings permitted by law in the country of origin where the contract exists. The legal proceedings section is statutory and parties to the contract have access to them as a given right which is affirmed.

Attestation

This is the execution and witnessing section of a contract. The contract is executed under hand as a simple contract or as a Deed. The difference is the limitation period for legal claims against the contractor for defective works

which is 6 years for a contract and 12 years for a Deed. Contracts of high risk and value are normally executed under a Deed as a matter of course.

Contract Particulars

The Contract Particulars address specifics of the Agreement that are cross-referenced to standard clauses and written specifically for a project. They include, e.g. the dates of issue of interim certificates for payment, dates for sectional completion for part(s) of the works and/or a date for completion of the whole works. Contract Particulars may also include reference to the Recitals.

Definitions

Definitions are a series of key words used as interpretations and a glossary of contract wording. When definitions are conditional in a contract, the parties to the agreement are bound by them. Certain wording in the clauses might be presented as italics so they can be quickly cross-referenced to the definitions for clarification. The glossary entries could have capital letters that appear at variance with their natural meaning and they should always be quoted when the need arises as they have legal status that forms part of the contract. The quantity surveyor must be aware of this when communicating in writing in relation to the contract. The entries might apply to a person, title, group of persons (and what they represent), a place or thing. For example, contract parties are the Contractor and Employer and the Recitals are in the Agreement, all with a capital first letter. These definitions form part of Legal English wording and generally means that the contract lacks normal punctuation and may include the use of some Latin words.

Definitions need not be limited to wording and could clarify ambiguities relating to meaning. For example, say the contractor has received a payment certificate from the architect advising the employer to pay the contractor. The quantity surveyor might be assessing the number of working days before the contractor will receive payment. The contract may state that 14 working days can pass before a payment is due and the Definitions may clarify that working days are Monday to Friday inclusive and if any working day falls on a public holiday, that day is excluded.

4.7.2 Insurance

A construction project must have adequate insurance cover. This is to protect the interests of the physically built works, risks to the parties of the contract, persons engaged on a project carrying out their duties and the existing built environment within the vicinity of a project. Project insurances need to provide adequate financial protection to cover the cost of rectifying an incident. This includes any incident created naturally or as the result of an accident or developing from a situation involving risk or by the creation of an occurrence associated with the project that would cause financial harm and loss to a person

or business if liable for the incident. Insurance is a complex field and a well-researched project will recognise insurance needs within the contract form. The contract should reflect the requirements as well as the parties' responsibilities for obtaining policies to ensure there are no gaps in the insurance cover. A range of insurances as a minimum requirement for a construction project are discussed below.

Insurance for the works including new works and existing structures

Insurances for the works include protection for what JCT contracts refer to as 'Specified Perils' and 'All Risks Insurance'. A 'Specified Perils' policy is insurance cover for one or a number of named events specifically mentioned in the contract, e.g. fire, lightning, floods, explosions. It excludes 'Excepted Risks' caused by circumstances considered unlikely, e.g. pressure waves caused by aircraft. The policy covering 'All Risks Insurance' is generally for insurance against loss or damage incurred for any event not covered by 'Specified Perils' or considered 'Excepted Risks'. There is a distinction between perils and all risk insurance cover, with the perils clause clear on the type of event and extent of cover required. 'All Risks Insurance' generally applies for cover for the physical loss of works already constructed that are damaged or destroyed because of an accepted risk causing an incident. It is also required to cover the cost of replacement charges for destroyed unfixed site materials, the removal and disposal of debris and the propping or shoring of the works as a result of an incident giving rise to an insurance claim. It does not apply to incidents caused by unaccepted risks to property resulting in costs to repair, replace or rectify works or goods because of:

- Wear and tear or obsolescence of an item or part of an item
- Deterioration including rust or mildew
- Works or materials lost because of defective design and specification criteria
- Loss or damage by or from war, invasion, foreign hostilities and similar listed political situations
- Disappearance or shortages if only revealed when an inventory is made or not traceable to an identifiable event
- Excepted risks.

A project might have a contract with a clause requesting the need for a specific policy to cover destruction caused by war or acts of terrorism that would not be included in a standard policy. Here, a provider needs to issue a separate policy that generally aims to fulfil the requirements of the contract. Where cover is unavailable, it might be considered as 'Excepted Risk' because it is too expensive to provide or not possible to obtain.

Policies for the works under contract are required to be in joint names (contractor and employer) and provided by an insurance company or broker.

A general policy obtained by a contractor for all of the projects it undertakes could be insufficient because cover is for the maximum amount a contractor can claim in one year irrespective of the number of projects it may have in progress. For this reason, the contract wording might state that a specific policy is obtained for a project which must be named on the policy. Where this is the case, a general policy issued by the contractor would be rejected by the architect. Incorrect spelling of names or titles on a specific policy would also be rejected but can usually be corrected by the policy provider. In many JCT forms of contract, responsibility for obtaining insurance is set out under Options A and B that respectively allow either the contractor or employer to obtain insurance for new works. Option C is used where work is to or within an existing structure, including building extensions.

The quantity surveyor needs to become acquainted with works insurances and be in receipt of copy policies effective from the date works commence. It is a normal contractual requirement for parties to a contract to provide the other with evidence of the existence of policies in joint names to affirm the project has adequate works insurance. It is time well spent by the quantity surveyor to highlight insurance cover requirements written into the contract to emphasise the extent of cover required. As a matter of course (although not usually contractual or mandatory), copies of insurance policies should be submitted with each progress claim for payment as it demonstrates the existence of relevant cover at the time of requesting payment.

Policies usually run for one year and, if a project is to run longer, any policy must be renewed and be effective immediately upon the expiry of its predecessor. Due to the number of policies that might be required on a project, it would be wise to create a register of insurances including dates of expiry to ensure there is suitable cover at appropriate times.

Injury to persons

Insurance is required for persons going about their business on a project to cover the unfortunate event of an incident giving rise to personal injury or death. In general, if a supplier of services or goods and services is injured whilst carrying out their duties, giving rise to an insurance claim, it is a contractor's responsibility to provide insurance. Generally, the contractor indemnifies the employer from liabilities caused by such events for all persons. However, contract clauses might distinguish between employer- and contractor-appointed operatives which could influence the type of insurance. The employer's operatives are individuals engaged or authorised by the employer or employer's contractors to visit a project and perform specific duties and the contractor's operatives carry out a service directly for the contractor. Depending on the form of contract and the parties' agreement, it is possible for a contractor to issue a policy to indemnify the employer in respect of any of the employer's operatives carrying out duties if there is an action by any of them that triggers an insurance claim. Therefore, the employer will only be liable if he/she is

negligent in their duties with the responsibility for insurance to persons carrying out their services with a duty of care resting with the contractor. The employer may provide insurance for any persons it engages who perform duties on the employer's behalf and indemnify the contractor in the event of the employer's negligence when the contractor's insurance would be ineffective. It is highly unlikely a contractor would obtain insurance for an event involving negligence by the employer.

Damage to surrounding property

During construction operations, there could be risk of damage to existing buildings resulting from events such as ground heave, subsidence and plant machinery operations that can cause damage by vibration or impact. Contract insurance provisions usually require the employer to provide a policy to cover damage to neighbouring properties should any event damage the stability or integrity of surrounding buildings. A claim on this type of policy is effective when a contractor has not defaulted and has followed the design and procedures in accordance with the employer's requirements and acted with a duty of care. Thus, if carrying out excavations close to an existing building that results in damage to the building, the contractor would not be liable if it complies with the conditions of contract and is not negligent in its duties. A contractor might be required to provide a policy to indemnify the employer for damage to any surrounding property insured by the employer in the event of damage caused by its negligence or default by one of its subcontractors.

Joint Fire Code

The Joint Fire Code considers the risk of an outbreak of fire on a project in relation to the locality and construction methods used, e.g. timber frame construction or the widespread use of acetylene. The code is not associated with the completed structure and is intended to deal with risks associated with the construction process itself from design through to completion. To obtain an insurance policy for a project, insurance companies could request compliance with the code due to the nature and risk of a project and for this reason compliance with the code is included in a number of standard forms of contract. When called for, both employer and contractor must provide a policy to indemnify the other in the event of unintentional breach of the code. If the Joint Fire Code does not apply, the standard contract clauses are usually struck through.

Professional indemnity insurance

When a contractor provides a design for the works, a separate policy (or policies) is required to indemnify the employer in the event of an error, breach or omission creating defective design that is incorporated into the works. In general, professional indemnity insurance protects the employer from

incurring liability as a result of a claim following an event it had no control over that is attributed to a defect in the design. This may only become apparent over time and years into the life of a building, e.g. the failure of constructed foundations. The contractor is obliged to provide this insurance if it provides a design service and the policy wording should define the extent of any liability and length of time the policy will run after a date of practical completion. Individual policies provided by consultants engaged by a contractor to provide a design service may not be acceptable if the employer is seeking a single policy provider to provide the indemnity. An insurance company would provide a single policy to a contractor once it receives satisfactory details of design and construct consultants to be covered in that policy.

4.7.3 Employer's financial security

With normal industrial practice, it is usual for a contractor to provide financial security for the employer in the event of its default under the contract. Default includes insolvency and an overall lack of performance to deliver a scheme and there are various methods open to the parties to provide this assurance.

Cash retention

When the employer makes a payment for works in progress, it is reduced by 5% (or to a percentage written in the contract) which is part released at practical completion of the project with the balance payable at the end of the defects liability (or rectification) period. This cash retention is deposited into a trust account usually opened by the employer and independent of the employer's business because the money belongs to the contractor. In general, the contractor has no access to the account whilst the construction and rectification periods run and the employer remains solvent. However, in the event of the employer becoming insolvent, receivers dealing with the employer's estate will not usually prohibit a contractor from accessing the funds. In general, the trust fund is not an investment for the employer and any accrued interest is for the benefit of the contractor and is released at the time of refunding the retention. The status of retention is shown on each payment certificate excluding accrued interest and, because it is taken as a percentage, interest increases with each payment and may be capped to a maximum amount depending on the wording of the contract. The quantity surveyor must ensure the correct retention sum is withheld from each payment and is in accordance with the contract.

Bank guarantee

A contractor might be starved of income as a result of cash retention and an option is to provide a bank guarantee in lieu that the employer can accept or reject; if accepted, it must be stated in the contract as the accepted alternative. Normally, a bank guarantee is issued as two certificates provided by the contractor's nominated bank that assures the beneficiary (the employer) on the

performance of work provided by the services provider (the contractor) to predetermined sums. The sum on the first certificate is usually equivalent to a cash retention sum that would be due for release on the date of practical completion with the guarantee effective to that date. The second certificate is to the value of cash retention that would be held at the end of the rectification period, effective to that date. The process involves the contractor paying a fee to the bank which, once received, releases the certificates to the contractor with the bank acting as guarantor. The contractor then issues the original certificates to the employer and retains two copies, one for itself and the other for the architect.

A review of the main contract by the quantity surveyor must ensure that any bank guarantee certificates are deemed suitable and issued to the employer before the first payment is received otherwise the architect will take cash retention. In general, each certificate must be project specific and name the contractor and employer. If the architect notices errors in names, titles or project description on the certificates, however minor, they may be rejected and cash retention will be taken until the architect is satisfied the certificates are effective. Certificates must not be generic and a parent company guarantee from a contractor is not usually sufficient as it does not involve a bank who would be deemed a suitable financial guarantor.

Certificates for a bank guarantee are to fixed amounts, meaning additional security could be required for variations that increase the contract sum and the contract may be silent how to deal with this. With construction projects, an increase in the value of works would automatically create a pro rata increase in cash retention which causes a problem with bank guarantees. Unless worded specifically in the contract, a wise contractor would provide certificates guaranteeing sums greater than the cash retention equivalent with expiry dates beyond that stated in the contract. This allows for any increases in the contract sum and extensions of time and the contractor can negotiate their effect as and when any changes arise if the guarantees are low in value and a period of cover. Upon completion of the contractor's performance without call on the guarantor, the employer returns the certificates to the contractor for return to the bank to discharge the guarantor's services.

Performance bond

This is separate to cash retention or a bank guarantee requirement. It operates in a similar manner to a bank guarantee except it is a single bond, usually at 10% of the contract sum, and issued prior to a start on site. It would be used when a project incurs high expense during the early stages when cash retention or the equivalent in a bank guarantee is considered low security. The purpose of the bond is for the guarantor to provide the employer with reimbursement if the contractor fails to perform under the agreement.

Advanced payment bond

An employer may elect to pay an advance (similar to a deposit) before works commence to assist the contractor with site mobilisation costs and

deposit payments to material suppliers. When applicable or if a contractual requirement, the contractor must issue surety in the form of a bond. The bond is released once the value of works completed exceeds the value of the bond and the contractor is entitled to further payments.

Off-site materials insurance

Where a clause permits the payment for materials stored off site, the contractor must provide insurance for the goods and will receive payment if a policy is in place and conditions for payment of the goods are met, i.e. if they are protected and suitably stored.

4.7.4 Carrying out the works

The body of the contract is made up of titled sections with sets of conditions which have clauses and sub clauses identified by numbers, e.g. clause 1.1 Materials, goods and workmanship and sub clause 1.1.1 dealing with the responsibilities of Materials, goods and workmanship. The title sections of the body of a contract are now discussed.

Contractor's obligations

These obligations generally refer to the execution of the works which a contractor agrees to be:

- Carried out in a proper manner
- Completed at an agreed cost
- Completed and commissioned on time to ensure the date of practical completion is met
- Constructed to the quality specified in the contract documents.

The obligations have a distinct link to time, cost and quality. Time and cost matters are straightforward, as it is the contractor's agreement to deliver a project on time to a cost the employer will pay. Quality may be defined differently and is usually with reference to specifications and notes on the drawings and anything stated in the contract that affirms referral to the documents. If a term in a contract or specification states that a product is to be manufactured of 'good quality' it probably means a material free from defects which achieves accreditation to British Standards, quoting the appropriate number and part. This is a minimum acceptable standard and applies regularly in a design and build contract when a contractor's proposals are accepted by the employer who relies on the contractor's skill and judgement for selection and methods of installing. If 'high' or 'superior' quality is specified, the employer is expecting something beyond good quality when the selection and product brands are mentioned in the specification together with methods of workmanship used in their manufacture and installation on site.

When reviewing the main contract, the quantity surveyor and project manager need to be aware of any expressed terms, especially those referring to quality. In general, an expressed term is a written requirement in a contract that is specific and leaves no doubt to the intention and scope. Ideally, the quantity surveyor should highlight these terms with coloured markers so they stand out as salient features and become easily identifiable should the need arise whilst the project is under construction. There may be an occasion during the construction phase when a situation arises with the need to refer to the contract to clarify the existence of an expressed term. For example, a situation may occur where the quality of installed goods fails to meet the architect's expectations, whereupon the architect states the contractor's obligations apply and issues an instruction referring to a clause with an expressed term, e.g.,

> Clause x.xx '…works are to be carried out to the satisfaction of the Architect.'

This will be of concern to the contractor if it has installed a product it considers complies with the contract and the architect has a difference of opinion and also that there was a failure to seek approval of a product sample because approval was not a condition of contract. If there is a disagreement with the standard of quality provided, the contractor can refer to statute, as it would be expected to deliver to the minimum standards in the absence of an expressed term stating otherwise. Here, the contractor could refer to the Sale of Goods and Services Act 1982 to resolve any misunderstanding regarding the quality of a product.

To enforce a new term to dispel doubtful wording, the courts would need to insert an implied term into the contract to give it business efficacy. When inserting an implied term, a court usually concludes it must not contradict an existing expressed term and the implied new term must have clarity. In general, a court will be reluctant to reinvent the wheel of an agreement by implying a term unless any expressed term is illegal or is a mistake and was included unintentionally. When implying a term, it is implied in accordance with statute and case law created over time and the courts will not usually consider anything else that would leave the parties with a bargaining power different to that they have already created.

Possession of the site

Giving possession of the site to the contractor is generally an employer's obligation. This is to permit the contractor to establish the site accommodation and commence works and is to a stated date written into the contract. However, there may be reasons for deferring the date which is usually for the employer's benefit, e.g. a delay in receiving planning permission or a delay in completing works to be carried out by the employer before the contractor takes possession which is not part of the contract. Here, the contract may have provisions for the scenario, allowing the employer to defer the date to a maximum number of

stated days or weeks. With such a clause, a contractor cannot claim breach of contract if the date of possession arrives and it cannot possess the site. However, once the deferment period elapses, the contractor should request the architect to adjust the completion date, which may extend the construction period. In the event of a delayed start beyond the contractor's control, the project manager is usually the person advising of the situation, who writes to the architect exercising the appropriate clauses with the quantity surveyor copied in on the communications.

Supply of documents including setting out information

One set of contract documents is provided by the architect to the contractor as a matter of procedure and it is formally certified when executing the contract. Thereafter, the contractor will require an issue of 'for construction' design and documentation to carry out the works. The terms of the contract on the issue of 'for construction' information will differ between a construct-only and a design and build contract because the employer and contractor respectively drive the supply of information from consultants. With a construct-only contract, the architect must provide working documents in a timely manner. The architect prepares an Information Release Schedule, which is a document stating when working details will become available and released as 'for construction' information. The schedule is not usually annexed to a contract and may be confirmed in the Recitals which in practice are driven by dates stated in the construction programme. When a programme does not state dates for issuing documents and relies on a reasonable period prior to the works commencing, the contractor must coordinate with the architect and agree dates. A suitable contract clause will include for the architect to provide information to assist the contractor with the task of meeting the date of practical completion and this may be all that is said. If the contractor considers that the information requires more detail for practical working or believes the architect is unaware of timing for the issue of critical information, a suitable clause permits the contractor to make a request in advance. The request must state the requirements for which the architect has a fiduciary duty to acknowledge. In some projects, 'for construction' issues are replicas of contract documents with the revisions updated, thus recognising the contract issue as a formality only. However, the contractor cannot assume this by working to the contract documentation and must await 'for construction' information. With a design and build contract, a contractor must rely on its own resources to drive consultants for the Information Release Schedule and subsequent issues.

The architect has a responsibility to ensure information supplied is suitable for the intended works and might produce additional information for construction purposes. This does not usually pave the way for a variation as, in effect, the works may not have changed. This is because the additional information is issued to clarify ambiguities and amplify critical details to a reduced scale or is the result of final coordination between consultants. The additional

information may also be for works included as a provisional sum that the quantity surveyor must assess and treat as a variation.

So what should the quantity surveyor do if there appears to be a delay in the supply of information that could hinder site progress? Suggestions would be to:

- Consult the programme to confirm there is a delay and it is not hearsay
- Notify the project manager if he/she is unaware of the situation
- Keep records of the length of delay
- Consider where the burden of responsibility rests for the delay, i.e. employer or contractor
- Ensure a letter is issued to the architect stating clauses of the contract and the works that are delayed, citing reasons
- Ensure the architect is aware of the extent of the delay in days – an approximation will suffice.

Any response from the architect should be copied and kept on file.

One of the first activities on a project involving new works or the extension of an existing building is for the contractor to set out the works. This will involve working to datums, gridlines, levels and points of reference provided by the architect on behalf of the employer. Normally, the employer will have already engaged a surveyor to address site boundaries, topography, existing levels and proximity of existing buildings and the contractor works to those benchmarks. If the contractor exposes errors in the information supplied whilst setting out the works, an appropriate clause will usually explain the procedure and the architect will make a decision on the implications of the inconsistency. If during the works the contractor notices an error in the setting out of its own creation, the contractor must rectify the situation at its own expense and a clause of the contract will usually have a procedure to follow in the event.

Errors in quantities

Under a construct-only contract including a bill of quantities as a contractual document, where there is a discrepancy in the bill that alters the nett measured fixed quantity, a contractor is usually entitled to a variation of the works valued at billed rates. The same would apply to any scheduled quantities given in a specification or drawing considered contractual documents. Ideally, the quantity surveyor should inform the architect of any error(s) and seek an instruction prior to commencing the works, and the contract could outline the procedure when doing so. However, a contract could be silent on a situation where works proceed and the procedure of seeking an instruction beforehand fails. If the contractor proceeds and completes the works in accordance with 'for construction' documents, it does not change the root of the situation, which is an installed quantity differing from the contract bills, drawing or specification. If this occurs, the quantity surveyor must issue the architect with a priced variation to correct the quantities and request an instruction. Let us say a contract

bill of quantities states a requirement for 100 m^2 of 100 mm thick block walls which the quantity surveyor at some time discovers should be 200 m^2. There may be reasons why the quantity has doubled which are of no concern to the quantity surveyor as the contractor has agreed to construct quantities to a billed allowance. Once an instruction and variation have been requested, the architect might request the PQS to make an assessment. The conclusion is issued from the architect who may provide an instruction exercising the clauses of the contract to deal with the situation and could read as follows:

Architect's Instruction Nr 20

Pursuant to clause xx.xx of the Main Contract, the Contractor is hereby issued with this Instruction to amend the works as follows:

OMIT BOQ 6/3 (d) Block walls in dense concrete (1990 Kg/m^3) size 440 × 215, 100 mm thick with keyed face, bed & joint in gauged mortar (1:1:6), over 300 mm wide 100 m^2

ADD Block walls in dense concrete (1990 Kg/m^3) size 440 × 215, 100 mm thick with keyed face, bed & joint in gauged mortar (1:1:6), over 300 mm wide 200 m^2

The value of any difference is to be assessed based upon rates in the Bill of Quantities.

Naturally, with a design and build contract, in general no such scenario applies because the contractor is responsible for quantities.

Inconsistencies with design documentation, including errors and omissions

If there is a fault on the drawings, or specifications that contradict each other, or a construction operation is unachievable due to a defect in the design, the architect must be advised. This is to allow the architect to issue revised drawings or provide a written instruction to correct the error. Care should be taken by the quantity surveyor or project manager before advising the architect of their observations because some JCT contracts include terms where the contractor agrees to design 'discrete part(s)' of the works. Here, the architect or other designers engaged by the employer may complete a design to a certain stage for the contractor to finish and it may be a wrong assumption by the contractor to make a request to alter a design so that it can be completed for practical purposes.

An incomplete design is usually finalised with the creation of shop drawings. Shop drawings are usually produced by subcontractors for a contractor and are of an architectural or engineering nature. Generally, they are produced from a design supplied by a consultant to show how components will be fabricated in a shop or factory and installed into a building, which by industrial custom is approved by the consultant that prepared the 'for construction' design. This applies to items such as:

- Windows
- Structural steel roof and wall assemblies
- Precast wall panelling
- Wall cladding façades
- Mechanical plant.

A contractor may provide shop drawings when completing its obligations to design 'discrete parts', e.g. final window details. The contractor may also submit shop drawings for any other design that requires approval where it is not involved with the design. It should be noted here that, under a construct-only contract, if there is an inherent error in an initial design that goes unnoticed in the shop drawings approved by the employer's consultant, the contractor is not usually responsible. However, with a design and build contract, in the event of an error going into production from an approved drawing and the error is only noticed once the product is installed, in general, the contractor cannot claim reimbursement for rectification because the contractor has committed the error. Should there be a situation where goods are designed, produced or installed that inherit or may inherit problems and are observed by the contractor, the contractor must seek an instruction on the action it is to take.

There may be ambiguities in the documents that are genuine mistakes. Where this is so, the architect will issue an instruction that involves the works only. The architect is generally not empowered to issue an instruction involving ambiguous or contractual errors such as clause writing. Here, the matter would be addressed by the employer and contractor who may resort to legal remedy, as discussed under the paragraph 'Vague contractual terms and errors' later in this section.

With normal industrial practice, the execution of works follows an order of precedence. This means that the specification and drawings for a discipline must not conflict. Furthermore, information on one discipline that may contradict information not of the same discipline is disregarded. For example, works of an electrical nature are stated in the electrical specification and electrical design drawings. This will take precedence over an architectural specification or drawing if they include items of an electrical nature. By contrast, if electrical details show fixing to a partition that has wall insulation and the insulation does not appear on the architectural details, there is no insulation because insulation of partitions is an architectural precedent. Similarly, if there is reference on an architectural drawing of large scale, say 1:100 that refers to a detail on an architectural drawing to a reduced scale of say 1:5, the information on the reduced scale is normally the working document. However, wording on the contract may override normal industrial practice and, if so, it is the order of precedence in the contract that must be complied with. If the contractor notices ambiguities, it must seek an instruction and the architect has a duty of care to clarify.

Divergences

Changes in documents that are required to comply with statutory requirements including Building Regulations are called Divergences. With a construct-only

contract, methods of dealing with design changes to comply with these requirements are usually stated in the contract. The contractor must not actively seek divergence yet has a duty to advise the architect if it becomes aware of its existence. For example, if roof trusses are designed to be spanned 600 mm apart which are installed and later found to require additional bracing, the contractor will rely on the information supplied and does not need to question the inclusion of bracing in the first instance. This is because the consultant is deemed competent to provide the information and, as such, the contractor would be entitled to extra costs for installing the bracing and should receive an instruction.

A contractor must not alter the design or change any completed works without receiving an instruction as the contractor may be in error about its assumption. For example, planning permission may have been approved based upon an earlier version of the Building Regulations with the changes unnecessary. An instruction may require emergency works or rectification to address works about to start or those completed that require altering which the contractor must oblige. However, if a drawing or specification contravenes Building Regulations or other statutes and the works are installed with the contravention unnoticed, the contractor is not normally in breach of contract because it failed to notify. The quantity surveyor needs to be aware of divergences and their implications because changes could well involve additional expense. If the architect issues an instruction to change something without mentioning reimbursement, the quantity surveyor needs to advise the cost and seek a variation to the contract sum. With a design and build contract, normally it is the contractor who accepts responsibility for compliance with statutory requirements and the Building Regulations.

Vague contractual terms and errors

Where there is a discrepancy with wording in a contract, any genuine errors are deemed acceptable to change by common sense unless there is an expressed term stating to the contrary and what the procedure should be. In general, any clerical error with wording that contradicts numbers, e.g. 'too' instead of 'two', is corrected without seeking legal change. However, once a contract is written and executed, in general it is only possible to change through a court of law and a vague or ambiguous term may be serious to a contractor if overlooked. For example, a clause on payments may state:

***approximately* (inserted in ink)**

'The final date for payment pursuant to an Interim Certificate shall be ^ 14 working days from the date of issue of that Interim Certificate'

Here, a contractor would expect payment no later than 14 working days after issue of the architect's interim certificate. However, because the word 'approximately' has been inserted, the clause becomes ambiguous. This may result in a

scenario when, after 14 days, the contractor has received no payment or notification why payment is withheld because the employer is relying on the word 'approximately'. If a dispute arises because of an ambiguous term, it is possible to resolve the situation with the *Contra proferentem* rule. '*Contra*' is Latin for the English word 'against' and '*proferens*' means '(the) one bringing forth'. This rule is imposed under contract law that favours a party who did not request the change and goes against the interest of a party who did who, for whatever reason, failed to clarify the point. In this example, the rule may suggest the word 'approximately' is ambiguous and a court may alter the term by deleting the word, which would go against the drafter who inserted it and may be the employer. The quantity surveyor needs to be aware of ambiguities by error that could do harm, however small they appear, and that are usually caused by editing terms put into the contract by either party. Some editing may be so minor they require no action, yet those that are vague and obviously wrong could require input from the contractor's legal adviser. who may seek to change the wording to avoid a dispute.

If the contractor and employer have an oral agreement with a term and the contractor has notes of discussions that failed to be included in the contract, a court can amend the contract terms by Rectification. This is remedy where a contract has an appendix or alteration endorsed by the parties to say what was intended to be said in the first place that by mutual error was omitted from the form. Changes are granted by Equitable remedy instead of legal alterations at the discretion of a court as long as the Rectification is legal and parties to the contract give consent. This makes it different from an implied term because it does not need to involve case law or statute because it is merely a correction the parties mutually wish to address.

Unfixed materials

A contractor may or may not be entitled to receive payment for unfixed materials and this depends on the conditions of contract. If the contract is silent on the matter, it will mean the contractor is not entitled to payment. Where permitted, it applies to materials stored on or off the site awaiting installation. The contract will include clauses on methods of securing the goods, as well as identifying a location if they are stored off the site, such as in a manufacturer's factory. Contractors generally seek contract forms that include provisions for the payment of unfixed goods. Payment aids cash flow because the contractor will need to pay suppliers for goods once they are delivered to site, with some suppliers only agreeing to accept an award if they are paid for materials stored off site. A wise contractor will be aware of this prior to signing a contract involving certain material suppliers who are specified, and only trade on these terms, meaning the contractor must abide and will seek reciprocation under the main contract.

Payment is subject to an assessment of the works and is usually carried out by the PQS following the provisions of the contract. In general, the contractor

will be paid for goods it has purchased for the project that are secured, not defective, comply with the specification and have not been purchased prematurely. 'Not purchased prematurely' generally means goods that can be installed within one month of purchase. Materials purchased prematurely may not be included for payment when it is obvious their installation is not imminent, e.g. roof trusses when the foundations are under construction and the construction programme states that trusses are due for installation six months after the foundations are constructed. Materials stored off the site may be stored longer than one month but this depends on the project and the contract may include the provision of insurance as surety. Once the contractor receives payment, the goods become the property of the employer and the contractor has a responsibility to safeguard them.

Defects

The contractor is responsible for defects for a defined period (usually 6 or 12 months) after the date of the certificate of practical completion which triggers a defects liability (or referred to in JCT contracts as the Rectification Period). If the employer sells the building or rents space to tenants, the contractor is still bound to the employer and not the new owners or tenants.

A defect generally refers to shrinkages, faults and inherited problems associated with materials and workmanship that are the responsibility of the contractor. During the Rectification Period, the employer is responsible for general maintenance and cleaning and the contractor must differentiate and understand the difference between general maintenance and defects. For example, tiled grout requires general maintenance by bleach cleaning and it is not a defect if the material loses colour by the end of the Rectification Period because of a lack of cleaning. By contrast, if the ceramic glazed faces of the tiles show crazing, it may be due to the co-efficiency of expansion of the glaze over the tile, becoming a material defect and, if the tile supply was the contractor's responsibility, the defect becomes the responsibility of the contractor. The fact that the contractor may have subcontracted the works to a tiling contractor is generally irrelevant and the contractor must attend to the defect with or without subcontractor involvement. The quantity surveyor needs to ensure that any trade package award to a subcontractor who supplies and installs materials and commissions works includes a condition that the subcontractor is directly responsible to the contractor in the event of a defect for the duration of the Rectification Period.

4.7.5 Delays in carrying out the works

Time is crucial on a project and a contractor's best endeavours are to maintain the programme so that the project starts and completes on time. The quantity surveyor must express an interest with time on a project and understand procedures to follow in the event of a delay, which are usually written into

the contract. A contract generally states procedures to follow if there is a requirement to adjust the completion date because, in general, circumstances causing a delay are linked to risk that involves the employer who will need to know if the end date is in doubt. However, if a contractor is behind on a programme that it accepts as its own responsibility, the clause for an adjustment of time will generally not apply and the contractor must accelerate the programme to put it back on track and achieve the end date. The interest here, however, is a review of the main contract to understand the effect of delays that requires the architect's involvement acting on behalf of the employer.

Adjustment of the completion date

The term 'adjustment' is probably a better word to describe a request to alter the end date as it is possible to bring a date forward as well as extend it. Say, for example, a contractor takes possession of a site on a date included in an executed contract and the employer halves the scope of works soon after. This would naturally indicate the contractor could finish early. However, the contractor has no contractual obligation to issue an adjustment of time to reduce the contract period even at the employer's request as it is normally beyond the contract. The contractor may only formally reduce the construction phase in a collaborative fashion and must ensure the new date is realistic, i.e. halving the scope of works may not halve the project duration.

Unfortunately, due to the nature of construction projects, the end date can be delayed, and there must be specific reasons for this to be accepted by the employer. JCT Contracts include a list of Relevant Events that give rise to the issue of a Notice of Delay for an extension of time. Referring to clause 2.20 of the JCT Intermediate Building Contract 2011 these are:

- Variations: any works that are a variation to the original works which delay the programme
- The issue of one or more architect's instructions
- The deferment period of site possession when it is beyond that stated in the contract
- Where a bill of approximate quantities is used and that installed is significantly more
- The contractor elects to suspend the works and is later vindicated and recommences operations
- The employer's design team or contractors impede, delay or default the works
- Delays caused by statutory undertakers
- Exceptional adverse weather conditions
- Loss or damage caused by 'Specified Perils'
- Civil commotion, e.g. the use or threat of terrorism and an imposed method of dealing with them
- United Kingdom central government involvement, excluding local authority powers

- Industrial actions, e.g. strikes or lock outs on site or off the site if involving goods that are being manufactured for the project
- *Force majeure*, French for 'superior force', generally referring to an 'Act of God' if not included as 'Specified Perils' or exceptional adverse weather conditions.

Where this form is adopted, only the aforementioned circumstances will give rise to an extension of time being granted and the architect is only empowered to acknowledge these events. If the contractor seeks an adjustment to extend the end date, the Relevant Event(s) must be cited.

Contracts are often unable to provide extensions of time following the insolvency of a domestic subcontractor(s). A contractor must therefore safeguard any programme float for the unexpected where a subcontractor succumbs to business failure. The general exception is any subcontractor named in the JCT form where the architect has input with the selection. Here, a contractor must issue an award even if concerned about a named subcontractor's business vulnerability and, in the event of insolvency, must follow the procedure stated in the contract or the contractor will be in breach of contract. A substitute named subcontractor, because of insolvency of a first named, could fall under the category of variations, thus becoming a Relevant Event with the contractor possibly entitled to an extension of time as long as it does not hinder the process.

The JCT 2011 forms decline involvement of nominated subcontractor selection with the nomination process itself somewhat outdated. However, the quantity surveyor may be engaged on a project where the architect does nominate subcontractor(s) using an appropriate form and would need to address the relevant clause(s) in the event of a subcontractor becoming insolvent and seek an extension of time as necessary.

Liquidated damages

This is a fixed sum of money, usually stated as a rate per day or week, that a contractor will pay the employer for delays after the agreed date of practical completion if the contractor defaults. To be effective, the damages must be written into a contract and are calculated to reflect the true loss of income the employer will suffer through a delay for which it has no control, e.g. income from the rent of new properties that is lost because the project is delayed. Liquidated damages do not need to be proven and are usually included in the tender documents for advice to competing contractors. The computations for applying the damages are straightforward to calculate and would be assessed by the architect. For example, if damages written into a contract are £500 per calendar week and the contractor completes six calendar weeks later than agreed, the assessment will be:

6 weeks @ £500.00 per week = £3,000.00

Contractors try to avoid these damages by completing on time and the quantity surveyor must monitor the process throughout the construction period by reviewing the construction programme. Where the contractor has not defaulted, the quantity surveyor must exercise contractual obligations and seek an extension of time to the end date.

The quantity surveyor needs to be aware of project activity and its influence on time during the construction phase, because a delay and the possibility of liquidated damages being applied are best avoided by both employer and contractor. A clear objective of a contractor is to avoid these damages where possible by exercising the appropriate clauses of a contract that usually has remedies for delays.

When an architect grants an extension of time, it may not be what the contractor requests and time is said to be 'at large' when there is disagreement to an end date. This term applies when the employer is responsible in full or in part for a delay and cannot agree what the end date should be with the contractor. With this scenario and in general, without a revised end date, liquidated damages will not apply meaning a contractor may avoid them. A contractor must not see this as an advantage and exploit the situation if the 'drop dead' end date is in dispute as any delay will most probably incur a cost to the contractor's preliminaries. Furthermore, a contractor could incur increased charges from its material suppliers and subcontractors as a result of inflation, as they are completing late and generally are not directly responsible for the delay. Any expense a contractor incurs for delays would not normally be recoverable under the main contract and could do possible financial harm.

Delays in commencement and effect on liquidated damages

Care is required in understanding the date for commencement of the project and the date of practical completion written into a contract. If there is a delay in the date of commencement, it does not have the same consequences as a delay to the date of practical completion. The date of practical completion may be revised during the construction phase, and if this date passes and the project is not practically complete without agreement to a delay, it triggers the liquidated damages for which the contractor is liable. Contract forms may omit to state the construction period in weeks and allow the period to self calculate from a date of commencement to a date of practical completion. For example, a project that has start and end dates that calculate as a 1-year programme will more than likely mean the works will take one year to complete. This is irrespective of the dates because the nature of the works dictates the duration, which the employer may agree to accept by including the programme as a contract document and binding the parties. If the employer delays the start, the contractor must make a request for an extension of time to the end date. It is not up to the contractor to change the commencement date even if it cannot commence works and there may be deferment written into the contract permitting the employer to do this. In resolving this, the employer may extend the start

and end dates by the maximum permitted deferment, thus not altering the construction period. For example, if four weeks is the permitted deferment with no change in the length of the construction period, the consensus will be:

ORIGINAL:

Start 1 January, Finish 31 December = 52 - week construction period

REVISED:

Start 1 February, Finish 31 January = 52 - week construction period

This is an important distinction because the contractor may perceive the delay as giving rise to a 56-week programme that creates a one-month delay and would normally make a claim for staff and preliminary expenses because of a longer programme. This is clearly not the case because the dates only have altered and not the construction period and the contractor would be liable for liquidated damages after 31 January if it fails to complete on time because of its own performance.

Partial possession by the employer, project completion and lateness

Clauses in a contract may include for partial or sectional possession of the project by the employer prior to a date of practical completion, thus giving the employer an opportunity to conduct business during the construction period whilst the contractor has a presence. This may occur with a newly-built combined multi-storey residential and commercial project, where commercial businesses occupy the ground floor as retail outlets and residential apartments on upper levels will be handed over at a later date. Here, a precondition would be for the architect to issue a sectional completion certificate to permit the commercial businesses to operate.

A sectional completion date must be written into a contract and must not be an afterthought, and the quantity surveyor will need to recognise this date because liquidated damages could apply for non-completion. When a sectional completion date as stated in the contract arrives, it is not ignored if the works are incomplete. When an extension of time is granted to the sectional completion date, the architect normally issues a certificate of non-completion on the date it would have been completed (or a notice of non-completion by the employer's agent if a design and build project). The irony is that if an extension of time exists, it automatically cancels the certificate of non-completion and once the revised date of sectional completion arrives and the works are complete, the certificate of completion is issued.

Practical completion generally happens when a contractor completes a project, including any previously certified sections, and in the architect's opinion the works achieved comply with particular contract clauses. In a similar situation with sectional completion, once the original date of practical completion arrives, the formality for issuing a certificate of non-completion applies if the works are incomplete. This is automatically cancelled when an extension of time is granted, with the certificate issued once the works are complete. So,

what happens if either a sectional or practical completion date arrives and an extension of time has been requested but not granted and the architect does not issue a certificate of non-completion? In short, the answer is found in the wording of the contract. Under the JCT Intermediate Building Contract 2011, for example, the architect may issue an extension of time granting prolongation up to 12 weeks after the agreed date of sectional or practical completion. In the meantime, the employer cannot deduct liquidated damages because in effect there is no certificate stating the works are incomplete. The architect, however, has a contractual duty to issue a certificate of non-completion and may issue this at the same time as the decision to grant an extension of time.

There is a fine line between the 'drop dead' date for sectional or practical completion when it is issued on a completion certificate and the actual date the employer takes possession. Although the procedure is systematic, in reality, physical occupation is somewhat different. The employer might not be expected to take possession on the date of issue of a completion certificate as the building could be undergoing testing and commissioning and the contractor be in the process of demobilising the site accommodation and making good the area disturbed. Thus, it is not unusual for one month to pass after the certified date of completion before the employer occupies a building as the project in essence is complete, albeit for final testing and clearance of the site accommodation.

4.7.6 Control of the works

The managerial control of the works is driven by the selected procurement route which influences the degree of involvement from the contractor, employer, architect and other employer-appointed persons. With a design and build project, the contractor controls works to a greater degree than the employer, whereas with a construct-only project, the employer takes a more active role.

An employer usually receives pre-contract advice about the type of procurement and contract form to use for a project from an architect or appointed advisor. Alternatively, the employer may elect to use a form based upon experience from past projects. The procurement type influences the form selection for the main contract and the quantity surveyor will need to review this to be aware of the different representatives and level of control that will apply for administering the contract. A first observation is to understand the form in use which must be compatible with the procurement route as well as the stated methods of controlling the works and the parties involved. The JCT 2011 Contracts generally aid this process by providing a separate guide to the selected contract form as well as advice at the beginning of each form stating where it is appropriate, where it can be used and where it is unsuitable.

Representatives and right of access to the works

In general, with a construct-only contract, the contractor must allow access to the works at all reasonable times to the architect or persons authorised by the architect who are representatives of the employer. This is subject to any reasonable

objections to protect any proprietary rights. However, the employer's representatives must acknowledge the contractor's responsibility for health and safety and comply with the requirements, i.e. using protective clothing, reporting to the site manager upon arrival and signing the visitor's book. At all reasonable times, the contractor must appoint a 'person in charge' who is competent to accept the delivery of instructions on behalf of the employer. This implies the competent person is a management member of the project team and includes the quantity surveyor. In general, JCT Contracts include clauses addressing cessation of the architect's or PQS's services when the employer engages a replacement. Where applicable, the clause will have a provision permitting the contractor to make reasonable objections to a replacement which the employer must acknowledge if there are compelling grounds and seek to appoint an alternative. With this clause, no replacement professional is empowered to reverse previous instructions, certificates or variations unless the contract advises otherwise. The contractor loses the right to an objection if the employer is a local authority and the nominated replacement is an official of it.

Assignment

Assignment is a transfer of the rights and duties of the contract to another party. With a construction contract, the contractor or employer to the original agreement can assign the agreement by giving up an interest in the project if permitted by the contract. This can only be carried out by a legal transfer to an assignee who will become a new party. Construction contracts generally discourage this conduct and, if expressly forbidden, it will be an end of the matter. However, if permitted, it must be expressly included as a provision and, when completed successfully, it is novated which may be under an alternative form of contract with a new party. A contractor needs to be aware whether this provision applies because it may mean a new employer at some time during the construction phase or period thereafter where the contractor is responsible for defects.

Subcontracting

Subcontracting is the delegation of a duty that does not absolve the contractor from its obligations and duties of the contract. The main contractor will not normally plan, construct and commission an entire construction project using all its own resources and will need to subcontract portions of the works by delegation to others in order to achieve objectives. Generally, subcontractors to a main contractor are domestic subcontractors and rarely have contact with the employer or architect. It may be a condition of contract that a contractor supervises and coordinates works with contractors engaged by the employer that JCT title as 'Employer's persons'. These are not subcontractors in the usual sense as they are not bound to the main contractor but play an important role in the overall delivery of the scheme.

The JCT 2011 forms of contract act in a collaborative fashion and permit the contractor to adopt a generic JCT form suitable for domestic subcontractors engaged by a contractor awarded with a JCT main contract. Here, the theme of a main contract is reflected in the subcontract form which highlights the degree of risk and obligations a main contractor undertakes. Although not mandatory, using these forms has an obvious advantage to a main contractor because it mitigates the risk undertaken with the main contract. Where a subcontractor is named in the documents, the contractor must execute an award with a subcontractor using the appropriate form and not one of its choosing.

Statutory control

Works under contract must comply with statutory regulations in order for a project to be compliant with legislation and appropriate standards including the Building Regulations and this is usually confirmed in the contract documents. Where this is not provided because of an error in the design, or works are complete and include the error, it must be rectified which is discussed with Divergences under section 4.7.4 earlier in this chapter. Statutory control also applies to CDM Regulations. All projects that fall under the umbrella of CDM Regulations must be acknowledged by the employer and contractor and the contractor must be aware of its duties as principal contractor which includes updating the construction phase plan from time to time.

Instructions

Due to the level of employer control on a construct-only contract, clauses have provisions for the issue of instructions that in general a contractor must acknowledge. This does not mean to say a contractor should comply, as it might not agree with the instruction yet it must respond because it may have a contractual duty to do so. Situations where instructions may be issued include:

- Variations including the expenditure of provisional sums
- Postponement of the works
- Notification of compliance and non-compliance with existing instructions
- Intentions on works not considered in accordance with the contract
- The removal of work and exclusion of person(s) from the works
- The right of the architect or appointed clerk of works to carry out inspections, including opening up and testing of the works.

Whilst most forms have clauses that provide a basis for the issue of an instruction, they often omit to state the methods of issue. A contractor may lose the right to a variation, including associated costs, if an instruction is oral and not confirmed in writing or the confirmation received is different than what was understood by the oral instruction. In practice, an oral instruction from a person authorised in the contract to issue an instruction triggers the appropriate clause. This authorised person is usually the architect, and if a contractor

complies with an instruction that is included in the contract and issued by someone other than the architect and carries out the works to that instruction, it does so at its own risk and may not be paid. This may be a bitter pill for a contractor to swallow when dealing with a number of entities appointed by the employer and the quantity surveyor needs to ensure that the project team is aware who is authorised to issue an instruction and who are written into the contract.

Instructions from consultants, representatives of the employer including clerk of works and even the employer may have no effect unless they are named in the contract as an authorised person to issue an instruction. So, what happens if a contractor supplies and hangs doors in accordance with the documents and the employer visits the site and instructs them to be replaced, advising the contractor it will be paid for the replacements but who is not an authorised person to issue an instruction? The answer is that the contractor should do nothing until instructed by an authorised person named in the contract and politely advise the employer of its position. However, if an instruction is issued by anyone representing the employer that merely enforces the contract because the issuer is of an opinion that part of the works fail to meet the contract, e.g. a wall is a wrong thickness, the contractor must comply if the facts are correct. This is because the instruction is a reminder to the contractor of its obligations under the contract that it must comply with. If the issuer of an instruction merely enforcing the contract quotes a clause of the contract for non-compliance, they may only do so if permitted under the contract, otherwise they must contact the authorised person to issue an instruction.

In practice, anyone who issues an instruction should be acting in the best interest of the project and inform the architect of their actions and, if not, the contractor needs to make contact with the architect. For example, a building inspector might require foundation trenches to be excavated to a deeper level than shown on a drawing and issue an oral instruction to that effect. Here, an oral instruction contractually may have no effect and as a matter of course the contractor needs to confirm it with the architect which can easily be done by fax or email. In the building inspector's instruction scenario, the position is one of a person with authority and the architect will rely on the impartial opinion and usually issue the instruction. Here, the architect would usually issue an instruction addressing the work and the implications it has on the contract, as there may be a provisional sum for the additional excavation to cover the expense. Instructions from an authorised person such as an architect should be made on the architect's letterhead and are usually numbered and dated for reference.

The quantity surveyor needs to be aware of any conduct that could be considered an instruction. For example, what happens on a construct-only contract if a drawing is revised or a new set of drawings is issued that adds another level to a building? Although on the face of it, it would appear the drawing is an instruction to treat the works as a variation, the quantity surveyor and project team would be unwise to proceed with the works unless

the drawing(s) are issued with a written instruction from an authorised person. It is more than likely in this situation that the conduct is an instruction requesting a variation quotation only and the works are not to be constructed until the quotation is approved which must be issued as an instruction. Any instructions involving expense must be retained by the quantity surveyor for assessing variations and the possible effect they may have with time on the project.

4.7.7 Cost variations

Variations are alterations or modifications to the works under contract that are changed by way of design, quantity and quality. This is brought about by employer changes that add, delete or substitute works including scope or material changes before and after they are installed. It may also apply to a change of working sequences at the employer's request or a change of obligations or the imposition of restrictions instructed by the employer. Cost variations also apply for assessing the expenditure of any provisional or prime cost (PC) sums included in the contract. By contrast, a variation may not involve cost. For example, there may be a request to change a wall tile colour of an identical size, pattern and manufacture. If the wall tiles have not been ordered, delivered to site or fixed, the new ones can be procured to meet an unaltered programme at no extra charge. However, in this scenario the change needs to be recognised and recorded as a nil cost variation to ensure the materialistic change occurs, i.e. a variation at nil cost must be communicated as accepted by the architect for the material change to happen.

Cost variations do not usually apply if the architect issues an instruction to change anything constructed or to replace materials stored on or off site that are not part of the works under contract or approved variations. In this scenario, the contractor must usually correct any errors at its own cost.

With a construct-only contract, variations involving cost are usually valued by the PQS and the contractor's quantity surveyor assists the process by submitting variation requests. The contractor's quantity surveyor must not rely solely on the PQS to assess the value and must provide evidence to substantiate the cost. It is equally important to ensure the PQS complies with clauses of the contract that define rules for assessing quantities and rates that drive the value of variations. An example is the correction of errors in a bill of quantities as discussed under Section 4.7.4 above. Once the PQS makes an assessment, it is issued to the architect and approved or amended for inclusion in interim or final payment certificates. In reality, rarely will an architect disapprove of the assessment as the PQS is considered reliable for cost managing a project for the employer.

Variations may arise at any time and it is the responsibility of the architect to adjust the contract sum to a value that includes the total of approved cost variations. This task is normally carried out after each variation assessment and, when complete, the architect issues a contract sum adjustment which

represents the employer's financial liability. The contract sum adjustment is numbered for reference with the amounts stated as cumulative. For example,

Contract Sum Adjustment Nr 4

Original Contract Sum :	**£3,000,000.00**
Value of Variations :	**£ 100,000.00**
Revised Contract Sum :	**£3,100,000.00**

In this example, any amount included in earlier contract sum adjustments will be superseded and the revised contract sum will be the employer's financial liability in a final account.

The architect will only issue a contract sum adjustment based upon the appropriate clause(s) of the contract. Using JCT Intermediate Building Contract 2011 as an example, this involves:

- The value of work cost variations
- The full value of:
  - Fees and charges in respect of the works
  - The cost of carrying out inspections and testing following an architect's instruction
  - Cost and expense associated with recommencing works following a suspension of works with the contractor exercising a right to make a claim
  - Fluctuations in payable amounts to named subcontractors
  - Fluctuations in payable amounts because of levies, contributions and revised taxation
  - Loss and expense claims
  - Insurance purchase for the works under the Insurance Options Schedule 1, i.e. either by the contractor or employer
  - Restoration costs borne by the contractor following an incident where the employer purchases insurance for the works
  - Incorrect supplied details regarding levels/set out information that alters the scope of works
  - The cost for works carried out by others because the contractor ignores instructions
  - Insurance for Terrorism Cover - policy extension and premium adjustments
- The deduction of provisional sums or the value of any works assessed with approximate quantities in the contract that are reassessed as work cost variations
- The cost to repair defects after a date of practical completion which are not carried out by the contractor
- Changes in the premiums payable if the Joint Fire Code applies

A contractor may generalise the above bullet points as 'variations to the contract sum'. However, if communicating anything of a contractual nature

involving a contract sum adjustment, the correct contract interpretation should be used as this will be the architect's understanding which is based upon the provisions of the contract. Ideally, the value of a contract sum adjustment should be to an amount agreed with the contractor. If there is a disagreement, the contractor may accept or reject it and, if rejecting, may refer the matter to dispute resolution. Normally, in the event of a dispute, the works must be carried out and the dispute procedure does not vitiate the contract. The arrangement for approving works variations in a design and build project is usually different because there is no PQS. Here, the employer may deal direct with the contractor who issues the employer's agent (if engaged) with an approval stating an agreed amount that varies the contract sum.

4.7.8 Payments

In general, payment clauses outline the process for reimbursing the contractor, including the dates for issue of interim payment certificates and time frame for a final payment certificate that state an amount due. A characteristic of construct-only projects is the level of involvement from the PQS who assesses a value of the works on behalf of the architect which is required to prepare each certificate. The contractor's quantity surveyor must not be complacent about these clauses by permitting the PQS to assess the value of works alone and must assist the process by providing progress claims or 'interim payment notices' as well as a final account in a timely manner.

In the unusual situation of an architect not acknowledging a date for issuing a payment certificate, the architect will have created a breach of the contract. This may be unwilling conduct if the architect becomes insolvent and can leave a vacuum in the process with the contractor starved of income. If the quantity surveyor witnesses this on a project, the employer must be contacted who has a duty to make alternative arrangements.

Usually, each architect's payment certificate is issued to the employer and a copy sent to the contractor. To be effective, a certificate does not need signing specifically by the architect and can be authorised by a person permitted as the payment certifier to act on the architect's behalf which is usually in the business name of the architect. Should the employer not contest the certificate, there is a duty to pay the sum within the terms and conditions of the contract. A contractor may assume that receipt of the architect's payment certificate is a guarantee for payment and proceed to make plans based upon the assumption. However, this is not the real situation because contracts have clauses permitting an employer to advise the contractor if an amount stated as due on a certificate will be paid in full or if it will be reduced and if the reduction is temporary or permanent. The requirement to provide a 'pay less notice' is legislated under the Construction Act and Local Democracy, Economic Development and Construction Act 2009. This latter Act amends the Construction Act and requirements of the Act(s) are reflected in standard forms of contract to reflect legislation. A pitfall for the employer is that a 'pay less notice' must be issued

and received by the payee within a defined period. Failure to comply will result in the loss of the privilege with the full amount becoming due. If the employer complies with the contract and legislation by advising the contractor and issues a 'pay less notice' within the specified timeframe, the contractor's remedies upon receipt include:

- Accepting the change and acknowledging any oversight by the contractor and architect
- Rejecting the change and referring the matter to dispute resolution as a contractual right
- Suspend the works in full or in part using the contractor's right of suspension clause.

If a contractor elects to suspend the works and is later vindicated and paid in full with the suspension lifted to recommence works, it can issue a claim for loss of interest on the outstanding payment subject to the terms of the contract as well as an extension of time.

The quantity surveyor should be committed to ensuring payments are received which is a reflection of the work that goes into preparing each progress claim. Of course, it also maintains the solvency of the contractor and is the financial lifeblood for the project.

4.7.9 Termination

A successful way of discharging a contract is by performance when both parties complete their obligations with the project satisfactorily concluded. However, it is possible for a contract to be terminated at any time, and in the event of this unfortunate event, contracts usually have clauses to deal with the matter. In general, contract clauses list grounds for termination when it is sought by the employer only, the contractor only or by mutual agreement. In general, and following the JCT Intermediate Building Contract 2011 as an example, grounds for termination by the employer are:

- Contractor's insolvency
- Default by the contractor including situations where a contractor is responsible for the whole or substantial suspension of the works
- Failure of the contractor to perform regularly or diligently with progression of the works
- Contractor's negligence for repairing defective works
- The contractor does not comply with the CDM Regulations
- The contractor assigns the contract without consent
- The contractor fails to procure subcontract works in accordance with the contract
- The contractor is guilty of corruption
- The employer decides not to complete the works.

Under the same form, grounds for termination by the contractor are:

- Employer's insolvency
- Default of the employer if the contractor receives no proper payment
- The employer interferes or obstructs a payment certificate
- The employer does not comply with CDM Regulations
- The employer fails to issue certain instructions covered by specific clauses
- The employer assigns the contract without consent
- The works are suspended for a defined period resulting from specific instructions.

Terminations by either party with this form are:

- *Force majeure*, releasing a contractor from its obligations caused by an event
- Statutory undertaker's default or negligence
- Loss or damage to the works caused by 'Specified Perils'
- Delays invoked by authorities dealing with civil commotion and the use or threat of terrorism
- Central government intervention.

When termination is sought, it is necessary to observe clauses outlining the notice procedures that the party seeking termination must give to the other and the consequences of termination. As part of the review of the main contract, it would be prudent for the quantity surveyor to be aware of the existence of notice periods and to understand their repercussions to ensure that appropriate procedures are followed which do not breach the contract. During the construction phase, if there are unique circumstances that give rise to termination which are not covered by clauses in the contract, termination may take place using common law principles. This is beyond the quantity surveyor's skill and control, and legal advice would normally be sought by the contractor's directors. This may also apply if works are carried out in the absence of a contract, when the contractor relies on the preliminary agreement that for whatever reason fails to transpire, leading to the permanent cessation of the works by the contractor.

If there is a dispute because of the conduct of termination or situation where the contract may have no remedy or a party considers the other is in breach, it will be necessary for the parties to consider the dispute resolution clauses of the contract. One type of dispute resolution is litigation which is a process dealing with conflict on legal grounds and involves a court of law applying remedy at common law or statute. This does not require including in the contract because access to the legal system is a statutory right and it is usually included in the Articles as a matter of course. Jurisdiction with litigation is prolonged and decided on a win/lose scenario which might be an undesirable outcome for the parties and the dispute itself may be a waste of the legal system's time. For this reason, other methods of dispute resolution are available and usually

included in the contract. This includes mediation, conciliation, adjudication and arbitration, which are methods of alternative dispute resolution (ADR) to litigation and not restricted to a dispute involving termination. The subject of litigation and ADR is discussed further in Chapter 6, Sections 6.8.

4.7.10 Warranties

A warranty is a contractual term meaning the promise or pledge of security by the contractor to the employer to repair or replace any defective component or part of a component in the event of its failure to perform the intended function. If an owner or occupier inherits a defect, the contractor has no obligation to acknowledge the warranty if the employer is insolvent and the rectification period has expired. This leaves the owner/occupier to either replace the component at their own expense or sue the contractor in tort (a civil wrong) of negligence with a civil action. To avoid this unpleasant scenario, owner/occupier(s) are named in a schedule of the contract as beneficiaries of collateral warranties that a contractor and/or appropriate subcontractors will provide. To be effective, collateral warranty clauses are linked to contract particulars which identify the names of owners, tenants and project funders who share an interest in a project that will be beneficiaries and lists the part(s) of the works requiring warranties.

In general, an employer can only seek collateral warranties from a contractor. However, there may be a need to obtain warranties from certain trade contractors (who are subcontractors) and suppliers selected to supply goods for the works. These trade contractors and suppliers must be prepared to legally assign their bound rights and obligations with the contractor to the employer/owner/occupier and/or any other named party. This usually takes effect at the date of practical completion or at the end of a period when the contractor is not responsible for defects. For example, an employer may engage a contractor to construct a jetty where there is high salt content in the natural environment and specifies a particular paint because the supplier provides a 20-year warranty. The employer may seek favour in a collateral warranty from the manufacturer to provide assurance in the event of a defect and will have automatic redress if provided the warranty. However, as a trade contractor will apply the product, it may be the trade contractor who provides the collateral warranty because, to be effective, the material must be applied in accordance with the manufacturer's guidelines. However, any beneficiary will need to ensure the areas are maintained in accordance with the guidelines for the warranty to be effective.

When reviewing a main contract that includes a provision for collateral warranties, it is important for the quantity surveyor to consider which part(s) of the work(s) are to have warranties and the trades involved. This is because the contractor must select subcontractors who are able to provide appropriate warranties or are licensed to apply, install or commission a product that is to have a warranty supplied.

4.7.11 Contract schedules and special provisions

Separate to the clauses of a contract, the parties may elect to include contract schedules that are either part of the standard form or specific for a project which are appended to the form. A range of schedules includes:

- Rules and methods for the engagement of named subcontractors
- Rules and methods for the engagement of nominated subcontractors including tripartite arrangements and the parties obligations under the contract.
- Employer's engaged contractor's requirements including their schedule of works
- Schedule of optional insurance for the works with options not to be used struck through
- Schedule of bonds, i.e. bank guarantee, etc as the employer's financial security. Bond provider's certificates are not usually attached to the form. However, existence of each bond requires formal mention in the contract
- Contractor's period of notice for responding to an instruction
- Fluctuations option where prices are subject to change and the rules applicable to calculations
- Termination payments
- Bonus incentive payments for early sectional or practical completion
- Payment schedules by works stages, usually applicable to a design and build contract
- Health and safety bonuses, i.e. benchmarked for the lowest number of reported accidents
- Construction programme
- Contractor's proposals and design obligations with a design and build contract.

Special provisions (or Supplemental Provisions as per the JCT forms of contract) have grown in popularity to use in standard forms. The provision of industrial buzzwords and phrases has become customary in the construction industry due to legislation and cultural change and it is encouraging that standard forms include these special provisions as they act as a breath of fresh air from the written clauses. As a condition of contract, they are technically and legally enforceable. However, the spirit in which they are intended appears to be the focus, and rarely, if at all, should they require enforcing as their inclusion is to remind parties of the common goal of a project, i.e. to deliver a scheme on time, at an agreed cost, of the anticipated quality and dispute free. For example, the JCT Intermediate Building Contract 2011 Supplemental Provisions Schedule 5 promotes collaborative working as an expressed term that requires parties to work 'in a co-operative and collaborative manner, in good faith and in a spirit of trust and respect'. It also promotes collaborative working with health and safety in addition to statutory duties which seek to promote good practice 'in which

health and safety is of paramount concern to everyone involved in the project'. The form also provides parties with the option to exclude the provisions.

The growth of information technology has become influential with construction procurement and is a vital management tool for providing the flow of information for the construction of buildings. Collaborative project management systems are being included in standard forms to ensure parties understand their obligations that save time rather than wastes it. It is good practice if a contract also includes methods of effective communication. An example is the method of communicating instructions, i.e. they must be in writing, and the method must be clarified because with emails and faxes being widely used, an instruction may be considered received if it is sent by any of these methods.

Standard forms of contract also include collaborative methods that aim to improve project performance and include provisions for contractors to provide cost savings and value management or suggested improvements to a design. Furthermore, because many contractors are involved with design and sustainability, there is encouragement for contractors to participate with the design process and offer suggestions to economic and viable methods of construction for the employer's consideration. With the growth of design and build procurement, contractors are considered suitably competent to advise an employer on design matters and act as consultant on related construction matters.

Other special provisions include the use of performance indicators created and monitored by the employer. Here, the contractor is obliged to provide information to the employer who will assess the contractor's performance with the employer reserving the right to advise a contractor if it considers its performance does not meet the requirements.

The aforementioned points are generally driven by industrial change which drafters of contract forms have recognised and appropriately include. However, some forms may require special provisions that are unique and suitable to the culture and sensitivity of a project and may be appended to the contract. These includes specific health and safety requirements where a contractor is working on projects of high risk which are driven by the employer, contractor or both and need to comply with CDM Regulations. Special Provisions may also apply because of an employer's business and industrial policy for projects such as nuclear power stations, working at height and specialist structures that require specific work method statements. Furthermore, these provisions may apply for projects requiring confidentiality and may be for security reasons. This may involve not disclosing a project's identity to the public and media, and applies to embassies, security buildings and places of worship where the confidentiality of the employer and project require respect.

4.8 Edited and bespoke forms of contract

Standard forms of contract may be edited by either party and both must agree the changes in order for them to take effect. Words on a standard form might be changed for practical reasons because they serve no purpose (where in fact

Table 4.10

Employer modified version

'Not later than ~~6 months~~ ***21 days*** after the issue of the Practical Completion Certificate or the Section Completion Certificate, the Contractor shall provide the Architect/Contract Administrator, or (if so instructed) the Quantity Surveyor, with all documents reasonably required for the adjustment of the Contract Sum. Not later than ~~3 months~~ ***120 days*** after receipt of those documents a statement of all the final Valuations under section 5 shall be prepared by the Quantity Surveyor and copies of that statement and the computations of the adjusted Contract Sum shall within that ~~3 month~~ ***120 day*** period be sent to the Contractor.'

Contractor modified version

'Not later than 6 months after the issue of the Practical Completion Certificate or the last Section Completion Certificate, the Contractor shall provide the Architect/Contract Administrator, or (if so instructed) the Quantity Surveyor, with all documents reasonably required for the adjustment of the Contract Sum. ***In the absence of written instructions from the Architect/Contract Administrator being available to substantiate any variations that should be included in the final Valuation, the Contractor will provide it's own written proof of communication for consideration by the Architect/Contract Administrator or Quantity Surveyor for inclusion in a final Certificate***. Not later than 3 months after receipt of those documents a statement of all the final Valuations under Section 5 shall be prepared by the Quantity Surveyor and copies of that statement and the computations of the adjusted Contract Sum shall within that 3 month period be sent to the Contractor.'

Bespoke clause using an alternative form drafted by the Employer

Not later than 21 days after the issue of the Practical Completion Certificate or the last Section Completion Certificate, the Contractor shall provide the Employer with all documents required for the purposes of the adjustment of the Contract Sum. Not later than 120 days after receipt of those documents, a statement of the final account shall be prepared by the Employer in consultation with the Employer's engaged Quantity Surveyor/Project Manager and a copy of that statement and the calculations of the adjusted Contract Sum shall be sent to the Contractor.

they could be left in place as they will not be referred to anyway). Furthermore, the parties may wish to change implications so that the form becomes either a contractor or employer-friendly contract, thus clarifying with whom the risk rests. To be enforceable, any insertions must be legal which may be advised by one or both parties' lawyers before the contract is executed. When the parties elect to include a number of changes, it may be practical to abandon the use of

a standard form and create a bespoke contract which is a uniquely prepared contract usually drafted by the employer for a project or series of projects.

To demonstrate the differences between editing and the creation of a bespoke form, Table 4.10 is an extract from the JCT Intermediate Building Contract 2011 citing Clause 4.3.2 which addresses methods of adjusting the contract sum. The standard clause describes the length of time after a date of practical completion in which a contractor must issue a final account and the length of time the architect has to respond once it is received. Editing of the clause involves modifying the contract by striking certain wording and inserting new which is shown in bold italic to create either an employer- or contractor-friendly version. By comparison, Table 4.10 shows a contract term addressing the same subject that could be used with a bespoke form of contract.

When a new employer–contractor relationship is formed, knowledge of working ethics may be lacking and there may be initial distrust on the contractor's part as to why such a form is chosen when there is a variety of standard forms available for purchasing. For a quantity surveyor who has some experience of standard contracts, a bespoke form may take some time to relate to as it may clash with experience gained from standard forms that are generally impartial. Clauses written in bespoke forms that vary from a standard contract may include:

- A catch-all clause stating the contractor is satisfied the contract documents permits the contractor to have an understanding of the scope of the project defined in the contract.
- Time barring claims for an extension of time or a loss and expense claim from the contractor. Thus, in the event of a delay giving rise to a claim, an expressed term may state that notification must be issued in writing within a certain timeframe after the incident giving rise to the claim, and if it is submitted late, it may be grounds for rejection.
- A contractor's responsibility to coordinate the design on a construct-only contract and advise the architect within a stipulated timeframe of any inconsistency together with associated costs. A clause may state that if a specified period elapses without the contractor responding, the employer may assume there is no cost and the issue of the drawing is deemed an instruction. The inclusion of such a clause is to ensure the contractor is proactive with design involvement and participates with the process, especially if designing discrete parts of the works.
- A responsibility of the contractor to notice errors or omissions on drawings, whether or not the contractor produces them. Here, a clause may express a requirement for the contractor to check 'for construction' information and at its own cost carry out any alteration or remedial works caused by the error. This clause would permit a contractor to amend drawings without in any way reducing the functional performance of the component.
- Expressed exclusion for the payment of unfixed materials, per se.

- In the event of litigation, the law of the land applying in the country where the project exists is the rule of law. Thus, if a project is in country 'A' and the employer is based in country 'A, B or C' and the contractor is based in country 'A, B or C', the effective courts and their rulings will be in country 'A'.

Advantages of bespoke forms include:

- They are suitable when the contractor and employer have repeat business and the form stands the test of time with the business relationship
- They are usually advantageous for the employer who pays for the creation
- They may have suitable clauses for a project that may be vague on a standard form
- Certain forms may have been tested by the courts and are enforceable.

Disadvantages include:

- They are expensive to prepare and take time to draft
- They generally disadvantage the contractor because clauses favour the party requesting the form, i.e. the employer
- Illegal clauses may be included unbeknown by the parties until tested by the courts
- The quantity surveyor administering the project will spend more time reviewing the form than with a standard contract with which he/she may be familiar.

As with standard forms of contract, if the quantity surveyor reviews a bespoke form at the earliest available stage, it will aid an understanding of how a contract is to be administered that will save time once the project is flourishing.

5 Supply Chain Procurement

5.1 The supply chain

Supply chain procurement is an important aspect of managing a construction project and could have been included in Chapter 6, 'Running the project'. However, as it is a vital part of commercial and project management, the topic warrants its own chapter.

Supply chain procurement refers to a system of appointing businesses, individuals, resources, and technological input from a range of suppliers which combine to deliver a product to a customer (the client). For a project to function properly, placement of awards is necessary for any or all of the following:

- Labour-only subcontractors
- Subcontractors who supply and fix materials and commission the works
- Material suppliers
- Manufacturers that produce goods for material suppliers to sell or fabricate as components
- Raw material resources to supply manufacturers
- Plant equipment hire
- Design and specification writing consultants
- The contractor's own in-house resources that need mobilising to a project.

The methods of procuring these items will involve different levels of responsibility and control by those involved with the project. A client might elect to place awards with material suppliers for the supply and delivery of goods for installation by the contractor or for the supply of goods and services to be incorporated into the works excluded from the contractor's works. Furthermore, a client might place awards with statutory authorities to supply and lay utility service mains and provide points into a building for connection, servicing and commissioning by others. 'Others' can be the contractor, its subcontractors or client-engaged contractors where the contractor will supervise works undertaken by statutory authorities in addition to its own works and appointed trade

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contractors as long as the works are carried out during the construction phase. The procurement of materials is delegated to the contractor, material suppliers and trade contractors who must manage the process to ensure manufacturers and suppliers at the bottom of the supply chain produce the goods in a timely manner.

As part of its responsibility for a project, a contractor must endeavour to procure a supply chain in a timely manner. The quantity surveyor plays a vital role in the process because it requires a commercially-aware person to drive activities and ensure awards are placed on time and within the parameters of the budget. On a large project valued at say over £5 million, the first three months are the busiest time for procurement and the quantity surveyor should aim to award most trade and material packages within this timeframe where possible. Small projects require awards to be issued in a short timeframe and these must be addressed within the time available using the construction programme as a guide and the resources used for preparing the tender. It is possible that scores of supply chain members are engaged on a project, and to maintain control it is necessary to create and update a list of the names and contact details of subcontractors, major suppliers and consultants as well as client-engaged suppliers and contractors. This is to ensure the project team is aware of contact detail information to enable them to coordinate the construction activities.

A contractor might be tempted to delay the placement of awards if it is made aware of works variations, and decide to halt procurement until the revised information becomes available. This decision cannot be commended because a delay in issuing awards might not go to plan and could be detrimental to the contractor. For example, say a contractor has secured a contract to construct a dozen houses based upon a set of drawings, but with the floor plans due to be enlarged and a revised set of drawings to come before the foundations are excavated. Here, the contractor must endeavour to place an award for the foundation works based upon the information available so the works can theoretically commence on time, and it should not wait for a quotation based upon revised information and then place an award. If an award is placed, it is possible for a contractor to instruct the engaged subcontractor not to proceed with the works until revised information becomes available. When a contractor is issued a contract based upon a set of drawings and documents and proceeds to award packages based upon the same information, any variation will reverberate along the supply chain. Needless to say, the earlier the awards are placed with the supply chain, the better it is for the project.

5.2 Labour-only subcontractors

Unless restricted by the main contract agreement, the contractor may elect to split certain trade packages when materials are purchased by the contractor for installation by appointed labour-only subcontractors.

Advantages of this type of procurement for the contractor include:

- Payment is made for works at set rates that a contractor can afford
- The main contractor incurs no employment costs, meaning payable rates are competitive when tendering for works
- Engagement is on a needs basis
- The hierarchy management of a subcontractor's business structure is omitted or reduced, with less bureaucracy to deal with
- Terms of engagement are generally rapid and less formal
- Benefits from full trade discounts for material purchases
- More control and a say with working operations
- There is no contractual duty to pay if works are hindered when the contractor is not responsible.

Disadvantages include:

- Close scrutiny of material wastage as labour-only subcontractors are generally not responsible
- Possibility of payments for abortive time due to late deliveries of materials that are beyond the control of the labour-only subcontractor
- Possibly harder to source than labour and material subcontractors
- More supervision is required, i.e. coordinating materials/plant requirements
- Material scheduling is required because labour-only subcontractors are not responsible for the quantities delivered
- Additional accounts and administrative arrangements due to the number of accounts to process and maintain, i.e. weekly or fortnightly payments
- Limited control over the reliability to arrive on site (a written contract will provide protection)
- Drain on cash flow because payments are regular, i.e. weekly or fortnightly, when the contractor is paid monthly or by stage payments on an Activity Schedule.

5.2.1 Methods of engagement and reimbursement

Generally, site and project managers will procure trades where market payable rates apply and the contractor is in the fortunate position that it can drive the situation without tendering the works. In this scenario, established contractors have a database of labour-only subcontractors to choose from and it is usually the site and project managers who initiate contact and engage them. Alternatively, the contractor could place adverts in local newspapers, trade journals or recruitment and job agencies, describing the project and requesting contact from particular trades. Due to the competitive nature of labour-only subcontracting, a contractor advertising in the media or through an agency

may elect not to disclose payable rates and describe prices as 'subject to negotiation', or 'competitive rates apply'. This approach is generally used and more so with brick- and block-laying trades, and is common in residential construction. When negotiating payable rates, site and project managers have cost targets that are the maximum a contractor can afford to pay for a project and are advised by the quantity surveyor, as discussed in Chapter 4, Section 4.5.2.

Unlike contractors, national house builders tend to procure a larger number of trade works with labour-only subcontractors instead of labour and material subcontractors to service their projects. This involves the house builder creating cost targets for selected trades by house type, i.e. carpentry prices for 3-bedroom semi-detached properties, 4-bedroom detached, etc. These are issued as a price list to site and project managers who appoint tradesmen upon agreement with the prices. With this approach, there is no tendering and the labour-only subcontractors claim a percentage each week of the total price for the works completed.

If a main contractor, constructing any type of project, cannot negotiate payable rates using cost targets, it will be necessary to obtain a schedule of rates or a fixed price by using a competitive tendering system. This is the quantity surveyor's responsibility and is dealt with in the same manner as procuring labour and material subcontractors.

As a last resort, labour-only subcontractors may be engaged and reimbursed on hourly rates. Reasons prevailing for this type of engagement include:

- Scarcity of the number of trade persons in a particular locality
- High demand for trades in a locality, making them hard to source
- Limited existence of specialist trades for which no rates exist
- Small quantities of work or the work is so complex that pay at normal rates would be a pittance.

This provides a contractor with the following disadvantages:

- The contractor does not know what the final expense will be
- There is no incentive and the works can become prolonged
- Additional site supervision is required to authenticate works and record time
- Subcontractor complacency.

The only advantages to a contractor of paying hourly rates are that the appointments will actually trigger the start of the works and if a contractor is reimbursed on dayworks, the risk is transferred to the client.

5.2.2 Contractor's risk

The main contractor may have to address the problem of a scarce labour force once a project commences when trade markets become exposed as fickle. Here,

a contractor must deal with the situation the best it can, because it has probably committed to delivering a project on time for an agreed cost even though a scarce labour force might not have been a point of concern when the project was tendered. For example, timber frame wall construction involves using a brick veneer, which reduces the value of wall construction for bricklayers because the frame substitutes a block wall. This means the amount payable to bricklayers is low compared to combined brick and block construction so when demand for the trade outstrips supply, operatives might elect to work for others carrying out brick and block construction. Their earnings could be higher, especially if they are unfamiliar with the timber system that will take time to understand.

When a labour-only subcontractor submits a tender, it is necessary for the quantity surveyor to consider qualifications that state inclusions, exclusions and clarifications with the scope of works. A subcontractor may state that its tender is based upon assumptions and attendances that a contractor must provide free of charge for its operatives, e.g. materials supplied and located for ease of installation, free use of scaffolding, power supply for tools, etc. These are examples of attendance items a contractor usually includes in the project preliminaries. The list of attendance items required for subcontractors is generally in accordance with the contractor's project manager's requirements and part of the preliminaries pricing assessed during the project tender period. When these items are qualified as excluded by the subcontractor, they should be accepted as a matter of course because the contractor's cost for their supply is part of the contract sum payable by the client to the contractor.

The appointment of labour-only subcontractors is not suitable when testing and commissioning works is required, including electrical works and heating systems. This is because with these trades the contractor cannot take the risk for material scheduling and ordering of goods as they are not within the contractor's expertise.

In general, appointing labour-only subcontractors is risk to a contractor because sufficient supervision might not be available, meaning additional resources would be required. Furthermore, the material wastage is an unknown factor and will require monitoring. On the flipside, this type of procurement has historically proven to be financially competitive for a contractor, which it should adopt when it is confident it can deliver.

5.3 Labour and material subcontractors

Labour and material subcontractors are sourced from three origins:

- Those selected and appointed solely by the contractor as domestic subcontractors
- Those named and inserted into schedules, specifications or a bill of quantities that form part of the appropriate JCT contract and are subsequently appointed by the contractor when they become domestic subcontractors

- Those nominated in the form of contract with the contractor involved in a tripartite contractual arrangement with the client and subcontractor.

Procurement of each of these and the contractor's involvement is discussed below.

5.3.1 Domestic subcontractors

Methods for selecting domestic subcontractors include:

- Using the contractor's database of companies
- Recommendation from other contractors
- Contractor's staff referral
- Client referral
- Those that submitted prices to a contractor when it was preparing a bid for the project
- Those involved with creating the site accommodation
- Advertising the project in the press and requesting trade businesses to contact the contractor
- Yellow Pages.

During the construction phase, subcontractors and suppliers might express an interest in a project and approach the quantity surveyor, site or project manager. Interested subcontractors may have heard of the project from the contractor's estimator or other staff member. They may have also gained knowledge of the project through industrial networking, public notices or simple observation if they are passing by and the contractor has a visible presence. This interest is encouraging because it places the contractor in a better position to obtain competitive quotations without restricting its choice. Any subcontractor or supplier making oral contact with the contractor should be requested to issue a letter expressing an interest in the project, stating its desire to be included on a tender list of companies for the quantity surveyor to keep on file.

It is important that a contractor appoints subcontractors able to service a project so that it runs smoothly, and one method of assisting this is to have a vetting process. This involves the quantity surveyor completing a questionnaire to assess a subcontractor's capabilities and appropriateness for a scheme. Small-sized contractors tend to be informal with this procedure and rely on word of mouth or only apply a vetting process to unknown subcontractors. Larger contractors, however, might adopt a policy of completing a pre-tender questionnaire for any subcontractor it wishes to obtain a quotation from, even if they have been engaged on existing or completed projects. This might also be a mandatory requirement stated in the policies and procedures manual which could contain templates to act as guides to the type of questions used. The questionnaire should be project specific and outline the project scope of works and commitment expected from a subcontractor if engaged, and should be issued to the subcontractor for completing

and returning. Alternatively, the series of questions and answers can be conducted over the telephone and the form completed by the quantity surveyor. Information required about the subcontractor includes:

- Registered business title and address
- The current business financial turnover
- Minimum and maximum value of works undertaken
- Type of works undertaken
- Name of two referees of current or completed projects and their contact details.

In the absence of a formal vetting procedure, it would be wise for the quantity surveyor to keep notes about a subcontractor's capabilities from initial contact as the objective is not to waste time by approaching businesses that are unable to service a scheme. For example, if a contractor wishes to award a plumbing and heating package worth £400,000, there would be hardly any point contacting a subcontractor that only carries out minor domestic works because the works they undertake are incompatible. By contrast, a small building extension would not be suitable for a subcontractor involved only in large schemes because their prices would not be competitive. A simple vetting process would quickly identify the situation and 'make the shoe fit' for appropriate subcontractors to be selected as suitable for a scheme. Contractors have differing policies for awarding trade packages, with some leaving selection to the project team and others applying company policy and procedures. There are certain business considerations that drive this objective, i.e.:

- The project is small in value or requires an immediate start after executing the main contract. Possibly time is not on the contractor's side and it must approach those subcontractors that provided quotations during the initial tender period. The exception would be any subcontractor that has since become insolvent.
- The contractor may have reduced its margin in order to obtain an award, meaning budgets are lean. This will result in risk to the contractor and by inviting subcontractors to issue tenders during the construction phase, financial savings may be produced that mitigate the risk.
- Quotations received during the initial tender period may be open for acceptance for a period of 30 or 60 days, and because works will not be required for some time after, the quotations become invalid.
- Where a bill of quantities is a contractual document, it forms the basis of the main contract and a contractor's policy might be to issue awards to subcontractors that priced the bill of quantities.

If a bill of quantities is not a contractual document and the project team's consensus is to tender the works as time is permitting, the quantity surveyor must issue invitations to tender to obtain quotations. The process is similar to

that carried out during the initial tender period which may have been carried out by a quantity surveyor involved with the estimating team as discussed in Chapter 3, Section 3.4.2. Naturally, any subcontractor that submitted a tender to the contractor during the initial tender period must be given the option to sustain or update their price.

A failure of the tendering procedure during the construction phase is when the contractor overwhelms subcontractors with information or provides irrelevant information whilst also omitting relevant details. For example, an electrical contractor will require the electrical specification and electrical drawings as a minimum requirement to price its works but would not need, for example, drawings of architecturally designed partitions that show the location of power points if the information is stated in the electrical specification. If there is confliction between the electrical and architectural documents, the problem needs to be clarified by the architect. Here, the quantity surveyor should make a request to the client's agent to explain the problem and, with time permitting, delay the invitation to tender pending an answer if the discrepancy is likely to influence the price of the works. Ideally, a set of tender documents should include:

- A set of contract or 'for construction' documents
- A written scope of works
- The construction programme
- A draft of the proposed form of subcontract agreement.

The scope of works is a statement of requirements. It is usually drafted by a quantity surveyor and approved by the project manager, and it informs subcontractors of the works required and specific requirements the contractor wishes the subcontractor to include that may not be obvious in the documents. Ideally, the scope should be tabulated to include:

- A brief outline of the trade works cross-referencing to the tender documents
- Staging and phasing of the works
- Items a contractor will provide the subcontractor as builders work in connection
- Items a contractor will provide as attendance
- Involvement and coordination with other trades
- Compliance with CDM 2007
- Site-specific requirements.

The scope of works is not a statement telling the subcontractor how to do the work as that is a matter for the subcontractor. It is a mere statement of what is required from a subcontractor to fulfil the trade works. When issuing the scope, a contractor's objective is to ensure there are no gaps in the requirements that leave minor parts of work unaccounted for. This is because it could lead to a

claim for payment for additional works whilst works were in progress, which a contractor could not recover through the main contract.

A contractor may be managing a sequence of working activities involving coordination between trades and, if applicable, notes will need to be included in the scope of works. For example, say a contractor is inviting electrical subcontractors to submit tenders for power and lighting, and the client is to appoint a contractor to supply and install a system to control lighting using 'intelligent wiring'. The scope of works has to state that the successful electrical subcontractor must coordinate its works with the client's contractor, and explain the lighting system. This is because suitable coordination is required to test and commission the electrical system for the project.

When inviting tenders, it is necessary for the quantity surveyor to state the tender period. This needs to allow sufficient time for the businesses involved to assess the documents, seek prices from suppliers, ascertain the risks involved and prepare quotations for the works. A reasonable duration would be two working weeks as long as the works are clearly documented, of an uncomplicated nature and a bill of quantities is provided. This can be extended to four weeks when the works are complex in nature and a bill of quantities is absent when subcontractors are responsible for producing their own quantities. The information issued by the contractor needs to be accurately collated and scheduled, and must include a cover letter and a document transmittal that lists the title, number and revision of each item sent as they may become items to include in a contract. The cover letter must state a method of submitting a tender which should be addressed to the quantity surveyor and can be by snail mail (post), fax or email. Fax or email would be the preferred options as they are automatically communicated. Snail mail has a disadvantage as it may be delayed in distribution or lost.

5.3.2 Named and nominated subcontractors

The named subcontractor concept is mid-way between domestic subcontractors appointed at the contractor's discretion and those nominated by the client. Named subcontractors have involvement with the contractor during the project tender period and, in essence, an award is the continuation of negotiations without the client having a contractual link to the subcontractor. The process is used where the form of main contract is the JCT Intermediate Building Contract. The process involves the contractor issuing an invitation to tender using JCT form ICSub/NAM/IT, giving details of the project and stating the nature of the subcontract works. The subcontractor must issue any quotation on JCT form ICSub/NAM/T addressed to the employer and contractor quoting a price for the works as per the documents and including entries under items T1 to T5. These items are associated with programming, contractor attendances, price fluctuations, dayworks and installation of the subcontract works into the main contract works. The quantity surveyor must observe requirements of the contract for engaging named subcontractors. For example, JCT Intermediate

Building Contract 2011 clause 3.7 affirms an obligation of the contractor to award these subcontract packages not later than 21 days after the contractor executes the main contract agreement.

Client nomination

The appointment of nominated subcontractors is the limit of the client's control and involvement with the selection of subcontractors. In broad terms, the nomination process involves the client facing two contractual fronts. The first is where it enters into a binding agreement with a subcontractor it chooses to nominate using a predetermined form. The second is under a separate agreement with the contractor who is contractually obliged to appoint and reimburse the subcontractor because of a tripartite agreement, thus contractually binding the same subcontractor to the contractor.

In general, the client must include the nomination provision in the tender documents to allow the contractor to reasonably object. At this stage, the contractor may decline to tender or might submit an offer outlining any objections as a condition of tender subject to negotiation. Any objections must be clearly stated together with reasons for the client to consider, e.g. unfavourable credit term requests from the subcontractor or the subcontractor's reluctance to indemnify the contractor from claims against the client. The client takes the lion's share of the responsibility for nomination and must have a strong desire to control a portion of the works because, in general, the client is agreeing to protect the subcontractor from default by the contractor.

The contractor has a responsibility to deliver a project on time and may see the nomination process as a risk that can cause tension with procurement and this is one reason nominated provisions are seldom used in standard forms. However, if nomination does apply on a project and is included in the contract agreement, the quantity surveyor needs to observe the rules of appointment and comply because the subcontractor will have recourse from the client because of the separate contract.

5.3.3 Tender periods and openings

As the contractor is driving subcontract selection and seeking to obtain new or updated tenders, subcontractors could approach the quantity surveyor to help answer queries such as:

- **Problems with the building process** If the query involves items such as locality for storing materials, site access, etc, it is generally the contractor who provides answers.
- **Design errors** Any design error must be referred to the client's agent or appropriate consultant to answer the query after the contractor affirms a subcontractor's observation is valid.
- **Inconsistency with design** Here, the order of precedence should apply. For example, if the thickness of a precast concrete floor is shown as 250 mm deep

on the structural drawings and 200 mm on the architectural, the structural will take precedence because the floor thickness is critical to the structure of a building. However, the quantity surveyor should seek clarification from the architect or document controller and, in the meantime, exercise the order of precedence methodology by instructing subcontractors to provide quotations based upon the structural drawings and clarify this in their tenders. It would be a waste of a subcontractor's time to request optional prices for the different thicknesses and would be best answered with a clear instruction.

If one or more queries are raised by one trade subcontractor and the response is to amend the original tender documents, each subcontractor issued with the enquiry must be provided with the contractor's response. This is to enable them to submit priced quotations on an equal basis. If a response takes time to answer and stifles the tender period, the contractor should grant an extension of time (which is usually at the request of subcontractors) and take into consideration any time lost that affects the length of negotiations prior to the issue of an award.

There may be situations when a subcontractor makes a request to price additional works that are not part of the invitation to tender. For example, a formworker may also want to include a price for placing steel bar reinforcement in addition to formwork because it also provides the service. Here, the quantity surveyor may elect to accept the request and issue additional information and instruct it to be an optional price. It would be wise to advise the relevant subcontractor that, by accepting the request, the contractor reserves the right to accept any offer based upon the initial enquiry and acceptance of the subcontractor's offer is not contingent that the subcontractor must receive an award for the initial enquiry plus other works. When the number of subcontractors issued with invitation to tenders alters, the project and site managers need to be informed so they are aware of the number of tendering companies pricing each trade package. This is best tracked with a tender schedule created on a spreadsheet that lists the trades and name(s) including contact details of companies tendering the works together with due dates.

Situations can occur when a subcontractor cannot or does not wish to comply with a tender enquiry and seeks direction from the contractor. For example, an earthworks subcontractor might wish to exclude the disposal of excavated material off site as requested in the tender enquiry and instead place it in a designated area on site for disposal by others. Here, a degree of flexibility is required of the quantity surveyor who may accept the request if there is a storage area on site and instruct the subcontractor to qualify the exclusion in their tender. However, a subcontractor seeking the change should be advised they are in competition and that competitors are expected to submit quotations in accordance with the conditions of tender; by making a decision to alter the scope, they do so at their own risk and their tender may not be accepted.

Competing subcontractors must price the works in accordance with the specification and it is not acceptable to substitute anything without approval by the client's agent or title stated in the contract documents with the authority to instruct a change. However, a standard form of main contract might

provide flexibility that actively promotes input from the supply chain to improve the value of a project. For example, Supplemental Provisions forming part of JCT forms of contract include:

- **Collaboration** This term has grown in popularity in the construction industry since the early 2000s and is used to promote a spirit of good faith within working relationships. Where included in the main contract, the contractor should repeat the obligation with its supply chain and welcome the opportunity for integration using ideas that promote collaboration. Subcontracting companies employing staff that includes estimators and quantity surveyors may be eager to offer a service where a client can explore alternative products and systems. They may also offer products that they consider are equal to the specification which can produce cost savings. The contractor could certainly consider cost saving options but the subcontractor must confirm that any changes would not jeopardise the programme as it would be counterproductive to accept an alternative product which provides a financial saving yet disrupts the programme.
- **Value improvements** Contractors and subcontractors may provide value improvement by offering cost savings for alternative methods of construction or materials or by increasing prices if the change can provide benefit over the long term. For example, a rendering specification for application to a block wall on a building in a coastal town may describe a traditional mix with sand, cement and water but a rendering subcontractor might recommend upgrading the specification to include admixtures. (Admixtures have an advantage because they can reduce pattern staining caused by salt crystallization to the rendered surface which may only become apparent over time as a result of salt attack from the coastal atmosphere.) Here, the subcontractor has highlighted something that might be considered low risk by the specification writer yet data from suppliers indicate the inclusion of admixtures reduces maintenance costs by 25–50% over a specified period. If wishing to be cynical, the client's agent might look on this as salesperson's talk to promote the product and a method of increasing the cost. However, in reality it is collaboration with value improvements at its best because the interest of the end user is considered.
- **Sustainable development and environmental considerations** As with value improvements, if a subcontractor sees benefits with anything of an environmental nature, suggestions should be put forward in the quotation for consideration. Where possible, additional expense for amending a specified construction component should be demonstrated as a possible trade off against the energy savings a building may produce over a defined period once it is occupied.

Receipt of subcontractors' tenders should be to a date(s) stated in the invitation to tender or to any revised date. Tenders received after this time should not be considered, even if they appear favourable, as failure to comply with the request lacks respect for the tendering procedure.

5.3.4 Tender comparisons

Subcontractors who issued quotations to a contractor during the initial project tender period may amend their price once the contractor is awarded the project. Legally, they are entitled to do this on the proviso their offer has not been accepted by the contractor, as in general this would mean a contract has been brought into existence. There are reasons why a price may fluctuate which include:

- A subcontractor may have provided an original price within a short time-frame and issued a 'guesstimate' only; following issue of 'for construction' documents there is time to examine the documents in more detail
- The price of labour and materials may have increased since the original quotation was issued
- As the contractor has secured the project, there is a realisation the project has become real and a subcontractor might discount its profit margin to make the offer attractive
- The scope of works may have changed.

The quantity surveyor must ensure submitted tenders comply with the contractor's enquiry together with subsequent communications during each trade tender period. All offers must be in writing and an oral quotation should be disregarded if the subcontractor fails to confirm the discussion. Written offers received must be described as a quotation or an offer to carry out the works and not an estimate. A quotation or offer is a firm price whereas an estimate is an idea of probable cost that is not binding unless written verbatim as an amount into an agreement and executed as a contract. If a fixed price is not on offer and a schedule of rates applies, the offer must state the rates are firm and not an estimate and that reimbursement to the subcontractor will be based upon a measure of the works completed in accordance with the tender documents charged at the rates.

A problem can occur when receipt of tenders for a trade exceed the budget allowance. This may happen when the contractor's budget is based upon the procurement of separate labour-only and material package awards which are generally lower than combined labour and materials packages. The contractor might have secured a project because it submitted the lowest offer and elected to include budgets for certain trades procured as split packages. Once the contractor secures the project and is responsible for subcontractor selection, it can alter the procurement method to service the project. However, this can incur costs in excess of the project budget if the project manager overturns a decision made by the estimator at the initial bidding stage and wishes to place a single labour and materials package in lieu of split packages. Reasons for this decision include:

- A scarcity of labour-only subcontractors
- An abundance of labour and material subcontractors
- A lack of suitable supervision available from the contractor

- Unfavourable credit terms from material suppliers or labour only subcontractors
- The project and site managers are of the opinion the risk is too high to manage.

If there is confliction with the project manager's preferred procurement method against that elected by the estimator and used in the project tender, the difference in cost must be brought to the project manager's attention. Here, the skill of the quantity surveyor as cost manager is put to the test as he/she can advise on consequences for changing the procurement method. This can be demonstrated in a cost analysis by comparing the budget allowance to an estimate of the anticipated cost of carrying out the works using either method. Let us say a block wall structure for a new building has been tendered and the favoured procurement method is to award a single labour and materials package but quotations received exceed the budget. The subcontractor with the most favourable conditions on their tender has provided a schedule of rates and has stated it is willing to accept an award for labour-only or labour and materials. Table 5.1 shows a cost analysis using the budget as a benchmark and a breakdown of anticipated expense for appointing the block layer under either option.

This assessment provides vital information on the viability of appointing the blocklaying contractor. The analysis shows that if the contractor elects to procure the trade as a labour and materials package, the contractor's risk is low but could result in a potential loss of £4,245, this being the difference between the estimated cost and budget. However, if the contractor splits the award and accepts greater risk by sourcing materials from suppliers and reverts to the estimator's decision made at tender stage, it is possible the contractor could save £1,175.

When subcontractors' quotations are within budget, the analysis is straightforward and involves the quantity surveyor collating tenders in a summary together with giving a recommendation which is part of the negotiations towards the issue of an award.

5.3.5 Negotiations

Once tenders are received and any cost analysis complete, the quantity surveyor would be wise to request a tender interview with each suitable subcontractor whose price is realistic and who is considered a suitable contender for an award. A degree of commonsense is required as to who should be invited for interview and preferably should be those that are serious with their efforts and presented their offers in a professional manner. Naturally, an interview must be practical to allow members of a subcontractor's business to attend, which may not always be possible. However, a face-to-face interview should be adopted where practical, and is one method of due diligence procedures a contractor can use as part of the selection process. This does not need to apply with named or nominated subcontractors as the contractor has restricted choices.

Table 5.1

BOQ Page 6/1	Description	Quant	Labour	Plant	Materials	Total	Total budget
	a. Block walls, 100mm thick	950 m²	25.00	*3.00	30.00	£ 55.00 m²	£52,250.00
	b. Form cavity 50mm wide	510 m²	3.00	0	2.00	£ 5.00 m²	£ 2,550.00
	c. Partial cavity fill insulation	510 m²	10.00	0	10.00	£ 20.00 m²	£10,200.00
	d. Lintels 200 × 150mm	56 m	35.00	0	65.00	£100.00 m	£ 5,600.00
	e. Lintels 200 × 250mm	16 m	40.00	0	100.00	£140.00 m	£ 2,240.00
	f. DPC horizontal cavity tray	28 m²	20.00	0	55.00	£ 75.00 m²	£ 2,100.00
	g. Adjustable stop ends to DPC	72 nr	5.00	0	2.50	£ 7.50 each	£ 540.00
	TOTAL BUDGET						**£75,480.00**

Item	Description	ABC Block layers Ltd Quotation			Contractor's assessment – split package		
1	Materials - block supply	950 m²	£ 70.00	£ 66,500.00	1093 m²	£ 21.00	£ 22,953.00
2	Materials - premixed mortar	950 m²	Incl	£ 1,782.00	12 m³	£ 148.50	£ 1,782.00
3	Labour - block laying	950 m²	Incl	0	950 m²	£ 30.00	£ 28,500.00
4	Plant- mortar mixers	950 m²	Excl	0	6 wks	Excl	0
5	Materials - cavity wall ties	510 m²	Incl	0	2500 nr	£ 0.30	£ 750.00
6	Labour - form cavity	510 m²	Incl	0	510 m²	Incl	0
7	Materials - cavity fill insulation	510 m²	Incl	0	586 m²	£ 7.00	£ 4,102.00
8	Labour - fix cavity fill insulation	510 m²	Incl	0	510 m²	£ 5.00	£ 2,550.00
9	Materials - lintel 200 × 150mm	56 m	£100.00	£ 5,600.00	62 m	£ 57.50	£ 3,565.00
10	Labour - install lintels	56 m	Incl	0	56 m	£ 35.00	£ 1,960.00
11	Materials - lintel 200 × 250mm	16 m	£110.00	£ 1,760.00	18 m	£ 80.50	£ 1,449.00
12	Labour - install lintels	16 m	Incl	0	16 m	£ 35.00	£ 560.00
13	Materials - DPC cavity tray	28 m²	£ 90.00	£ 2,520.00	34 m²	£ 54.00	£ 1,836.00

14	Labour - DPC cavity tray	28 m^2	Incl	0	28 m^2	£ 20.00	£ 560.00
15	Materials - DPC stop ends	72 nr	Incl	0	100 nr	£ 2.00	£ 200.00
16	Labour - DPC stop ends	72 nr	Incl	0	72 nr	Incl	0
17	Others/risk contingency	+2%		£ 1,563.00	+5%		£ 3,538.00
TOTAL ESTIMATED COST				**£79,725.00**			**£ 74,305.00**

*The plant rate in the budget is for mortar mixers and not used for this assessment as the cost for hire is in preliminaries

- Material quantities in the Contractor's assessment allow for waste.
- All rates for material supply include for delivery & off loading.
- Mortar is supplied and delivered @ £60.00 per tonne @ 1650 Kg/m^3 + 50% shrinkage & waste for mixing with water = £148.50 m^3.
- The volume of mortar is 0.013 m^3/m^2 of wall × 950 m^2 wall area = 12.35 m^3.
- Labour rates shown on the Contractor's assessment are obtained from the quotation provided by ABC Blocklayers Ltd.
- ABC Blocklayers Ltd quotation is based upon fixed priced rates and an allowance of 2% is added for contractor's risk.
  There is a greater risk to the contractor with labour-only procurement, therefore 5% is added to the Contractor's assessment.

The interview is part of the negotiations a quantity surveyor will need to conduct prior to making a recommendation for the issue of an award. It is a beneficial process for both contractor and subcontractor as it puts faces to names that may not occur during a tender period and acts as an ice breaker to the start of a potential working relationship. It also provides insight into the subcontractor's capability for administering, managing and delivering the works. The quantity surveyor may have conducted research regarding a subcontractor's suitability prior to issuing the tender documents as part of a vetting process. However, it is necessary to bring the process up to speed in the event of changed circumstances and the fact that the subcontractor will have become acquainted with the project when preparing the tender. Any subcontractor invited to attend must be informed that attending the interview does not guarantee an award. Furthermore, the subcontractor must be made aware that the interview is a process of ensuring the contractor and subcontractor have mutual understanding of the scope of works and the services expected once an award is placed and to confirm the price or schedule of rates for the works.

The purpose of the interview is to address any issues that may be misunderstood before entering into a contract and should involve the use of a questionnaire. The questionnaire should be in tabulated form and a draft copy issued to the subcontractor prior to the interview advising that a completed questionnaire would become part of a pending contract if the subcontractor is successful with an award. Furthermore, the subcontractor must be advised that in the event of a dispute between the contractor and subcontractor once the works are awarded, the questionnaire will be used to address the dispute. If documentation is required from the subcontrcator, it should be provided with an opportunity to provide the information prior to or at the interview and certainly before commencing works on site. The questionnaire should be straightforward with simple yes and no responses, elaborated where necessary with notes recorded on the form. The quantity surveyor will usually conduct the interview but might invite the project and site managers to attend. The questionnaire should commence with a heading stating the project particulars including the title and address of the project, type of subcontract package, name and business addresses of the contractor and subcontractor and the name(s) and title(s) of those attending the interview. The interview will iron out any creases with discrepancies and expectations of the pending working relationship and provide insight into the obligations and expectations of the parties. Figure 5.1 provides a suggested list of main headings together with a theme of questioning to include on a questionnaire. Upon completion of the interview, parties should sign off the questionnaire and keep copies.

Lowest price guarantees

The quantity surveyor may wish to obtain a subcontractor's best price in order to potentially close a deal by asking for the fairest price on offer when

General capability and status of the subcontractor

Questioning focus …

It is necessary for the contractor to have an understanding of the subcontractor's business, even if engaged on any of the contractor's existing projects or is known to the contractor. Information a subcontractor must provide includes:

1. Size of the existing workforce.
2. Proportion of the workforce to be committed to the project.
3. Name of contactable referees (not subcontractor employees).
4. Past project referral for viewing by the contractor if required.

Acknowledgement by the subcontractor of receipt of tender documents

Questioning focus …

The subcontractor must price works in accordance with the contractor's enquiry and confirm the subcontractor's compliance with:

1. The scope of works and discuss clarifications and exclusions as well as compliance with the contractors programme and agreement to the pending conditions of contract.
2. Any collaborative working methods, value improvements or environmental changes with suggestions noted.
3. Any special conditions of contract that affect the subcontract work (hours of working, parking arrangements etc).
4. A price for the works or schedule of rates and terms of payment.
5. A method of financial security, i.e. cash retention or bank guarantee.
6. At the contractor's discretion, the subcontractor will need to understand it must accept liquidated damages and the amount the subcontractor will accept as a capped sum if a subcontractor's default is the root cause of a delay when the contractor incurs liquidated damages.
7. Public liability insurance which must be provided by the subcontractor, and may be issued after the interview.
8. The subcontractors must understand it will be liable to the contractor for payment of the value of any insurance excess included in the 'All Risk Insurance' policy in the event of the contractor making a claim for an event to which the subcontractor carries sole responsibility.

Questioning leading to ….

CDM compliance

Questioning focus …

The subcontractor must confirm it will comply and cooperate with the requirements of CDM 2007 and contractor's legal obligation to maintain the construction phase health and safety file. The subcontractor must confirm:

1. A willingness to provide safe working method statements (SWMS) regarding its site works stating how it will perform them, the risks associated with them and how it will deal with associated risks. These must be project specific and not generic.
2. It will provide a health and safety file to comply with the contractor's requirements. The contractor must provide relevant criteria it requires for the file and the subcontractor must provide its file prior to commencement on site.
3. The file issued must be project specific. The subcontractor must be aware that the contractor's health and safety officer will check the file and the subcontractor must agree to comply with requests involving the subcontractor updating the file at any time.

Subcontractor's capacity to deliver the works

Questioning focus …

The subcontractor must demonstrate it is aware of its commitment to the project by providing:

1. Start and end dates of the works or provide a specific programme of the works for the contractor's consideration.
2. Information regarding lead times for specified materials including shop drawings and material deliveries as well as any special attendance requirements by the contractor.
3. The contractor must confirm the project specific general attendances that will be provided free of charge to the subcontractor including methods of vertical and horizontal lifting of materials, i.e. crane, hoist and forklift and the subcontractor must advise on a locality where the contractor will place materials for installation.
4. The name(s) and title(s) of supervisors the subcontractor will appoint to oversee the works.

Figure 5.1

subcontractor selection is of its choosing. Whilst this bargaining power is haggling, it is no different commercial practice than the buyer of anything. What the quantity surveyor must avoid is a Dutch style of auctioning where bidding subcontractors compete with each other once an award is imminent. The quantity surveyor, or any member of the contractor's business, must not on moral or ethical grounds inform another subcontractor of their competitor's price prior to the issue of an award. A subcontractor may have provided a quotation and be eager to be issued an award and might offer a lower price in an attempt to fend off competition. However, any subcontractor offering a reduction that appears too generous should be avoided. It could be showing signs of desperation for the award and, if accepted, the contractor could be placing itself at risk of an insolvent subcontractor after an award is placed. This is certainly a case of the buyer being aware. A small concession or reduction of 2.5% as a main contractor's discount (MCD) as a bargaining tool for monthly payments of invoices was at one time acceptable practice between contractors and subcontractors which increased to 5% from suppliers. However, the introduction of legislation with the Construction Act has placed tighter control on the flow of payments through the industry and the term is seldom used in terms of sale or contract. Notwithstanding this, a concession can be used as a negotiation tool if the contractor agrees to rapid terms of payment, such as weekly or fortnightly, following the receipt of invoices when a subcontractor shows gratitude for the concession. Prior to securing a discount for rapid payment terms, the quantity surveyor must ensure such an arrangement is possible because the contractor may only permit once-monthly payments, meaning the promise cannot be fulfilled.

Award recommendations

Once subcontract tenders are compiled, any cost analysis complete, interviews conducted and prices agreed, the quantity surveyor in conjunction with the project manager can make a recommendation for an award. Depending on the contractor's procurement policy, this may need authorisation by a commercial or other manager based at head office if the award sum exceeds a certain value, with anything less at the discretion of the project manager and quantity surveyor. Where applicable, the project team's recommendation for authorisation is usually issued on a written form stating:

- The project title
- Trade title
- Names of tendering subcontractors
- Names of subcontractors who declined to submit a tender after receiving the documents
- Prices received and amended prices following negotiations
- Copies of quotations
- Completed tender interview and questionnaire form

- Name of the recommended subcontractor
- Reasons for recommending the subcontractor.

The quantity surveyor should not make a recommendation based on lowest price alone and should consider the combination of price and service delivery which an authorising manager may agree or overturn. Overturning a recommendation could be for practical reasons. For example, a quantity surveyor/project manager might have recommended a subcontractor that had, unbeknownst to the project team, received a recent award for another project from the contractor. Here, the authorising manager may make a recommendation for the appointment of an alternative because of their belief that the subcontractor's business would be unable to meet the commitment if receiving an additional award. This may be contrary to a project team's understanding and subcontractor's belief but, nonetheless, is a deciding matter. Any decision by an authorising manager to overturn recommendation must be respected, and the award issued to another subcontractor, usually the second favourite. For this reason, the quantity surveyor should not commit an award verbally or in writing to any inquisitive subcontractor until the recommendation is approved. If any subcontractor enquires about the status of a pending award, the quantity surveyor must simply state that the tender and negotiation procedures are complete and the decision is pending authorisation. This should ensure the subcontractor understands that it has not been given the green light to schedule materials, process orders and mobilise resources because it might be disappointed.

Unsuccessful tenders

After the quantity surveyor receives the recommendation in writing, the process of issuing an award can commence. At this stage, it is courteous to advise unsuccessful subcontractors in writing that their tenders have not been accepted and thanking them for their interest. The letter may also state that the subcontractor's information will be kept on file for future reference and they will be included for future projects the contractor may undertake. Advantages of providing subcontractors with this feedback include:

- It allows the project team to approach the subcontractor at a later date if the need arises
- Subcontractors usually respect feedback and may submit tenders for other projects
- It maintains an abundance of subcontractors interested in the contractor's business.

Unsuccessful subcontractors may be interested to know why they lost the project. If the sole answer is because a bid was too high, the quantity surveyor can advise the percentage difference between their offer and the value of the award without stating an exact amount. The subcontractor can also be told of any legitimate reasons decided by the authorising manager.

5.3.6 Subcontractor insurances

A contractor cannot expect a subcontractor to provide insurance to indemnify the contractor and/or client from personal injury or death to persons carrying out their services during the sequence of works. Neither can it expect insurance or indemnity from a subcontractor for damage to property caused accidently by the subcontractor as it may be too hard or expensive for the subcontractor to provide. However, a contractor can ask each subcontractor to provide insurance for damage to its installed works, unfixed materials on site and damage to plant or equipment caused by the subcontractor as a result of an accident or negligence of its own creation. In addition, a contractor may wish subcontractors to indemnify the contractor from any event caused by negligence of the subcontractor that results in personal injury/death or damage to property. However, a contractor may need to concede it cannot rely on subcontractors to provide this type of cover and therefore will rely on its own resources or the client's instructions which are reflected in the main contract.

To ensure a project has adequate insurance protection, a contractor or client will obtain project insurance that covers new works and/or works to or within existing structures including building extensions. This insurance is to protect the project from an incident and is discussed in Chapter 4, Section 4.7.2 and is necessary in the event of a global claim. A global claim is an insurance claim for any event not restricted to an incident caused by a subcontractor. This has an advantage to the contractor because there is no requirement to obtain multiple issues of insurance policies from subcontractors. A contractor will obviously wish to restrict a global claim because of the amount of excess on a policy it would have to pay in the event of a claim. If an incident occurs that gives rise to a claim and is solely due to a subcontractor's default which is isolated and does not affect any other part of the works, it may not be treated as a global claim. Here, the contractor will rely on the subcontractor to provide insurance for its own works. However, if an incident has an impact on the performance under the main contract it would mean a global claim is unavoidable.

A contractor must rely on subcontractors to provide a degree of insurance protection in the event of a claim and, as a minimum, policies required from domestic and nominated subcontractors include:

- Public and/or general liability in the name of the subcontractor receiving the award
- Public and/or general liability from any engaged contractors appointed by a subcontractor that become sub-subcontractors who carry out works on behalf of the subcontractor on site. This applies to electrical contractors carrying out works for mechanical subcontractors, crane contractors lifting precast concrete panels for concrete façade subcontractors, etc. In effect, these are sub-subcontractors without a contractual link to the contractor and must provide insurance provisions.

Generally, public and/or general liability policies are only required for labour-only subcontractors that are companies. This is because a contractor usually has employer's liability insurance to cover engaged sole traders which also covers the contractor's employees. This extends to public liability in the event of an incident involving the general public. A subcontractor may delegate its responsibilities to execute the works to sub-subcontractors but cannot assign legal rights or duties including insurances without the contractor's expressed permission which is usually written into the agreement with the subcontractor.

Where a contractor agrees to pay a subcontractor for materials stored off site, insurance must be provided by the subcontractor and a policy must be specifically obtained for the project in the name of the subcontractor. The policy must also state what materials are insured and the value of cover, which must be adequate. The policy is normally submitted with a request for payment of the goods to which the contractor must be provided access to ascertain the quantities and quality. Once goods are paid for, they become the property of the contractor and in turn the property of the client once the client pays the contractor. In the unfortunate event of fire, flood, etc damaging goods which are paid for, the subcontractor will need to replace them at no charge to the contractor by relying on the insurance it has provided.

When a subcontractor has design responsibilities for a project, professional indemnity insurance must be provided. The inclusion of this insurance will generally not apply if shop drawings are produced from a master design provided by consultants appointed by the contractor or client, because indemnity insurance is provided by the designers.

Any specific insurance that a contractor requires from a subcontractor should be discussed during negotiations so the parties are aware of the cover required. Whilst a project is under construction, it is important for the quantity surveyor to monitor subcontractor insurance regularly to ensure suitable cover is provided and current. Monitoring is possible with the creation of a register or a process management system of record keeping.

5.3.7 Bespoke forms of subcontract agreement

A quantity surveyor administering a project must ensure that each subcontractor receives an award in writing before they commence their works. With certain trades, such as structural steel assemblies, this can mean before starting works on site, i.e. preparation of shop drawings or the scheduling and ordering of materials. To demonstrate a contractor's commitment to a subcontractor, an award can be issued in any of the following ways:

- A Letter of Intent as a preliminary agreement outlining the contractor's intention to issue a form of contract once the parties agree the terms and conditions of appointment
- A Letter of Acceptance as a preliminary agreement confirming the appointment with the contract issued as soon as practically possible
- The issue of the contract bypassing the need for a preliminary agreement.

When issuing a contract, a contractor may elect to use a bespoke form of agreement, a purpose-made form drafted by its lawyers to ensure it has legality and reflecting the contractor's requirements. Alternatively, a subcontractor might offer a standard form for the contractor to execute and, once both parties sign off the form, the agreement becomes binding. However, these types of agreement are 'subcontractor friendly', meaning the contractor loses control. Really they are only suitable for small value awards and are not practical when packages are of substantial value. The creation and use of a bespoke form can be beneficial to a subcontractor who has a long-term working relationship with a contractor where the arrangement stands the test of time without any major disputes occurring.

A contractor can adopt a two-tier document policy for awarding trade packages by making a distinction between what is considered a minor works agreement where the value does not exceed a certain amount, and major works for anything in excess of a minor works amount. The clauses and brevity of minor and major work contracts will differ and include sets of terms and conditions suitable for each form. Where this two-tier system exists, a contractor may delegate responsibility and authority for issuing awards to various employed positions with a hierarchy and authorisation procedure in place, i.e.

- Minor works package not exceeding £2,500 only to be awarded by a competent person named within the project team
- Minor works packages in excess of £2,500 not exceeding £10,000 to be awarded by the quantity surveyor or project manager only
- Major works packages in excess of £10,000 and not exceeding £50,000 to be awarded by the quantity surveyor and authorised by the project manager, or the project manager alone may issue the award
- Major works packages in excess of £50,000 require authorising by a director.

This hierarchical approach is to be commended for larger projects as it places a level of trust on the project team and reduces bureaucracy that may otherwise stifle the progression of the project.

The form of contract must cover the aspects of the agreement and include:

- **Project particulars and parties to an agreement** This is the introductory part of the form and includes:
  - Title and address of the project
  - Names and business addresses of the parties to the agreement
  - Contract sum or schedule of rates and payment terms
  - Subcontractor's security for the contractor i.e. cash retention or bank guarantee
  - Project commencement and completion dates
  - Start and finish dates for the subcontractor's works.

The particulars may also name the client and refer to industrial buzzwords used in the main contract for promoting a healthy working relationship. These include collaboration, value improvements, health and safety and sustainable improvements that a subcontractor and contractor may jointly elect to include.

- **Documents forming the agreement** These are the documents included in the invitation to tender and subsequent negotiations. The format must include a breakdown of the contract sum and/or schedule of rates for payment purposes. It should also include a schedule of insurances and daywork hourly rates together with agreed percentage additions to the prime cost of the purchase of materials and hire of plant.
- **Collateral warranties** Where required under the main contract, the contractor will advise the subcontractor of the names, titles and beneficiaries of collateral warranties as well as parts of works requiring warranties. The subcontractor must issue the warranties within a timeframe stated in the agreement, usually obtained from the main contract and advised by the contractor in the form.
- **Conditions** Conditions must focus on the rights, obligations and risk to the parties in a manner that favours the project. In general, conditions forming the body of the agreement under a list of headings include:
  - Contractor's access to subcontractor's representatives
  - Methods for the subcontractor claiming an adjustment of time
  - The effect of site instructions issued by the contractor
  - Adherence to health and safety obligations and regulations
  - Restriction of subletting the works, i.e. a subcontractor may delegate their duties to another without assigning the rights of the agreement
  - Variation assessment procedure and authorisation process
  - The contractor's right to instruct the removal of person(s) under the control of the subcontractor from the site for specified reasons
  - Termination of the agreement
  - Dispute resolution methods which are usually the same as those under the main contract
  - Methods of addressing damage to the works and defective works
  - Subcontractor's responsibility to maintain a clean working environment.

A dangerous and somewhat pointless exercise is for the contractor to include a generic term expressing that a subcontractor shall be liable for any of the terms written into the main contract. This drafting shortcut is not a credible catch-all clause even if included in a signed contract. In a dispute implications of liability to the subcontractor may be restricted by a court of law under the Unfair Contract Terms Act 1977. This type of ambiguous clause could be an attempt by the contractor to mirror its obligations to the subcontractor which, if sought, is best addressed with a back-to-back contract as discussed under Section 5.3.9 below.

Special conditions

A failure of some projects is when the contractor does not have works ready when the subcontractor arrives on site. This can be frustrating for the subcontractor, as there is the possibility that it incurs costs due to abortive visits without remedy in the agreement to recoup the loss. For this reason, subcontractors may request inclusion of specific clauses or a list of special attendances and requirements by the contractor appended to a contract. This may be provided with impartial advice obtained from a subcontractor whose trade works have a trade association affiliate. If a subcontractor makes such a request, it must do so under the umbrella of recommendations from its trade affiliate and not on its own terms. The reasons for a subcontractor wanting to include such conditions is to protect its interests and ensure a contractor is aware of the duties it must provide to prevent delays or incidents that may breach health and safety law. For example, piling contractors that submitted quotations for works may be affiliated to the Federation of Piling Specialists (FPS). This is a trade association comprising of members who carry out works for main contractors that are audited independently to ensure that high standards of technical ability, quality management, safety, training and management systems are maintained. To reflect these qualities, FPS produces a Schedule of Facilities and Attendances that a main contractor must provide for efficient and safe site operations, e.g. a suitable solid platform to allow the maneuver of a piling rig on site. If the quantity surveyor is requested by a subcontractor to include a trade affiliate's schedules and is a member of the organisation, schedules and conditions should be considered as reliable and appended to the agreement.

Conclusion of the formality

It would be wise for the quantity surveyor to keep a register of the date of issuing awards and the date each award is formally signed off by the parties which could be included on a letting schedule. Unfortunately, recording this formality is not always adhered to, especially on a project involving scores of awards when an assumption is made that once a subcontractor is issued an award it is the end of the matter. This is incorrect conduct because the subcontractor may forget to sign and return the agreement, making it hard to prove a contract exists should a dispute arise without recall on the executed contract for an answer. If there is a failure to execute the agreement and the subcontractor commences works, the project manager must be made aware of the situation because, if there is a dispute, the contractor could be exposed to limited remedy as the process towards formalising an agreement is incomplete. To conclude formalities, the quantity surveyor must issue two copies of the agreement to the subcontractor for execution with a proviso that both are executed and returned within a specified timeframe. Upon the contractor's receipt of both contracts and acceptance of the terms, the contractor executes the forms, keeps one copy and returns the other to the subcontractor.

5.3.8 Generic forms of subcontract agreement

The JCT publishes a generic Short Form of Sub Contract (Short Sub) and is suitable where a JCT form of main contract is administered. Although its use is not mandatory, it aims to maintain consistency with the contractual theme of a project where the subcontract works involve low risk and are straightforward. The adoption of this form has a distinct advantage for the parties as it is not prepared by the contractor meaning a subcontractor cannot be sceptical as it is not drafted in favour of the contractor. JCT also provide a Sub-subcontract (Sub Sub) form for use by subcontractors who appoint trade contractors, which again is not mandatory yet maintains consistency through the supply chain. Where a contractor elects to use a form of subcontract agreement provided by the same drafter of the main contract form, it does not mean a subcontractor has recourse to the main contract. Furthermore, by default, the client will not have recourse to the subcontractor because the two are not linked. A subcontractor may only have a liability to a client if the rights and duties under the main contract are legally assigned with the contractor's consent which must be permitted by the main contract.

When a subcontractor is named in the Intermediate JCT forms of main contract, there are provisions stating the type of form a contractor must use for appointment. For example, the JCT Intermediate Building Contract 2011, clause 3.7 states the form as the Intermediate Named Sub-Contract Agreement ICSub/NAM/A. The issue of this form is a contractual requirement and the contractor must not issue an alternative as this would constitute breach of contract.

The JCT 2011 forms of contract abstain from the nominated subcontract procedure. However, if a quantity surveyor is administering a project involving nominated subcontractors with alternative forms, it is necessary to understand the procedure, which would normally be found in appendices to the main contract and specific clauses.

5.3.9 Back-to-back forms of subcontract agreement

A back-to-back contract is a type of subcontract agreement which attempts to mirror the terms and conditions of the main contract into a subcontract form. In reality, these forms are extremely hard to create unless a contractor has repeat business with one or more clients that adopt the same main contract form. When this is possible, the contractor's lawyers review the standard form and edit clauses so that it makes commercial sense to apply in a subcontract package.

Advantages of a back-to-back contract include:

- The contractor is in a position to declare to its subcontractors that the form is not edited in any way that favours the contractor because it reflects the main contract requirements
- It can be used for repeat business

- With repeat business, execution is rapid because subcontractors are familiar with the form
- It can reduce the number of disputes because it is specific whereas standard forms are generic.

Disadvantages include:

- Subcontractors may be reluctant to be involved with such an extensive form, especially if they are a new business subcontracting to a contractor and unfamiliar with the process.
- A contractor may be at a disadvantage if it enters into a main contract agreement using a standard form that is edited or modified at a client's request. Here, and for the idea to apply perfectly, the main contract form used as a guide for creating the back- to-back form, will need to be edited to reflect the main contract agreement which a lawyer will need to prepare and the time may not be available.
- They are expensive to create due to the involvement of the contractor's management and lawyers time.
- Where a contractor's business is diverse and it carries out works under numerous standard forms, the back-to-back ideology is harder to create. This is because the lead time from the date of concluding the main contract to the date when the first subcontractor is required to commence on site may not be sufficient to draft the form.

Back-to-back forms of contract are ideal when they involve technical situations. The contractor can then mirror certain technical criteria to a subcontractor so they can perform exactly to the manner expected from the contractor under the main contract. This becomes complex when the contractor wishes to reflect legal and commercial clauses that may be hard to conclude. The contractor may elect to leave such clauses in abeyance and decide to accept the risk, yet be satisfied that it has transferred technical aspects only which mitigates some project risk.

5.4 Material supply scheduling and purchase ordering

In general, a contractor schedules material requirements for trade works so it can issue purchase orders for the supply and delivery of goods to site for installation by labour-only subcontractors. The contractor may also schedule materials for certain preliminaries items, e.g. timber for site hoarding for installation by labour-only subcontractors. The contractor does not need to schedule materials for domestic and nominated subcontractors because these parties are generally responsible for scheduling and purchasing materials themselves and require no input from the contractor other than the supply of 'for construction' information.

When a contractor is responsible for scheduling and ordering of materials, the information can be obtained from the following sources:

- A builder's bill of quantities prepared during the project tender period (as reference only)
- A contract bill of quantities (as reference only)
- Updated builder's bill of quantities or new material schedules
- Schedules in the specifications
- Schedules on the drawings.

A builder's or contract bill of quantities which is part of the tender or contract documentation should only be referred to when it is known that works to be constructed reciprocate identical requirements at the time of tender. Even if this is the situation, stated quantities should not be used for ordering purposes. This is because billed quantities reflect the nett measured quantity fixed in position, meaning they exclude additional quantities required for ordering purposes to allow for material waste created from cutting, working and shrinkage. Where works to be constructed are known to have altered since the contractor's tender was issued, a bill of quantities may not be current. Furthermore, changes in quantities to suit revised construction documents may not be included and it will be necessary to reschedule quantities for actual requirements in new builder's bills or a schedule of material requirements.

When scheduling is complete, the project manager can elect to delegate responsibilities for the placement of awards to members of the project team. This will entrust members to place purchase orders to certain financial thresholds in a similar arrangement to minor and major work awards for subcontract packages as discussed under Section 5.3.7 above. Where an order value exceeds a certain financial threshold, those delegated to award orders must not exceed their authority and the quantity surveyor must adopt a commercial lead. This will involve the issue of invitations to tender to obtain best value following a similar procedure to procuring subcontractors. In general, tendering and negotiation procedures prior to issuing material supply awards are not as robust as those used for placing subcontractor packages because there is less risk to a contractor because:

- The value of awards is generally less than subcontractors' packages
- The contractor may have existing price arrangements in place with certain suppliers of goods
- No cash retention or financial securities are required
- Insurance provisions do not apply
- Liquidated damages do not apply
- CDM requirements for health and safety are relaxed
- The contractor has generally more control with the supply of goods that is transferred when awards are placed with domestic or nominated subcontractors that take responsibility for deliverables.

The quantity surveyor must ensure that project team members tasked with the responsibility of placing purchase orders are aware they must deal with companies that offer reasonable prices and/or discounts. Material suppliers may offer discounts because it is repeat business and the quantities involved can be substantial which provides commercial benefit to a contractor. In addition to obtaining best price, suppliers must be able to deliver products on time to suit the construction programme and provide materials that comply with the specification(s) and contractor's requirements. It is equally important for project team members delegated to place purchase orders to be aware of a contractor's budgets as these are a driving force that help secure projects for the contractor. In order for a contractor to be competitive with its tenders for construction works, it is necessary to estimate the cost of materials including commercial benefits combined with the use of suitable management to supervise their installation. This commercial benefit may be lost if a contractor fails to manage the process and issues awards for the supply of materials to businesses not offering discounts or that are uncompetitive. To avoid this, a contractor's business may have a buying department based at head office that specifically procures materials, agrees prices by negotiation based upon schedules of rates and liaises with site and project managers for delivery requirements. However, in the absence of a buying department, responsibility may rest with the quantity surveyor, who is briefed by the commercial manager about the purchasing arrangements and who they are with.

Where issuing awards for material procurement is a project team's responsibility, the method is to issue each supplier with a supply order, including a unique reference or order number. The way supply orders are issued varies between contractors, with some adopting a formal approach and an order numbering system, and others using word-of-mouth agreements confirmed with site instructions. This latter approach cannot be recommended as it can lead to misunderstandings and errors. Orders of small value for the preliminaries and minor material purchases for labour-only trade works can be placed over the telephone if the supplier will accept an oral order. If this is done, it is necessary to carry out the following:

- State the unique purchase order number
- Describe the goods, quantities and delivery dates
- Complete a written order addressed to the supplier with project reference for identification. The written order must include: the contractor's business and site delivery address; date of the order; date(s) required for the supply of the goods to site; a description and quantity of the goods; quoted rates(s) or a lump sum price usually excluding Value Added Tax; and signature of the purchaser on behalf of the contractor.

A supplier may wish to include conditions of sale, usually in accordance with the Sale of Goods Act 1979 which is legislation aimed at reflecting commercial expectations in commonly arranged terms of agreement and, if requested,

should be accepted. When this legislation is not stated, the contractor's purchase order may include fine print at the footnote of the order or on the reverse side. If the parties are silent on the matter, there is no point in adding a clause as it is a statutory right whether written into the agreement or not. In addition, a supplier may request the buyer of the goods to complete a project registration form specifying the goods to be supplied as well as quantities required. Suppliers adopt this approach when they do not wish to be caught up in ambiguities, missing information or misinterpretated specifications or drawings, and wish to rely on the contractor's commitment for the requirements. For example, a door on a drawing and in a door specification might simply state a requirement for a safety glass panel described to BS6262. It is an obligation of the supplier to ensure the glazed panel complies with the stated standard but it will need to know if the panel is to be clear or obscured which may be decided from looking at the plans to see if the door leads to a room that requires privacy. Obviously, this is a requirement for the contractor to decipher or seek the requirement from the specification writer or search the documents for an answer, perhaps in the glazing specification.

When a verbal order is complete, the written purchase order should be faxed to the supplier as proof of the requirements to avoid errors and marked 'Confirmation'. It is necessary to note the order as confirmation because the recipient of the fax may not be the person who accepted the telephone order and may duplicate the requirement in error. Alternatively, the written order can be scanned as a document and emailed to the person issued with the verbal order.

If a contractor is a new account to a supplier, it may be necessary to complete a supplier's credit check arrangement which requires divulging the contractor's business details. Site managers and foremen delegated to place purchase orders may find this process a hindrance to project activities and, if no existing account supplier is available, the quantity surveyor should complete the form and return it to the supplier for entry into their database to create the new account.

Once goods are delivered, the transaction is usually confirmed with a delivery docket issued by the supplier, signed by the receiver as proof of delivery. The proof of delivery note should be kept in the site office for later distribution to the contractor's accounts department at head office who process payments based upon receipt of a supplier's invoice and the proof of delivery.

5.4.1 Bulk ordering

With large projects, it will be necessary to place bulk purchase orders to be installed by labour-only subcontractors and this will involve the quantity surveyor obtaining competitive quotations from various suppliers. To assess a quantity to include in a bulk order, it is necessary for the quantity surveyor to ascertain the quantity required. This is obtained from the bill of quantities or builder's schedules and involves converting the unit of billed measurement into a unit of sold measurement plus an allowance for waste. For example, a bill of

quantities may state an area of 500 m^2 of facing bricks for a half-brick thick (102.5 mm) wall and it is necessary to know the quantities to include in a bulk order. This can be assessed as:

$$\mathbf{500\ m^2 \times 59\ nr/m^2 = 29{,}500 + 15\%\ allowance\ for\ waste}$$
$$\mathbf{= 33{,}925\ total\ number\ of\ facing\ bricks}$$

In this example, because the bricks are purchased by the thousand, the bulk order quantity must not exceed 33,925 if the budget is to be preserved (providing that the payable rate is comparable with the budget). The quantity surveyor must exercise skill when placing the bulk order and cap the quantity required to the nearest available whole unit advised by the supplier. Let us say a quotation is received from a brick supplier stating a quoted rate per thousand, which includes delivery to site and offloading, based upon 10 packs of 550 bricks, i.e. 5,500 per delivery. What the supplier is implying is that it will need to supply this quantity of bricks per delivery to cover the cost of loading in the factory, haulage to site and offloading on site. If quantities for each delivery are less, the price for bricks will increase to compensate the fixed loading and transport costs. Here, the quantity surveyor could place a bulk purchase order to a maximum of six full deliveries (6 × 5,500) or 33,000 facing bricks, which acknowledges the supplier's terms of sale. This is also within an acceptable allowance for the budget to be safe and provides adequate allowance for waste, albeit slightly less than the budget assessment of 15%.

Bulk orders have a distinct advantage when running a project because only one order needs to be placed for each material, reducing administration time spent on a project. Imagine the chaos if a project requires 100 identical doors over a period of one year and one order was placed each time there was a site request for a door – this could mean up to 100 orders being individually placed!

A bulk order should include a proviso that it is to a maximum quantity which a contractor reserves the right to amend from time to time. The order should not be to a fixed quantity or total fixed price because of the following:

- The contractor's allowance for waste might be exaggerated and result in the pleasant scenario that the quantity required can be reduced. This may only become apparent when the supply of materials on the order is near completion
- If an order is placed upon a fixed quantity that fails to be fulfilled, it could expose the contractor to a claim for loss of profit that the supplier would have gained if it had completed the order. This will have been denied because of the contractor's or client's changes which altered the quantities
- The project may be terminated by either the client or contractor
- If the supplier defaults, the order can be terminated and a new order placed elsewhere.

So, what happens if the final quantities required are in excess of the bulk order because the design has changed or errors are discovered in the bills or

schedules in the specifications? If a variation occurs under the main contract altering the works or correcting a bill of quantities or schedule, the appropriate suppliers should be issued with variation orders to adjust the quantity. This is necessary because a supplier has an obligation to comply with a bulk order request; it may not accept a request from a site manager for a further delivery if cumulative quantities exceed that stated on the order. This could have serious results as a halt in deliveries could disrupt site production, with the possibility that labour-only subcontractors seek reimbursement for lost time if they are delayed because of a shortage of materials.

A criticism from some site managers about bulk ordering based upon a bill of quantities is that they consider the quantities incorrect for production purposes. This may have a ring of truth about it but there could be compelling reasons for the discrepancy of which a site manager is unaware. An example is if value engineering was carried out post-tender, altering the design without updating the bills because the consensus was that the production of new bills would cost time and money and were not considered necessary. It may also be that a contractor is wasting more materials than it allowed in a bulk order, and if this is the case, information about actual wastage should be fed back to the estimator for consideration on new works under tender. However, the project manager must be made aware of waste in excess of the allowance and be satisfied it is not site specific or the result of site management methodology because an estimator will only allow wastage based upon efficiency and not something particular to a project. If excess waste is found to be a contractor's responsibility, it is generally of no concern to the supplier and the quantity on the bulk order must be increased to compensate.

It will be necessary for the site manger and foremen to record bulk order deliveries in a goods supply register to ensure orders are tracked. The management of these registers is important because they highlight any discrepancies between contract documentation that drives the contract sum and 'for construction' documents that show final requirements. For example, let us say that on a construct-only contract, the steel reinforcement design to in situ concrete floors was incomplete at the time of concluding a contract with the design stating the steel bar reinforcement is to be based upon a ratio of xxxkg/m^3 (i.e. a stated weight of steel in kg to the volume of poured concrete). Here, the contractor will have received an award based upon this information and assessed an appropriate allowance of steel to the volume of poured concrete. Once works commence, a bulk order for steel reinforcement may be placed to include the supply of steel to a maximum tonnage in accordance with the contractor's assessment. Suitable management of the goods supply register will highlight the steel supplied for comparison with the bulk order allowance. A problem could occur when:

- BOQ allowance of steel bar reinforcement for a building = 500 tonnes
- Bulk supply order award = 500 tonnes
- Goods supply register = 500 tonnes delivered with 50% of the works completed

Here, the contractor is faced with a potential problem because the bulk supply order value has expired with half the project still to complete. This will involve an investigation to assess the steel requirement for the first half of the project to see if a variation is justified. Without these registers to track progress, a contractor will have no knowledge of material usage and the project manager and quantity surveyor must enforce their regular update.

5.5 Labour hire agreements

The hire of labour for the construction phase of a project can be separated into the following categories:

- General site operatives
- Semi-skilled operatives with an intermediate level of training
- Qualified skilled operatives that provide a labour workforce to carry out a range of site duties
- Managers and other professionals engaged on a temporary basis providing a service that does not involve design.

General site operatives (often referred to as site labourers) are employed by a contractor to assist semi-skilled and qualified skilled operatives with their duties, and their cost to employ is included in the preliminaries. Broadly speaking, the terms 'semi-skilled' and 'qualified skilled operative' mean trade operatives appointed by trade subcontracting companies and labour-only subcontractors appointed by a contractor and contractors engaged by a client. A general site operative's duties do not usually involve assisting trade contractors directly, unless expressed in an agreement as a result of an extraordinary requirement, e.g. a request to offload materials out of normal working hours. Trade contractors usually employ their own general operatives to assist directly with their operations, e.g. a rendering contractor will engage an operative to mix materials under the watchful eye of skilled operatives, which is not deemed a general site operation because it is specifically for a trade. However, it is the contractor's responsibility to ensure that materials are placed in a suitable position for access by the semi/qualified skilled operatives which is provided by the contractor's general site operative(s).

General site operatives play a vital role in the presentation of a construction site in progress as they maintain and keep working areas clean to provide continuous access to the works. If they have the appropriate license, some operatives are permitted to operate a fork-lift truck to transport materials around the site and lifting them into position for installation by others.

Occasionally, a contractor may need to hire additional labour to assist with site operations. When required, general site operatives or semi-skilled operatives are recruited at the discretion of the site or project manager who may hire them from other projects the contractor is undertaking or through a recruit-

ment agency. When hiring through a recruitment agency, a purchase order is placed with the operative hired at an agreed hourly rate. The agency reimburses the operative and there is no financial arrangement between the operative and contractor. The hours attended are recorded on a time sheet authorised by the site manager and the recruitment agency issues an invoice in accordance with the authorisation.

The quantity surveyor needs to monitor the amount of any additional labour hire because costs can escalate if left unchecked. A contractor's preliminaries will usually have an allowance for general site operatives and if additional labour hire is required, the supply must be monitored. This is to see whether the additional labour is a short-term solution to a problem or if it is something that will be prolonged. The site and project managers will usually be aware of preliminaries allowances for general site operatives and manage the process effectively by off hiring the service when no longer required. However, a habit of continuous hire is not unheard of and a need for an excessive general operative labour force may not always be justified. It may be surprising what the cost of additional labour hire can be in one month which, if left uncontrolled, could cause financial harm to a project. This could be a contentious matter for the site and project managers because they might consider they require the additional resources yet understand there is no budget allowance. The quantity surveyor must endeavour to advise the project manager of the weekly costs incurred versus the budget allowance and consider if there is benefit with the extra labour hire, i.e. will it assist production and recover lost time if the works are behind programme.

Apprentices

Contractors are encouraged to hire apprentices who are students on craft skill courses that combine college studies with practical experience on site. Encouragement for contractor participation in training schemes comes through industrial bodies such as the Construction Industry Training Board (CITB), where contractors pay a levy for the service and benefit from the arrangement because of the productive work they receive. Engaging apprentices also boosts the numbers of skilled people coming into the industry, with many contractors proactively participating by recruiting apprentices and attempting to motivate school leavers to consider a trade as a vocation. When engaged on a site, apprentices are supervised by the contractor. They are not expected to carry out general site operative duties because the intention is for them to learn the skills of the trade they are undertaking in their apprenticeship. The site manager inducts and briefs apprentices informing them of the contractor's duties including health and safety requirements and the role the contractor plays as principal contractor under the requirements of CDM. Thereafter, the apprentice commences training under the guidance of skilled trade operatives appropriate to their trade course for a specified duration before returning to university to recommence their studies.

Management hire

Professionals may be hired through a recruitment agency and paid at an hourly rate in a similar manner to general site or semi-skilled operatives. They are usually engaged on an ad hoc basis under a short-term agreement which aids a contractor's needs without commitment to long-term employment. For example, a project may be lagging behind schedule, with its trade procurement requiring assistance from a freelance quantity surveyor to put the contractor back on track to meet its objectives. Site management staff may also be hired from a recruitment agency as an auxiliary requirement which is suitable when accelerating a programme or if there is a change in the scope of works that warrants additional management over the short term. As these hire agreements are contracts of services, the recruitment agency incurs employment costs and is usually responsible for payment of taxation, unless the supplier of the services is an independent, self-employed contractor who elects to pay their own tax. Alternatively, a contractor might have a contact list of freelance persons for professional short-term appointments and elect to engage them directly instead of involving a recruitment agency.

5.6 Plant hire agreements

In general, a contractor will hire or purchase mechanical and non-mechanical plant to service a project. This is for preliminaries items, labour-only subcontractors, attendance as builders work in connection with domestic/nominated subcontractors or client-engaged contractor's works and some aspects of trade works it carries out itself, i.e. site clearance operations.

When hiring plant, the quantity surveyor must secure competitive rates based upon the length of time each item of plant is required. Where the contractor has a buying department, the buyer(s) will negotiate rates based upon a unit, hourly, daily or weekly rate plus delivery and collection charges which are issued as 'blanket' orders for each item. This approach permits plant to be hired in the first instance that can be later off hired and rehired to suit the sequence of site operations without the need to issue additional orders. For example, mortar mixers for use by bricklayers may be hired for the construction of a building which can be off hired when the building is complete. The mixers can be later rehired to construct a brick boundary wall not scheduled to be constructed concurrently with the building works. Where a buying department does not exist, it is a matter for the quantity surveyor to ensure that 'blanket' orders are placed with competitive rates which may be achieved by obtaining tenders or suitable predetermined rates if a contractor has repeat business with one or a number of hire companies. When agreeing rates, it is important to

qualify where the responsibility rests for insuring the equipment in the event of plant failure or damage whilst on hire. This is usually provided by the hire company and should be confirmed as a matter of course.

Site mangers and foremen usually hire plant to suit the programme of works and request delivery from any company in receipt of a 'blanket order'. Alternatively, the managers may place their own orders if they are delegated with the commercial responsibility. When hiring items, it is necessary for the site manager and foremen to record the commencement and off hire dates in a register to demonstrate they are managed efficiently. The register should only record plant hired by the contractor for the contractor's use. The plant register should distinguish between plant hired from a hire company and plant on site which is a contractor's asset because there will be no invoices from hire companies to reconcile if the plant is a contractor's asset. In the interest of cost management, the quantity surveyor should refer to the register regularly as it provides a snapshot of plant on a site at any time and is necessary to reconcile invoices from plant hire companies that refer to hire periods.

Any item of plant hired or owned by subcontractors to carry out their contracted operations does not need recording on a register as they are not the responsibility of the contractor. If the contractor hires plant and operatives to aid a subcontractor's contracted work, it will in effect have taken over the works and thus is taking a risk. This is because a form of contract normally has provisions in the event of a subcontractor failing to work diligently. Usually, a contractor can only take over a subcontractor's works after issuing a written notice to the subcontractor stating a date the works will be taken over unless the subcontractor resumes operations beforehand. If the contractor decides to take over the works earlier than the expiry date of the notice or omits to issue a notice and issue of a notice is a condition of contract, the contractor cannot recover expense from the subcontractor because it will have breached the contract. If this situation becomes apparent to the quantity surveyor, the project manager must be alerted because the contractor might incur expense it cannot recover. The same would apply if the contractor takes over any works undertaken by a client's contractor and the client must be made aware of the default.

The cost to mobilise, hire and demobilise certain types of plant such as cranes, hoists and scaffolding is considerable and involves qualified skilled operatives. This will require the engagement of companies to provide the base plant as well as operatives, maintenance, insurance, safety inspections and ancillary equipment supplies required for the plant to function. In line with industrial customs, these hire companies are addressed as labour and materials subcontractors and are procured in the same manner, involving a tender period, negotiations and issue of an award as discussed under Section 5.3 above. Some contractors, however, may have their own scaffolding equipment as an asset and appoint operatives to erect, adjust and dismantle the scaffolding on hourly rates or agreed prices on a case-by-case basis.

5.7 Consultant appointments

The appointment of consultants is necessary when a contractor provides a design service or requires a reporting service or range of supplementary services to enable it to fulfil its obligations. Reporting/supplementary services include:

- Site accommodation layouts
- Noise monitoring of site operations. BS 6472:1992 develops criteria relating to levels of building vibration which could give rise to 'adverse comment' in a frequency range applicable to impact associated with construction activities. A local authority may request monitoring and a periodic report to answer any questions raised from such comments which a contractor is obliged to provide
- Monitoring of dust air particles from site operations if a local authority so requests
- Field surveyor to set out the building and provide datums and levels where a contractor does not employ surveyors or engineers
- Construction programme if a contractor does not employ a construction planner
- CDM coordinator.

Consultants offering the above services may be engaged on a lump sum price where the services required are tendered. When inviting tenders, a contractor will usually outline the objectives it wishes to achieve by the appointment, to which the consultant submits a scope of services together with a fee proposal for the contractor's consideration. If the fee proposal is accepted, it is included in an award for executing as a binding agreement.

With a design and build contract, a contractor generally appoints design consultants involved with the initial design by novation and/or may source new and supplementary consultants. The selection process may be administered by the contractor's design manager or left to the devices of the project manager, and depends on the contractor's culture, the project itself and number of consultant appointments required. As part of the appointment procedure, design consultants are invited to tender a fee proposal following an invitation to tender from the contractor in a similar manner to a supplementary consultant where no design is required. The invitation outlines the level of services required to furnish the contractor's needs and the consultant responds with a fee and scope of services which generally include the following:

- Initial briefing with the contractor
- Preconstruction design and documentation including issuing to the contractor for approval
- Coordination with other consultants

- Issue of design and documentation for the construction phase including a predetermined number of site visits and attending meetings
- A review of As Built information provided by the contractor or its subcontractors.

Once a fee proposal is issued and accepted by the contractor, a contract of services is placed which excludes retention and, in general, once formally executed creates a binding agreement. The contract agreement should include a lump sum fee that the contractor agrees to pay the consultant for the services as well as a schedule of payable sums in accordance with the fee proposal for interim payment purposes.

6 Running the Project

6.1 Managing the flow of documents

A project team tasked with the responsibility of delivering a project is usually issued with the contractual and initial working designs and documentation as soon as they become available. Thereafter, it is not unusual for the team to receive an influx of new or revised information prepared by the client or the design consultants, or from the contractor's head office manager in charge of policies and procedures which may change from time to time. Separate to this, the team will generate documents associated with running a project created by communication and instructions to and from the client, consultants and the supply chain. Furthermore, information will be created from progress reports, subcontractor and material supplier procurement, payments from the client and from the contractor to its supply chain as well as general administration. To deal with this, it is important for the project team to maintain control over the handling of documentation whilst the project is active, as there may be need to refer to any of these items during the construction phase and beyond.

6.1.1 Changes in design and documentation

At the commencement of a project, a hard copy of contract drawings and the documents are usually stored in files and racks within the site accommodation and electronically backed up on a computer server in the event of losing prints. The contractor also keeps at least one set of 'for construction' information as hard copy within the site accommodation for general use, which is updated as new information is received and stored electronically.

Design or specification changes can occur at any time until the practical completion of a project (and possibly within the defects liability/rectification period) and, when available, must be issued by the document controller to the contractor in a timely manner. The information can arrive via an electronic collaboration system, email, compact disc, hard copy or fax if practical, and is

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usually addressed to the project manager in the first instance. The project manager then issues the information to the quantity surveyor and site manager. When it is received, the quantity surveyor must assess the changes and ensure appropriate supply chain members are issued with the new or updated information. This is because works may be awaiting the information in order to proceed and its late supply can involve cost implications if not dealt with in a timely manner. Even if the quantity surveyor considers that no expense will be incurred as a result of the changes, e.g. drawings that magnify certain details or that confirm the design complies with the requirements of CDM 2007, the information must still be issued to ensure the correct design and responsible procedures to execute the works are carried out.

It would be typical for a contractor to engage two or three scores of material suppliers and subcontractors on a project worth circa £10 million who must be supplied with the correct information in order that they can supply the goods and carry out their services. Part of project administration involves the contractor issuing suppliers and subcontractors with a set of 'for construction' documents which are usually issued when placing an award. Alternatively, an award may state that the working documents 'for construction' purposes are those supplied in the contractor's invitation to tender. In following usual protocol, a client and/or consultant will not distribute initial 'for construction' documents or subsequent information to members of a contractor's supply chain because it is a contractor's responsibility. However, if a client engages suppliers or contractors that have no contractual link to the contractor, the client's agent normally issues the information direct and provides the contractor with a copy as matter of course.

Each consignment of new or revised information issued to a contractor is normally accompanied with a document transmittal. When a consignment involves the issue of a revised document it could state what the revision entails and, if involving a drawing, identify the changes with notations. However, consultants probably need to avoid this scenario for practical reasons if numerous changes are involved. Here, a revision could state 'changes to suit the client's requests', leaving the contractor to spot the differences and decide to whom the information should be sent. In order to understand the impact of changes and who is affected, it requires an understanding of the sequence of working operations and construction technology. For example, let us say a revised architectural drawing is issued with an instruction to proceed with changes to the elevations of a building that amend the height of windows before they are manufactured or the walls built. Figure 6.1 demonstrates the change by focusing the subject centrally and linking the effect to trades that will require notifying.

Where a trade package includes a number of trades that require notifying, whoever is in receipt of the award covering the trade scope should receive the notification. In the example used in Figure 6.1, the supply of glass and glazing for the windows may be part of a window manufacturer's award which also

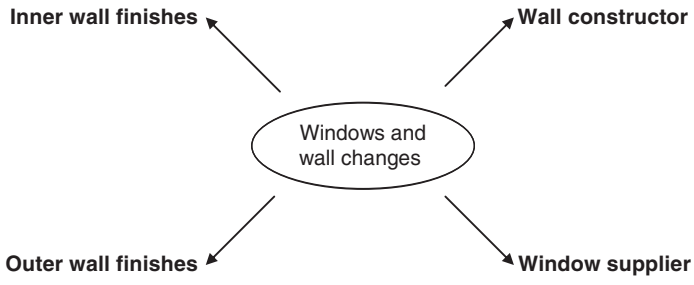

Figure 6.1

includes window installation. Here, the contractor would only issue notice of the change to the window manufacturer even if it knows the glass supplier's and glazier's details. If there is a knock-on effect because of the window changes – say, electrical power outlets need relocating because they clash with the revised window scheme – the client's agent or lead consultant responsible for design coordination will finalise the design with the electrical consultant. The electrical consultant will then amend and reissue the electrical drawings and send to the contractor, who will in turn issue them to the electrical subcontractor without needing to issue them to anyone else. When changes occur, issue of information by the contractor must be accompanied by a document transmittal; this could, for example, include a letter signed by the quantity surveyor if he/she wishes to confirm a quoted price for the changes which a subcontractor may have already provided.

On large projects running for say a year or more, subcontractors are often engaged for long periods of the construction phase. They might employ supervisors to coordinate works with the contractor's site personnel and are permanently based on site or are regular site visitors. Here, document distribution is usually via the contractor's site manager who places information in pigeonhole message boxes located in areas such as the general subcontractor's site office where the supervisor is able to retrieve information. However, it is normally the quantity surveyor's responsibility to ensure the contents of each distribution are confirmed in writing, which can be achieved by including a document transmittal with every consignment which must be recognised and enforced by the project and site managers. Failure to follow this procedure could lead to oversights by suppliers of goods and/or goods and services because they are working to superseded documents.

A wise contractor will not dispose of superseded documents and will ensure that they are retained in separate files or racks for reference. This information should be stored within the site accommodation, marked 'superseded' and put out of sight to ensure they are not used as working documents in error. If a project involves numerous revisions culminating in a large amount of superseded information and a site office lacks storage space, information can be kept as electronic copies which will free up some office space.

6.1.2 Contractor-generated documents

During the construction phase, written communications might be addressed to individual project team members without the others being copied in. This can be a disadvantage to a project team as it could mean the flow of communication is hindered, especially if certain matters require relaying to others. To enable collaborative working, effective communication and an understanding of each member's activities, it is wise to create a shared reading file containing copies of the written communications received in a working week. An effective system can be implemented by each project team member leaving received and read documents in an office in-tray which are inserted into a common reading file. The file is then circulated to project team members who initial a sign-off sheet attached to the front of the file to confirm they have read the contents. When all team members have signed off, the file contents are removed for general filing and new information inserted for the cycle to recommence. To be effective, the file should commence on a given day and have a system where items are read and returned to a secretary without anything being removed.

The use of a reading file is beneficial on large projects as each team member cannot be expected to know all the activities of the others, and the file allows an insight into matters that may affect another person's role. For example, a client's agent might have issued a number of written site instructions to a site manager: if the instructions are included in the file, the quantity surveyor will become aware, assess their effect on the contract and act as necessary. Items to include in a reading file should be specific and not of a general nature so they can be retained as evidence or referred to at a later date if required. They include:

- Site instructions to the contractor
- Site instructions from the contractor to the supply chain
- Communication to and from the client/client's agent
- Document transmittals from the client's agent or consultants
- Minutes of meetings
- Health and safety notices
- Communications between the contractor and supply chain
- Communications between statutory authorities and other authorities involved with the project
- Communications from stakeholders with an interest in the project
- Contractor's Requests for Information (RFI) addressed to consultants to answer design or documentation queries
- Register of RFI showing the date of requests to check whether anything is outstanding.

It does not need to include:

- Delivery dockets from suppliers
- Quotations or payments

- Variation prices
- Registers, other than RFI
- Payment details
- General communications that are concluded and require no further input from anyone
- Anything not considered relevant to the project team's roles.

The amount of paperwork eventually finding their way to master files can be overwhelming and a way to reduce this is by electronic communication. When general communication is electronic, it would be wise to store emails in a site-based electronic file using the project identification number for reference. Any attached documents should be downloaded and stored on the project file for general access. It is important for email senders to copy people in (Cc: carbon copy) and use their discretion about the amount of electronic and hard copying. For example, a supplier may be having problems with the delivery of materials to an agreed programme and the site manager has a flow of email communications to and from the supplier copying in the quantity surveyor. There would be no point in the quantity surveyor storing hard copies of the emails unless there is a breach of contract by the supplier and the Cc will be for information only. Alternatively, it is perfectly acceptable for anyone to issue emails with the notation FYI (for your information) addressed to the appropriate person. This would be suitable communication from the site manager to the quantity surveyor to forewarn of a potential problem involving expense or delays. This is because the quantity surveyor is not directly involved with construction activities but must be made aware of issues that could develop into a dispute. If the quantity surveyor has received a flow of emails regarding a matter that leads to a conclusion and resolved without further input required, he/she can delete the electronic communications as they no longer serve a purpose.

Throughout the construction phase, each project team member will have a responsibility to ensure files in relation to their role are accessible and maintained at all times. For example, a site manager is usually responsible for safekeeping site instructions issued from the client's agent as it is a site management duty. If the quantity surveyor requires access to these instructions, they should be readily available because it is unusual for the quantity surveyor to make copies for his/her own use.

In general, the quantity surveyor is responsible for creating and managing documentation normally restricted to:

- Contract execution files with subcontractors, consultants and material suppliers
- Payment and variation files for subcontractors, consultants and material suppliers
- Communications to and from the contractor's supply chain of a commercial nature

- Purchase order books
- Communications regarding disputes or claims between the contractor and supply chain
- Progress payment claims under the main contract
- Communications of a contractual nature between the contractor and client/ client's agent
- Project insurance details including policies provided by subcontractors
- The executed main contract
- Estimator's handover pack including contract or builder's bills of quantities.

For security purposes, information retained as hard copy should also be stored electronically and backed up regularly on a computer server beyond the confines of the site accommodation. This is in the event of a fire, flood, etc, that may destroy the hard copies.

6.2 Changes to the works

A contractor might be instructed by a client's agent to change the works under contract. When this is not because of a default by the contractor, it generally results in variations and the quantity surveyor will face variations from two fronts. The first is from changes under the main contract and the second from the contractor's supply chain. For clarity, it is wise for the quantity surveyor and project team to define variations as those listed under the terms of the main contract only. Some contractors use the term 'variations' generically, and link it to anything considered as additional works to a contractor's supply chain based upon instructions issued by the contractor. These additional works may not be a variation under the main contract and generally they reflect the manner in which the project is managed and procured by the contractor. To demonstrate, if a contractor executes a contract with a plumbing contractor omitting the supply of sanitary ware and the supply is part of the main contract, and the contractor later wishes the plumbing subcontractor to provide the sanitary ware, it is not a variation to the client under the main contract. It merely means that the contractor will not place an award for the sanitary ware elsewhere and its supply is additional works for the plumber once the contractor issues an instruction. However, if the client alters the style of sanitary ware that was part of the main contract, it becomes a variation under the main contract and, in turn, to the plumbing subcontractor once the contractor issues an instruction. This is a reason why a cost management system will distinguish descriptions and only consider a variation as those works permitted under the main contract with anything else described to whatever the contractor chooses, i.e. additional or extra works applicable to the contractor's supply chain only.

The quantity surveyor must understand what constitutes a variation because definitions stated in a main form of contract might be broad in context as it is not possible for the form to detail every scenario. A variation can occur:

- Naturally arising from the nature of the works whilst they are in progress
- By instructions from the client's agent
- By conduct of contractors and design consultants appointed by the client
- By the issue of an instruction for the expenditure of a provisional sum
- By the contractor seeking changes for improvements and increased scope of works.

If the quantity surveyor is faced with any one of the above and is unsure whether it is a variation, a project manager or other staff member experienced in contract administration should be consulted before a variation request is prepared because a client's agent may reject it if it has no grounds. The quantity surveyor will need to be aware of any latent conditions associated with the project as they may influence the existence of a variation. Latent conditions are physical conditions that become exposed once the works commence that a contractor could not have foreseen when preparing a tender by observing or examining the site. This may relate to anything underlying or adjacent the land when there is no specific mention in the tender documents and the contractor may have qualified such conditions as excluded from its tender, e.g. excavating in rock. Should any of these conditions manifest whilst works are in progress, they may be considered a variation by relying on the terms and conditions of the tender.

Once a need for a variation is verified, the quantity surveyor will normally prepare a variation request or quotation for the client's agent to approve and will need to adopt a suitable approach for assessing the value. Driving factors influencing the approach are whether the variation changes quantities, quality or both and if the changes can be measured. When it is possible to measure the changes, the form of contract may state a method of valuing variations.

6.2.1 Changes in quantity

When a variation involves changes in quantities without altering the quality of a specified product, a straightforward approach is to measure the original and revised works to arrive at a difference and apply rates from the contract bill of quantities or builder's bills. For example, let us say the concrete ground floor slab to five pairs of identically-sized semi-detached houses increases in thickness before construction commences and a bill rate of £120.00 m^3 is applied including labour, plant and materials. Assuming the mesh reinforcement arrangement remains unchanged and no additional excavation is required to accommodate the extra thickness because the floor level will be raised, an assessment for changing the floor price would comprise the following:

<u>OMIT</u> Original floor details as per Contract drawing A1234 Revision 'A'

$$\mathbf{5 @ 20.00 \times 5.00 \times 0.150 \text{ thick} = 75\,m^3}$$

<u>ADD</u> Revised floor details as per Construction drawing A1234 Revision 'B'

$5@20.00 \times 5.00 \times 0.250$ thick = 125 m^3

<u>Therefore,</u> OMIT 75 m^3 ADD 125 m^3 = +50 m^3@ £120.00 = £6,000.00

<u>Variation cost is an ADDITIONAL £6,000.00</u>

There would be no additional charge for increasing the width of the formwork edge because it still falls within a category not exceeding 250 mm wide. This assessment excludes an amount for the contractor's off site overheads and profit which is usually charged at an agreed percentage to the cost of the variation. If the variation amount is a credit to the client, only the cost of the variation is submitted. Value added tax is normally excluded from the assessment and noted to that effect on the variation request.

6.2.2 Changes in quality

Where there is a change in quality, the assessment is more detailed as it involves assessing the rate as well as quantities if they also change. To assess an alteration to a rate, new plus or minus adjustments for any change in labour requirements are allowed including substituted material costs. Alternatively, the change can be substantiated with a quotation from a material supplier or subcontractor. Using the earlier example of altering concrete floors to houses, let us say the concrete specification has changed as well as the quantities required. To verify a price for the material change, the quantity surveyor obtains a quotation from the subcontractor in receipt of the award to carry out the works. The quotation includes a letter from a concrete supplier advising that the specification is an upgrade from the original requirement and the subcontractor will be charged an additional £10.00 m^3. The subcontractor confirms there are no changes to the price for placing the material and requires a contribution to the supplier's extra charge for overheads and profit and wishes to charge the contractor £12.00 m^3. The assessment can take the following form:

<u>OMIT</u> Original floor details as per Contract drawing A1234 Revision 'A' and Concrete specification S1234, 'concrete to include minimum cement content of 200 Kg/m^3'

$5@20.00 \times 5.00 \times 0.150$ thick = 75 m^3@ £120.00 = £9,000.00

<u>ADD</u> Revised floor details as per Construction drawing A1234 Revision 'B' and Concrete specification S1234A 'concrete to include minimum cement content of 300 Kg/m^3'

$5@20.00 \times 5.00 \times 0.250$ thick = 125 m^3 @ £132.00 = £16,500.00

<u>Therefore</u>, OMIT £9,000.00 ADD £16,500.00 = +£7,500.00

<u>Variation cost is an ADDITIONAL £7,500.00</u>

A variation price should reflect the overall impact of the change where possible. For example, if window heights are altered on a new building prior to their manufacture and affect walls which are not yet built, the variation must address changes in quality to the windows together with changes in quantities to the walls including their finishes. It is impractical to submit one variation for windows and another for the wall changes as this involves unnecessary administration.

When it is necessary to obtain subcontractors' or suppliers' quotations for pricing a variation, the quantity surveyor must be satisfied that the prices quoted are fair and reasonable. This means that written quotations must reflect current market prices for materials, plant hire and labour charges, and descriptions recognise the changed scope. This requires a basic understanding of the components of construction materials and the methodology for their construction, and the quantity surveyor may consult the estimator for advice to check the cost. For example, using the change in the concrete specification discussed above, if the contractor's estimator advises that concrete with a cement content of 200 Kg/m^3 will cost £100.00 m^3 to purchase which a subcontractor advises is an extra £12.00 m^3 when the cement content is higher and the concrete classification changing, the rate is reasonable. This is because the material supply price for concrete includes cement, sand, large aggregate, water, mixing, quality control and delivery to site and the increase in the quantity of cement is a minor part. If a revised quotation states the extra as £75.00 m^3 representing a 75% increase merely because of the increased cement content and change of concrete classification, it would be excessive and should be queried by the quantity surveyor before being included in a variation quotation. Failure by the contractor to observe reasonable prices could mean that the assessor of the variation carries out an independent assessment. Therefore, the quantity surveyor must conclude and be confident with the price prior to submitting the variation.

On a construct-only contract, the contract form might state that a PQS will assess the price of a variation on behalf of a client's agent with the client's agent having the final say. When this applies, the quantity surveyor must assist the process and not leave the PQS to act alone, as vital information might be required which, if not forthcoming will lead to a fair assessment on merit without contractor input.

Where the quality change is radically different from the original, it may be ideal to delete the original works by fully crediting the value and assessing a price for the new works from scratch. Here, it may mean introducing new unit rates because they are not provided in the bill of quantities which can be obtained from the estimator and, once known, can be built up as a part of a composite rate. Where this applies, the contractor must drive the situation with or without subcontractor input because, in general, a client will seek

commitment from the contractor. Let us consider a project with a contract bill of quantities that includes 50 metres of 1800 mm high timber fence along a boundary of the site. The fence is not erected or an award placed and the client's agent issues an instruction requesting a price for the fence to be changed to a brick wall for a given specification and there are no rates in the bill of quantities for the wall. What is the price of the variation? The options are to price the works with a measure using the Standard Method of Measurement as a guide and apply market rates or create a composite item for the wall and calculate a suitable unit rate. Table 6.1 demonstrates a process using a composite item and method of calculating a unit rate.

The contractor should endeavour to meet its obligations by issuing a variation quotation based upon a fixed price. However, if changes are impractical to measure or the contractor considers the risk too great, a solution is to revert to daywork and the contract may provide for the scenario. Here, the variation request must state a contractor's reasons for electing to carry out the works as daywork and include a schedule of rates. An item such as a boundary wall would generally not be considered acceptable as dayworks as the price can be ascertained by a commitment from the contractor.

6.2.3 Changes in sequence of works

A contract could permit a client to instruct a contractor to change the sequence of working operations. This may apply in situations which suit the nature of a client's business, e.g. retail stores that require revised sectional completion dates. Furthermore, limitations of working space and/or hours might be imposed on a contractor that reduce the output of trades and prolong the construction period, which can be identified with a new programme. However, if a decision to alter sequences is discussed early enough without applying restrictions, they may be reorganised so they do not delay a date of practical completion with the variation resulting at possibly no extra cost to the works. The assessment of each scenario is on a case-by-case basis and a client will usually be responsible for the extra cost of any works carried outside normal hours or the reduced output of labour because of restrictions imposed. Items to consider when assessing a price are:

- Reduced area for storing materials that may need to be stacked or stored off the site
- Premium time by subcontractors for shift work, overtime or out-of-hours working
- Additional supervision by the contractor outside normal working hours
- Reduced trade labour constants in relation to output.

A method of assessing a variation quotation is to consider the hours disrupted because of the change and apply the extra cost to the base hourly rate to cover overtime expense. In addition, it may be necessary to charge for the storage fees for materials stored off the site and factor reduced output to trade works because

Table 6.1

****** Boundary fencing change - AI Nr 100, Replace 1800 mm high timber screen with brick wall ******

OMIT - BOQ
Page 11/5 item g

Timber fencing 1800 mm high, close board feather edged 100 × 13, overlap 25; posts 75 × 75 × 2200 long at 2400 centres secured in and including 100 × 300 mm concrete foundation (1:2:4 / 40 agg) poured on earth.

50 m @ £75.00 = £3,750.00

ADD

Brick wall 215 mm thick, 1800 mm high overall above ground, in English bond facework (PC Sum £300.00 per thousand for brick supply) flush gauged mortar bed and joints pointed both sides as the work proceeds including brick on edge coping. Wall constructed off 600 × 200 mm reinforced concrete foundation

(1:3:6 / 40 agg) with 300 mm deep substructure in common brickwork including backfilling the trench upon completion and disposal of surplus materials off site.

Analysis of new price based per metre run of wall

Foundation and substructure:

Excavate trench	1.00 m × 0.60 × 0.50	0.30 m³ @ £ 19.70	£ 5.91
Backfill with arisings	1.00 m × 0.60 × 0.50	0.30 m³ @ £ 26.00	£ 7.80
Earthwork support	2/1.00 m × 0.50	1.00 m² @ £ 14.31	£14.31
Compact bottom	1.00 m × 0.60	0.60 m² @ £ 1.00	£ 0.60
Reinforcement	1.00 m × 0.60	0.60 m² @ £ 20.00	£12.00
Concrete found	1.00 m × 0.60 × 0.20	0.12 m³ @ £120.00	£14.40
Substructure, 215th	1.00 m × 0.30	0.30 m² @ £ 45.00	£13.50
DPC	1.00 m × 0.30	0.30 m² @ £ 10.00	£ 3.00
Ddt Backfill	1.00 m × 0.60 × 0.30	0.18 m³ @ £ 26.00	(£ 4.68)
Add dispose off site	1.00 m × 0.60 × 0.30	0.18 m³ @ £ 40.00	£ 7.20
Total			£74.04 m

Wall above ground

The wall height will be 1698 mm + 102 mm brick on edge coping to achieve 1800 mm overall. English bond comprises of alternate rows of brickwork laid as stretcher and header bonds and there are 119 bricks per m². The contractor has agreed a bricklaying rate with a labour-only gang to construct the wall at £350.00 per thousand and £10.00 per metre for laying the coping course. This includes the use of the contractor's access equipment and subcontractor's quotations are unnecessary. The contractor will need to provide the access equipment and mortar mixer and allows for this as consumables and attendance. The material cost for the mortar is assessed at £150.00 m³.

Brick supply 1.00 m x 1.698 m × 119 nr + 15% waste	232 nr @ 0.30	£69.60
Brick coping supply 1.00 m/75 mm wide + 1 +15% waste	16 nr @ 0.30	£ 4.80
Brick laying 1.00 m × 1.698 m × 119 nr	202 nr @ 0.35	£70.70

Table 6.1 (*cont'd*)

Brick coping laying	1 m @ £ 10.00	£ 10.00
Mortar supply 1.00 m × 1.698 = 1.70 m^2 × 0.05 m^3/m^2	0.09 m^3 @ £150.00	£ 13.50
Consumables and attendance, 15%		£ 25.29
Total		£ 193.89 m
Summary: £74.04 + £193.89 + Contractor's off site overheads and profit of 15% = £308.12 m		
OMIT Timber fencing 1800 mm high	50 m @ £ 75.00	£ 3,750.00
ADD Brick wall 1800 mm high	50 m @ £308.12	£15,406.00
Therefore, OMIT £3,750.00 ADD £15,406.00 = + £11,656.00		
Variation amount as a contract sum adjustment is an ADDITIONAL £11,656.00 (Excluding Value Added Tax)		

of imposed restrictions. A client may accept the charges and consider it a benefit because it is having a say with the operations to suit its business needs. If the works are going to extend the construction period, this must be included in the assessment and will be the additional time a contractor will have as a site presence beyond a date of practical completion. These costs are ascertained on a daily or weekly basis for supervision, hired plant and site accommodation charges which are found in the preliminaries costing. It is far better for a contractor to submit these costs as a variation quotation for acceptance or rejection by a client's agent instead of anticipating or actually incurring expense without negotiation. Should this happen, it will become a claim under the main contract which is discussed further under Sections 6.6 and 6.7 later in this chapter.

6.2.4 Variation submissions

When issuing a variation quotation or price for approval, the quantity surveyor must give reasons why the contractor considers it necessary to have an instruction confirming the acceptance of a variation. This can be substantiated with reference to written instructions and/or the issue of revised and new information as proof for the request. It should also include information used in arriving at a price such as subcontractor or material supplier's quotation(s) and the quantity surveyor's calculations.

Once a variation request is submitted, it is necessary to create a variation register to keep track of submissions, which can be achieved by creating an excel spreadsheet. The register should list each variation in numerical order, including a brief description of the changes, the value, date of issue and status of the approval decision. It is wise to include a withdrawal notice on the status section to demonstrate the contractor has no financial commitment when a variation is a quotation only with the changes not required and not to proceed.

Variations are normally approved in a statement issued as a contract sum adjustment by the client's agent and the adjusted sum should equal the sum

shown on the variation register, excluding items that are withdrawn and agreed by the contractor. Table 6.2 demonstrates a format of a suitable register.

An approved variation can be issued to the contractor as a written instruction or a contract sum adjustment, and might include new or revised drawings and documentation. When the scope of changed works involves works by a subcontractor or materials from a supplier that have agreements in place with the contractor, the changes must be communicated to the appropriate party. This can be carried out by issuing a site instruction authorised by the quantity surveyor or in a letter from the contractor instructing the works to be carried out. Normally, site instructions exclude items of a financial nature and, if finance is involved, should be issued as a letter. Variances that alter the value of an existing award to a subcontractor or supplier should be issued as separate contract sum adjustments as soon as practically possible to ensure the payment process runs smoothly.

The timing for the receipt of an instruction accepting the variation request is important and ideally the contractor should receive it prior to the stated works commencing, which unfortunately does not always happen. Construction projects are active environments and works considered a variation might begin after issue of a client agent's instruction without an agreed price. This is acceptable when a contract states the approval process must not take priority if it could hinder site operations. Some contractors sometimes 'miss the boat' when they carry out the works and take the risk of not being paid. Strictly speaking, this might not be a contractual fault by the contractor because there may be a consensus to carry out variations based upon the issue of new or revised drawings which is considered an instruction. Ideally, such information should be accompanied by an instruction for there to be no doubt. In reality, if a contractor carries out works that it considers are a variation before issuing a variation request, it does not mean the request will be rejected; it depends on the circumstances and the responsibility of the parties providing neither party has breached the contract. If the quantity surveyor issues a variation request when works are complete, it must state the works as complete because the contractor will be seeking payment in its next progress claim and, ideally, any variation should be approved before making a request for payment.

Table 6.2

Variation Register ***Client: Housing Association***		***Project Nr: 1888*** ***Project Title: 10 nr new 2 story residential properties***			
Nr	***Description***	***Date Issued***	***Amount***	***Status****	***Approved amount***
V 1	Change of slab thickness		£6,900.00	A	£6,900.00
V 2	Boundary wall change		£11,656.50	P	
V 3	Wall render change		£1,380.00	W	0
*A = Approved: P = Pending: R = Rejected: W = Withdrawn					

Rejection of a variation

There may be situations when a client or client's agent disputes the value of a variation with the contractor. In general, disagreement about the value does not make the contract invalid and in effect 'the show must go on'. The amount in dispute can be substantial, especially on a design and build contract where a client and/or client's agent wishes to amend a contractor's proposals and issues instructions for changes. If the number of change requests makes a project substantially different from the original scope, e.g. additional storeys or significant changes in product selection, and the value of the variations is considerable enough to make the contract sum appear minor, the contractor should consider requesting a new contract because it could be uneconomical to administer the existing contract. If this becomes evident because of the number of variation quotation requests received, the quantity surveyor should bring the situation to the attention of the project manager.

Once a priced variation request is issued, if the client/client's agent is of the opinion it should not exist and the works are part of the contract, the contractor must decide what to do, and act wisely in a positive way. If a contract is silent or ambiguous on a matter and the contractor issues a variation anyway, whoever administers the contract on behalf of the client can only administer the terms and conditions of that contract. The situation is the same for a quantity surveyor who administers a contract on behalf of a contractor although it is the project manager who remains responsible. If a contractor simply refuses to continue with the variation works without an approval and issues a notice to that effect, it may trigger the client's agent to exercise clauses of the contract and terminate the agreement before the contractor does. This would be an extreme situation but could occur if the sum involved is such a significant amount that it warrants the contractor's conduct. Such conduct suspending the works must be permitted by the contract or the contractor will be in breach of contract. However, if the contractor decides to commence works, it is possible the decision may be perceived as acceptance of the client/client agent's position. Here, and after commencing works, the contractor must protest politely by issuing a letter to the client explaining its grievance and grounds for the decision to proceed. The letter should be worded to the effect that the contractor respects the decision of the client/client agent's to reject the variation yet reserves the right to leave the subject in abeyance pending future summary judgement under dispute resolution clauses of the contract or at common law. The letter must be addressed to the client because the contractor is exercising its rights under the agreement it has with its client and not an agent of the client. The letter must insist the client acknowledges the contents of the letter and state that if an answer is not received by a specified date, the contractor will consider the contract as repudiated and seek damages at common law, i.e. because remedy of the situation is not written into the contract. Alternatively, it may state dispute resolution using alternative methods to common law available to the parties. It is negative to view this approach as one where a contractor is backing down or

a client is being blackmailed – it should be perceived as merely a method of recording events that place emphasis on the dispute resolution methods and common law rights available to a contractor in the absence of any specific contractual provisions.

6.3 Reimbursement

A contractor must be financially reimbursed for its works under contract. This must also be carried out in a timely manner as stated in the terms and conditions of the agreement it has with the client. Similarly, reimbursement by a contractor to its supply chain must be in a timely manner to comply with each agreement. Until the mid 1990s, contractors may have been excused for adopting a policy of 'pay when paid', meaning a contractor's creditors on a project would only be paid once the contractor was paid. The Construction Act and changes to legislation associated with that Act by the Local Democracy, Economic Development and Construction Act 2009 means this situation is generally no longer acceptable. The 2009 Act addresses dispute resolution involving financial reimbursement where a construction contract exists. However, Section 113 (1) of the Construction Act relaxes the exclusion of 'pay when paid' in the event of insolvency by a third party. In effect, this means that there is no legal duty for a contractor to pay its supply chain engaged on a contract where the client becomes insolvent. Legislation regarding payments is not restricted between client and contractor, and generally reverberates through the supply chain when 'construction operations' are carried out.

A delay in payment to a contractor is usually unintentional. It may arise from either the omission of a stated date in a contract for the issue of interim payment certificates, or poor time management by the contractor by ignoring the date and not issuing a progress claim request early enough. However, the form of contract used may not make it conditional for a contractor to submit a progress claim and state that the client's agent will assess works in progress and issue a payment certificate. The JCT Intermediate Building Contract 2011 and other forms of contract, for example, state that the architect/contract administrator has an obligation to issue a payment certificate even if the contractor has made no request for payment whether by error or intention. The contractor should not permit this to happen, as it may receive a certificate stating an amount different than it expected and must then depend on the quantity surveyor to assess the value and submit a progress claim. Similarly, delays can occur with payments to a contractor's supply chain if the supply chain or quantity surveyor ignore the dates specified by the contractor's accounting department for receipt of authorised invoices in order to allow time to process payments. Unlike the main contract, the contractor is not usually obliged to pay for works completed or goods supplied by members of its supply chain without receiving their invoice or application for payment.

The quantity surveyor is not responsible for the collection of payments owed to the contractor or for ensuring supply chain members are paid on time as this

is a responsibility of the contractor's credit controller. However, the quantity surveyor is responsible for putting the wheels in motion to generate the payments.

6.3.1 Client interim payments

The form of contract will normally state a date when the client's agent or payment certifying officer must issue an interim payment certificate to the client stating an amount due to the contractor. To assist the process and ensure the contractor receives payment on time, the quantity surveyor must prepare a progress claim and submit it as an 'Interim Application' in a timely manner. This is usually to a timeframe, and in order to understand this, it is easier to work backwards from the time the contractor is due to be paid, i.e.

- The time a client has to pay a contractor once in receipt of an interim certificate, say 5 days

↓

- A date when an interim certificate must be issued to a client as stated in the contract, say 25th of the month

↓

- The time available to prepare a certificate before it is due for issue to a client, say 7 days

↓

- A date the contractor's quantity surveyor should issue an 'Interim Application' = 18th of the month

Assessments for interim payments are usually done by build stage or time. Where the preference is by build stage, it applies when works reach physical milestones of construction as stated in the contract on the Activity Schedules. This is a relatively straightforward process to follow and the quantity surveyor prepares a progress claim as an application for payment based upon the completion of each milestone or part thereof as stated in the schedules. Where preference is by time, the quantity surveyor needs to drive the process by presenting a detailed progress claim as an application for payment. The format of an application can be a trade breakdown as discussed in Chapter 4, Section 4.5.6, or as Activity Schedules that need to be agreed with the client's agent prior to the first application being issued.

Assessing measured works

One method for assessing an amount to include as measured works is to visit the site under construction and inspect the works in progress. An assessment may take the form of copying each trade bill and marking off in ink which items are complete or in progress at the time of the inspection. The emphasis here is to assess the status of the works on the date of making the inspection and not forecasting what might be complete on the date the interim payment certificate is due. For example, the excavating and filling works could be assessed as follows:

MAIN HEADING ON BOQ: **Excavating and filling**	
SUB HEADING 1: **Topsoil strip** – 2 nr items	**100% complete**
SUB HEADING 2: **Reduced level excavations** – 4 nr items	**100% complete**
SUB HEADING 3: **Filling** – 3 nr items	**50% complete**
SUB HEADING 4: **Detailed excavations** – 8 nr items	**50% complete**
SUB HEADING 5: **Service trenches** – 2 nr items	**50% complete**
SUB HEADING 6: **Dispose excavated materials off site** –1 nr item	**50% complete**

Upon returning to the contractor's head or site office, percentages representing completed works are valued at rates that form the breakdown of the contract sum. This involves examining sub-headings of the trade bill and applying a percentage of the financial allowance to arrive at a value for the trade. Thus:

M/H - **Excavating and filling**	
S/H1 **Topsoil strip:** 2 nr items – **100% of £7,000**	**£ 7,000**
S/H2 **Reduced level excavations:** 4 nr items – **100% of £15,000**	**£15,000**
S/H3 **Filling:** 3 nr items – **50% of £10,000**	**£ 5,000**
S/H4 **Detailed excavations:** 8 nr items – **50% of £18,000**	**£ 9,000**
S/H5 **Service trenches:** 2 nr items – **50% of £5,000**	**£ 2,500**
S/H6 **Dispose excavated materials off site:** 1 nr item – **50% of £60,000**	**£30,000**
Total value	**£68,500**

Therefore, the value completed is £68,500 out of a total £115,000 meaning the excavations and filling trade works are 60% complete.

In addition to measured trade works, it will be necessary to consider the value of other items on the progress claim format, i.e. variations, materials stored on site, etc, which are respectively ascertained from physical observation and suppliers' invoices.

Assessing preliminaries

When assessing preliminaries, the quantity surveyor should request payment for costs incurred when a project is running to schedule and in accordance with the construction programme. For example, if by the end of the first month on a programme, the site accommodation is established and foundation works have commenced which is in accordance with the programme, the full cost can be recovered because the project is on target to complete on time. However, let us say by the end of month 7 on the same project, the site accommodation is established and the foundations have commenced but the programme states that by this time the building should be complete. Here, it is only possible to request payment based upon the project running to the contractually agreed programme as it is not possible to include prolonged running costs if there will be a delay to the end date. Any additional expense caused by a delay to the end date resulting in a loss to the contractor when it is a responsibility of the client must be treated as a loss and expense claim and dealt with separately.

With each progress claim request, it is necessary to forecast future preliminaries expense through to the end of the project based on the contract programme. This can be determined by expressing the percentage of each item with a budget that a contractor anticipates will be spent for each progress claim until the programme expires. A determining factor is that the sum of percentages allocated for each budget item must not exceed 100% as this is the maximum a contractor is entitled to. Table 6.3 demonstrates this process on a construction programme that will run for seven months.

From viewing the table, the first assessment for progress claim No 1 (PC1) represents the contractor's actual expense because the project is running to programme. Thereafter, it is based upon a forecast assessment through to completion. Each forecast should be considered flexible to enable future anticipated expense to be modified in line with each progress claim request. For example, the forecast on the table is that 40% of the project insurance budget (P110) will be spent by the time of making the second progress claim. If this cost is not incurred by this time, it can be deferred for another progress claim.

Interim application submissions

The value of each progress claim as an 'Interim Application' is assessed as the cumulative value of works complete including builder's margin, plus/minus entitlements, less cash retention (if applicable), less an amount already paid. This produces a nett amount due for payment excluding Value Added Tax. The quantity surveyor should prepare and issue an 'Interim Application' on this basis for the project manager and contractor's financial controller as it is a guide to cash flow forecasts for the project. Depending on the contract, a client's agent may appoint a PQS to assess the works on its behalf. Where this happens, the quantity surveyor should endeavour to cooperate with the process and assist the PQS to ascertain a fair value of the works. At a reasonable time after the application has been submitted, the quantity surveyor should

Table 6.3

Project Nr:		**P100 - Preliminaries - Progress claims (PC)**					Forecast expenditure of BOQ allowance					
Cost code	***Standard description***	***BOQ allowance***	***Cumulative % claimed***	***Cumulative amount claimed***	***Progress claim PC1***		***PC2***	***PC3***	***PC4***	***PC5***	***PC6***	***PC7***
P100	Pre-commencement	£ 25,000	100%	£ 25,000	100%	£25,000	0%	0%	0%	0%	0%	0%
P101	Management and staff	£140,000	15%	£ 21,000	15%	£21,000	14%	14%	14%	14%	14%	15%
P102	Site establishment etc	£ 20,000	90%	£ 18,000	90%	£18,000	0%	0%	0%	0%	0%	10%
P103	Running costs	£ 60,000	10%	£ 6,000	10%	£ 6,000	15%	15%	15%	15%	15%	15%
P104	Temporary services	£ 10,000	75%	£ 7,500	75%	£ 7,500	0%	0%	0%	0%	0%	25%
P105	Temporary works	£ 15,000	0%	0	0%	0	100%	0%	0%	0%	0%	0%
P106	Security	£ 21,000	14%	£ 2,940	14%	£ 2,940	14%	14%	14%	14%	14%	16%
P107	Employer's Requirements	£ 5,000	90%	£ 4,500	90%	£ 4,500	0%	0%	0%	0%	0%	10%
P108	Contract conditions	£ 5,000	0%	0	0%	0	0%	0%	0%	0%	0%	100%
P109	Fees and charges	£ 10,000	60%	£ 6,000	60%	£ 6,000	10%	0%	10%	0%	0%	20%
P110	Insurances, bonds etc	£ 8,000	60%	£ 4,800	60%	£ 4,800	40%	0%	0%	0%	0%	0%
P111	Health and safety	£ 5,000	80%	£ 4,000	80%	£ 4,000	10%	0%	10%	0%	0%	0%
P112	Control and protection	£ 10,000	20%	£ 2,000	20%	£ 2,000	10%	10%	10%	20%	20%	10%
P113	Site records	£ 5,000	0%	0	0%	0	15%	15%	15%	15%	15%	25%
P114	Cleaning	£ 6,000	0%	0	0%	0	10%	10%	10%	10%	10%	50%
P115	Non-mechanical plant	£ 15,000	10%	£ 1,500	10%	£ 1,500	35%	10%	10%	10%	10%	15%
P116	Mechanical plant – major	£ 50,000	10%	£ 5,000	10%	£ 5,000	35%	10%	10%	10%	10%	15%
P117	Mechanical plant – minor	£ 20,000	25%	£ 5,000	25%	£ 5,000	25%	10%	10%	10%	10%	10%
P118	Defect liability period	£ 5,000	0%	0	0%	0	0%	0%	0%	0%	0%	100%
TOTAL		**£435,000**		**£113,240**	**26%**	**£113,240**						

contact the PQS to arrange a meeting on site to review the submission. A meeting after each submission will be beneficial to both parties and should be a regular arrangement because it permits the process to flow naturally. It is also in the contractor's interest because it starts the negotiations for an amount due which is expected to be paid on time. At each meeting, the PQS should benefit from the quantity surveyor's knowledge of the project, as items included in the application might not be physically built or immediately apparent and need discussion. For example, a number of subcontractors may have produced shop drawings for the manufacture of products that are under review by consultants, and are seeking payment for drawing preparation which is included in the application. The PQS will not be able to see this by visiting any structures in progress and will need to verify inclusion in a payment assessment by confirming sight of the shop drawings in the contractor's possession.

If the PQS disagrees about the value of a progress claim request because of a genuine calculation error by the contractor, it is normal practice for the PQS to issue a notice to the contractor advising an amended amount which the contractor should accept. If there is a discrepancy which is not a genuine error, the PQS must advise the contractor with reasons for the changes. The issue of this advice is courteous and usually a contractual requirement. Upon receiving such advice, the quantity surveyor must inform the contractor's project manager who can either accept the changes or raise a query with the client's agent or payment certifying officer. If this results in a dispute and the contractor wishes to exercise clauses of the contract for remedy, it may do so only upon receipt of the payment certificate and not before, as the payment certifier has the authority to amend the PQS's assessment.

6.3.2 Subcontractors' payments

In general, once a subcontractor is in receipt of a trade package award, the quantity surveyor must put the subcontractor's business details and agreed contract sum into a computer database on the cost management system (CMS). Where a schedule of rates applies, the contract sum must be an estimate based upon approximate quantities. This is to enable the system to recognise the award and generate payment certificates. If a subcontractor is already engaged by the contractor on other projects or had prior dealings on completed schemes, it will be recognised by the CMS. The quantity surveyor will enter a unique code reference against the project number and put in the financial value of the award. This will allocate the subcontractor an award to a predetermined value for a recognised project on the CMS, thus initiating the commitment. Once this is complete, the committed sum should be allocated to a cost code set up within the CMS that records the budget and may have been created at the pre-commencement stage of the project. Table 6.4 shows the input of an order issued to a subcontractor to carry out earthworks in comparison with a predetermined budget.

A distinct advantage of this arrangement is that the CMS is usually designed to ensure the value of each award is not exceeded by successive payments, meaning a subcontractor cannot be overpaid.

Table 6.4

Project Nr: 1888 ***CMS Code series:*** **Subcontract orders A100 – Excavating and filling**			
Cost centre	***Standard Description***	***Budget***	***Order value XYZ Earthworks***
A100-1	Remove overgrowth	£0	£0
A100-2	Topsoil strip	£7,000	£6,500
A100-3	Ground excavations to 1 m deep	£0	£0
A100-4	Ground excavations over 1 m deep	£15,000	£14,000
A100-5	Filling to level to 1 m deep	£0	£0
A100-6	Filling to level over 1 m deep	£10,000	£9,500
A100-7	Basement excavations	£0	£0
A100-8	Detailed trench excavations	£18,000	£17,000
A100-9	Detailed pad excavations	£0	£0
A100-10	Detailed lift pit excavations	£0	£0
A100-11	Service trenches	£5,000	£5,000
A100-12	Deposit spoil on site	£0	£0
A100-13	Deposit spoil off site	£60,000	£58,0000
A100-14	Land fill tax	£0	£0
TOTAL	**A100 - Excavations**	**£115,000**	**£110,000**

The quantity surveyor is responsible for assessing the value of works in progress which in effect is a payment withdrawal from the value of a committed award. However, there may be occasions when the value requires adjusting, including:

- If there was an error in the original amount input into the CMS that differs from the award
- Changes in Value Added Tax legislation
- Client's variations to the contractor that are to be carried out by a subcontractor
- Additional works authorised by the contractor
- Builders' work in connection with trades that the contractor wishes a subcontractor to carry out.

Where applicable, financial adjustments may require authorisation by the project or commercial manager, and once approved, are entered into the CMS to recognise the contractor's liabilities.

Interaction with the accounts department

A feature of a CMS is that it is also an accounting system which links committed order values to an accounts department to enable the processing of

payment certificates generated by the quantity surveyor. It will be necessary for the quantity surveyor to consider timing, and the latest dates by which an accounts department must be in receipt of payment certificates and invoices to ensure the procedure runs smoothly. For example, an accounts manager may state that the 25th day of the month is the latest by which an accounts department must be in receipt of payment certificates or invoices in order for it to process payments by their due date. Where this applies, the quantity surveyor must consider the length of time needed to assess the works and prepare payment certificates to enable the deadline to be met.

A contractor's accounts department may have numerous active projects requiring the processing of subcontractor payments which must be reconciled and balanced prior to making payment. It is therefore important for the quantity surveyor to adhere to the accounts department's request. Missing a deadline and submitting payment certificates late, resulting in payments not being paid on time is unacceptable and the contractor could be in breach of contract with the subcontractor. One cause of dispute between contractors and subcontractors is the contractor's failure to pay on time because of failing to comply with its own procedures, which is generally of no concern to the subcontractor. If a subcontractor is not paid on time, in general the client will have no interest in the process because there is no binding arrangement with the subcontractor. However, failure to pay a nominated subcontractor on time through a default by the contractor could trigger mechanisms of the contract that possibly enable the client to pay the subcontractor direct and recover the sum from the contractor.

Subcontractors' responsibilities with the payment process

To avoid delays in payment, the quantity surveyor needs to implement time management techniques and he/she will require the cooperation of subcontractors. To assist the process, it will be necessary for the quantity surveyor to advise subcontractors on the date(s) their invoices are to be received, which will be driven by any deadline set by the accounts department. However, this can create a problem if the contractor has a policy of logging receipt of invoices into the CMS by accounts personnel in order to record liabilities in the event of a subcontractor activating a dispute and making a claim under the Construction Act. The contractor's directors could well enforce this logging procedure and, where applicable, the quantity surveyor must understand the arrangement and make due allowances for time in the request for invoice submissions by subcontractors.

Invoiced amounts can be considerable sums and subcontractors with major works packages and those under contract for more than one month should be requested to issue a progress claim as an 'Interim Application' in lieu of an invoice. This is to permit an assessment and approval by the quantity surveyor who will advise on a sum to include on an invoice. No payments can be processed without an invoice unless the contractor uses a self-billing system with a

reciprocated tax invoice where the contractor pays the progress claim and issues a tax invoice with the payment.

Assessment of subcontractors' works for payment

A subcontractor in receipt of an award will usually issue progress claims or invoices for interim payments on a monthly basis or whatever timeframe is stated in the agreement. If a subcontractor's works is a minor contract that commences and finishes within one month, they may issue a single invoice to the maximum value of the award for one full and final payment. The amount requested for payment in a progress claim may be submitted as an 'Interim Application' in the same manner as would the contractor under the main contract. The claim must be a fair representation of the works complete and include any entitlement permitted by the agreement. In order to assess the amount claimed as acceptable for payment, the quantity surveyor will need to view the area of the site under construction. This will involve physically observing the appropriate works in progress in a similar manner as when preparing a progress claim on behalf of the contractor to a client. Alternatively, the quantity surveyor can prepare an Activity Schedule for reference and update the progress monthly which acts as a snapshot of the status of all works at any time.

A progress claim differs from an invoice in that it is a request to assess the value of works for payment whereas an invoice is an automatic debt. Once a progress claim or invoice is received, as a matter of course and if agreeing to the value, the amount claimed should be acknowledged within the timeframe stated in the contract with the subcontractor advised of the amount due.

There may be reasons why the quantity surveyor disagrees with a value on an invoice or progress claim which include:

- Incorrect calculations
- Errors involving Value Added Tax
- Inappropriate value of the works completed
- Claims for materials stored on or off the site that are not part of the agreement
- Disagreement about the value of materials stored on or off the site when part of the agreement
- No insurance provided with the application if requesting payment for materials stored off site
- The wrong project
- Dayworks not authorised by the contractor
- Unresolved amounts in dispute and still claimed that should be set aside
- Additional works or variations not authorised by the contractor.

Here, the quantity surveyor must act responsibly, responding within the same timeframe as if agreeing to the amount and formally rejecting the invoice, stating grounds for rejection with a 'pay less notice'. The rejection must provide a statement of a recommended amount for payment, including a break down,

and also applies if the amount to be paid is nil. By adopting this procedure, the subcontractor will have received notice and the contractor will have complied with legislation and the terms and conditions of the contract that should reflect the legislation. Awaiting the issue of any credit note is not an option for delaying payment, and the quantity surveyor must certify the amount due included in the statement. If a subcontractor issues a progress claim and later agrees to adjust the amount to include on an invoice it will submit, there is no point in communicating an agreement of the complying invoice once it is received.

During the construction phase, the number and value of variations and additional works can be substantial and the creation of a variation register will aid the process of managing payments. This is possible by creating an excel file for each subcontractor, listing the variations derived from the main contract in chronological order together with a description and amount of each one. The list can be extended to include additional works instructed by the contractor or this can be kept in a separate register. The register format can be similar to that created for administering the main contract as demonstrated in Table 6.2 above. The approved variations and additional works amounts are entered in the CMS which will automatically adjust the contract sum and recognise the contractor's liability to the subcontractor once the works are complete. It requires noting here that inputs entered in the CMS are the ones that create payments. The excel spreadsheet calculations are for reference only and the contractor's accounts personnel do not need to have any knowledge of such workings because they will rely solely on the CMS for the information.

The payment process is dictated by the level of automated information permitted by the CMS. A problem with some systems is that they have a one line approach, i.e. an amount to be drawn off the contract sum works or an amount from client variations and another for additional works, etc. The produced payment certificate will list the value of the contract sum plus or minus agreed adjustments to give a revised contract sum as the contractor's liability, less retention (if applicable) and less the sum(s) previously certified or paid to equal an amount due. Retention funds are held by the contractor and released in accordance with the agreement. This is usually half the amount held at practical completion with the balance due at the end of the defects liability/rectification period and usually mirrors the requirements of the main contract. Accrued interest on cash retention sums are retained by the contractor. This is because the cost to establish, manage and close a trust account for each subcontractor is not practical as amounts are usually low in comparison with the retention sum held under the main contract. Table 6.5 shows an interim payment certificate for an earthworks subcontractor for authorising and issuing to an accounts department to process. Once the certificate is authorised, it is necessary to append the invoice to the certificate which is usually required by the contractor's accounts department for auditing purposes and matters associated with Value Added Tax.

Some labour-only subcontractors may be paid weekly, meaning usual monthly credit terms applicable to labour and material subcontractors are waived. This is traditional because payments are in fact wages to individuals.

Table 6.5

Certificate Nr 2	**PROGRESSIVE WORKS PAYMENT CERTIFICATE**	
CONTRACTOR:	**BUILDER CO LTD**	
SUBCONTRACTOR:	**XYZ EARTHWORKS CO LTD**	
PROJECT:	**10 nr New 2 storey residential properties (Project Nr 1888)**	
Contract works award value		£110,000.00
Agreed additional works		£ 1,000.00
Agreed client variations		£ 0
Builder Co Ltd commitment to XYZ Earthworks Co Ltd (Excluding Value Added Tax)		£111,000.00
Value of works in progress **(60%)**	£66,000.00	
Value of additional works in progress **(100%)**	£ 1,000.00	
Value of client variations in progress **(0%)**	£ 0	
Total value of works	£ 67,000.00	
LESS Retention (5%)	(£ 3,350.00)	
Nett amount certified (Excluding Value Added Tax)	£63,650.00	
LESS previously nett amount certified	(£28,500.00)	
Amount due (Excluding Value Added Tax)	**£35,150.00**	

Signed: **Approved**:

Quantity Surveyor **Project Manager**
Date: **Date**:

Accounts entry on CMS
Date:

Where applicable, works in progress are measured and valued by bonus surveyors employed by the contractor who 'book in' works and process payments together with bonuses and incentives based upon productivity agreements with the site and project managers who engage them. The quantity surveyor is normally responsible for authorising these payments in conjunction with the project manager to ensure project cost management is suitably monitored.

Effect of site instructions on subcontractors' payments

In general, any supply chain member can request payment for works from the contractor if they are in receipt of a written instruction authorised by the

contractor. However, the procedure is generally applicable to subcontractors because they are at the works interface and the contractor may need to issue instructions to alter, enforce or reschedule the requirements. A contractor's personnel will issue instructions when they wish compliance with certain matters. This may be instigated by an instruction from the client's agent because the agent cannot normally issue instructions to subcontractors or anyone engaged directly by the contractor. The contractor's personnel may issue instructions for a contractor's purpose only and there is nothing stopping a contractor issuing an instruction to a client-engaged contractor (although the contractor should be aware of ramifications). Occasionally, personnel may be unaware of a subcontractor's contractual responsibility and issue an instruction in any event. The instruction may include the notation 'for record purposes' or initials FRP, the intention being for the subcontractor to carry out the works and the contractor to consider whether it is reimbursable later. Once a site instruction is issued it is enforceable, and the contract may be worded to that effect, and site personnel must be made aware that by marking an instruction with FRP, they are in effect committing the contractor.

If a subcontractor requests payment for additional works authorised by the contractor, the original written instruction or copy must accompany the invoice/progress claim. It is not a quantity surveyor's responsibility to search for these instructions even though it is the contractor that issues them, and a subcontractor must ensure such information is attached to substantiate its request for payment. If a subcontractor requests payment for additional works it states it has carried out based upon an oral instruction by the contractor's site personnel, the amount should be rejected, as it is hearsay and in general would be against the conditions of contract.

6.3.3 Material suppliers and hire company payments

Companies that supply materials to a contractor normally provide invoices for payment after the materials are collected from their premises by the contractor's personnel or delivered to site. This also applies to plant hired by the contractor, including operatives where applicable, and the supply of general or semi-skilled/skilled site operatives and hired professional management from recruitment agencies. Naturally, materials delivered to site or services supplied that are part of a subcontractor's award are invoiced to the appropriate subcontractor, with the contractor having no interest in the payment procedure. A contractor is only responsible for the payment of materials or services based upon purchase orders it raises. Invoices for goods supplied may be part of a bulk order that is ongoing or single item purchases that conclude an order, meaning one invoice is received. If plant, site operatives or professional management are hired, the hire provider must issue periodic invoices charged at agreed rate(s) or fixed term sums until the hire is terminated and the plant collected or the hire of human resources ceases.

Depending on the functions of the CMS, a supplier of goods or services may need an order value entering on the system in the same manner as for a subcontractor. Here, it may only be possible to input an approximate value because the price is not fixed and is based upon schedules and/or approximate quantities. For example, a bulk order for the supply and delivery of bricks might be to an uncertain quantity. Furthermore, a site cabin might be hired for an estimated duration or general site operatives hired for an unspecified duration, all of which are charged at a rate to an approximate quantity. A CMS may have the facility of inputting order values based on an approximate sum and is suitable to manage because it demonstrates a contractor's maximum financial commitment for any given item. It also assists with the cost management process because it exploits the benefits a CMS has to offer. To drive this process and assess an approximate value to commit, certain questions need to be asked and using the aforementioned examples, a range of questioning would be:

- What is the maximum quantity included on the bulk order for the brick supply?
- How long will the site cabin be required on site?
- How long will the general site operatives be required and is this to be a frequent request?

Once an approximate material quantity or hire duration is known, it is charged to a rate stated on the purchase order to calculate a value. Of course, this is not a commitment for a fixed value and the quantity surveyor may generate savings with value management after placing the award when the maximum quantity or duration is reduced. A less desirable CMS is one without an order value commitment facility where invoices are processed and allocated against specific cost codes. This has a disadvantage in comparison with an order-driven system because it is prone to human error as suppliers' invoices may be duplicated and paid more than once. To avoid this, a CMS may have a facility where the invoice number is logged and tagged to the invoice supplier's code and it will not accept a duplicate invoice number for the same supplier.

Assessment and authorisation process

In general, the quantity surveyor will authorise material supplies and hire invoices for payment. The number of invoices generated for a project will generally outweigh subcontractors, albeit probably for lesser amounts. When authorising invoices for payment, the quantity surveyor must be satisfied that goods delivered or items hired are to the satisfaction of the contractor. This is usually substantiated by a delivery note signed by the receiver of the goods, who ideally should be an authorised signatory of the contractor. Any queries about the quality and quantity of goods supplied and noted on the delivery note or communicated by the contractor after delivery should be addressed formally. This will involve contacting the supplier and requesting a credit note if

the goods were to be returned, were rejected upon delivery or were not the same as any written notation on the delivery note. Occasionally, oversights can occur when written communications on delivery notes are not acknowledged by the supplier. For example, a brick supplier's invoice may state that it delivered ten packs of identical bricks as per a written order, which corresponds to the delivery note. However, what the invoice may fail to say is that the receiver of the goods signed the delivery note with a caveat that five packs were not acceptable because they contained the wrong bricks and were left on the vehicle for return by the driver. Here, a credit note will be required for half the invoice amount and it is equally important for the supplier to fulfil the order by delivering the replacement materials and then issuing a separate invoice.

When plant is hired, usually a delivery note is issued and attached to an invoice which confirms a date for commencing the hire period. Ongoing hire invoices generally require no attachments and the hire dates require verifying with the plant hire register. Labour hire invoices issued by recruitment companies should include the days and number of labour hours worked and are authorised by the contractor's representative. In general, if plant is hired with labour as a goods and services supply order, invoices should be treated in the same manner as a subcontractor, which means the quantity surveyor must confirm the amount due.

A contractor's accounts department will usually create a list of ongoing projects with the names of quantity surveyors or the project manager responsible for authorising payments. An accounts department might in error issue invoices for approval to one quantity surveyor that are for other projects the contractor is undertaking, and care needs to be taken when authorising invoices when the same suppliers are serving a number of projects. To avoid errors, invoice(s) requiring authorisation must correspond with their appropriate delivery note which should state the project title and address and include a recognisable signatory confirming receipt of the goods. If the quantity surveyor is in receipt of an invoice addressed to the correct contractor but issued to the wrong quantity surveyor and is for another project, it should be returned to the accounts personnel for redistribution and cost allocating.

Suppliers may also make errors with their invoices. For example, a concrete supplier in receipt of a number of awards from a contractor for a number of projects it is constructing at the same time may confuse project titles on invoices, which can be clarified by observing the delivery note attached. Here, the supplier must issue a credit note(s) and raise a replacement invoice(s) to correct the error(s). This would also apply if a supplier invoices a contractor for the supply of goods that are part of an award with a subcontractor and naturally issues the new invoice to the subcontractor. In an extreme situation, a contractor might be constructing a project whilst another contractor is constructing a project in the same area, even in the same road with both engaging the same supplier that issues invoices to the wrong contractor. In any situation where the contractor is not liable for the debt, the invoice is simply returned to the supplier, ensuring it is not entered on the CMS.

Payment terms with suppliers of goods or services are usually monthly and the quantity surveyor must acknowledge the accounts department timeframe for receipt of authorised invoices to ensure payments are made on time.

Factoring company payments

Some suppliers of goods or services use factoring companies to assist their cash flow and in this case the quantity surveyor should be aware of the arrangement. The supplier to the contractor appoints a factoring company and advises it of the value of the debt owed by the contractor. The factoring company pays the supplier the debt, less an amount for commission, raises an invoice for the full debt to the contractor in its name and the contractor pays the factoring company. One flaw in this arrangement is that a contractor may misjudge the situation and pay the supplier, thus ignoring the factoring company arrangement. At worse, both supplier and factoring company may be paid, which is unusual and more likely an error on the contractor's part as there is usually one invoice per consignment with invoice duplications rare. Factoring is not assignment in the legal sense because the supplier remains responsible to the contractor for the quantity and quality of the goods and continues to comply with the terms and conditions of the agreement and it is only the debt arrangement that alters. Where a supplier factors its business dealings and is in receipt of an award from the contractor, it would be wise for the contractor to request a letter from the supplier confirming the arrangement together with the name, address and bank details of the factoring company to be paid.

6.3.4 Consultants' payments

When consultants issue progress claim requests or invoices for payment, these are generally in accordance with stage payments that form part of the executed agreement. For the purpose of the CMS, an order value for each award needs inputting to represent the contractor's commitment and cost to the project.

With construct-only contracts, the consultant might issue an invoice for a single payment based upon an ad hoc arrangement such as the issue of a report as advice on a specific matter, and receipt of the report is generally validation for payment. A design and build project, however, will involve the engagement of a number of consultants, and stage payment requests may not provide evidence of design or documentation. This is because the details are under development and not released 'for construction', e.g. design and documentation are pending final review before issue to the contractor. In this example, the consultant will have incurred expense and is entitled to payments under the agreement. As supporting evidence, the appropriate consultant(s) could supply a draft document register listing the design and documentation details to substantiate the payment request. This register is solely for the purpose of demonstration and must not be used on the project because nothing is

approved and the details might change. Understandably, a consultant may be reluctant to release information in case it is interpreted as a working document, and the quantity surveyor must act responsibly if supplied with such information.

In general, a consultant providing a service is treated in the same manner as a goods and services supplier. This means the quantity surveyor must confirm the amount due and ensure invoices are processed on a payment certificate and issued to the accounts department in a timely manner in order for payments to be made on time.

6.4 Cost centres and financial reporting

One aspect of running a project involves the quantity surveyor producing regular cost reports on the financial status of a scheme. A cost report is of interest to the project team and senior management located at a head office because it provides a snapshot of the progress of the project from a financial perspective. The report is normally produced on the CMS and can be provided at any time during the construction phase and defect liability/rectification period. A CMS will produce a variety of reports and is an essential tool for tracking financial activities. A fundamental report provided by a CMS is a financial progress report that displays the value of awarded packages for each cost centre compared with the budget, as well as the expense incurred and the anticipated final account. In general, cost centres are a summary of cost codes that create the financial activities of a project. Once a budget is set and an order for the value of awards is input against the cost codes, the CMS creates a financial residue or deficit on the cost centre, i.e. the difference between the budget and value of each award. Table 6.6 shows a financial progress report with cost codes for the excavating and filling trade on a project together with notes for managing the cost centre report. This table is a sample of one part of a project and the sum of all cost centres will drive the final account. The frequency for issuing these reports depends on the contractor's head office requirements and is usually monthly or bi-monthly.

6.5 Tracking expenditure

Quantity surveyors are often involved with projects which have contract sums worth millions of pounds. With projects of this value, a number of project team members, including the quantity surveyor, may place awards to procure the project and may also process payments. However, the quantity surveyor as cost manager must be aware of all project expenditure and the use of a CMS is beneficial because it shows commitments and enforces confidence with overall expenditure and cost limits. It may, however, be too optimistic to rely on an order-driven system to predict the final cost and a periodic check of actual

Table 6.6

Client: Housing Association ***Progress Report Date:***					***Project Nr: 1888*** ***Project Title: 10 nr New 2 story residential properties***				
A100 - Excavating and filling									
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Cost centre	***Description***	***Budget***	***Committed Contracts***	***Contracts yet to commit***	***Committed additional works***	***Q S Judgment***	***Projected Final Account (D+E+F+G)***	***Variance (C-H) + / –***	***Expenditure to date***
A100-2	Topsoil strip	£ 7,000	£ 6,500	-	-	-	£ 6,500	+ £500	£ 6,500
A100-4	RL excavations	£ 15,000	£ 14,000	-	-	-	£ 14,000	+ £1,000	£14,000
A100-6	Filling to level	£ 10,000	£ 9,500	-	£1,000	-	£ 10,500	– £500	£ 6,500
A100-8	Trench excavations	£ 18,000	£ 17,000	-	-	-	£ 17,000	+ £1,000	£ 8,500
A100-11	Service trenches	£ 5,000	£ 5,000	-	-	-	£ 5,000	0	£ 2,500
A100-13	Deposit spoil off site	£ 60,000	£ 58,000	-	-	+ £2,000	£ 60,000	0	£29,000
	TOTAL	**£115,000**	**£110,000**	**0**	**£1,000**	**+ £2,000**	**£113,000**	**+ £2,000**	**£67,000**

General Notes:

Columns A, B and C are created during the project commencement stage with information supplied by the estimator and input by the quantity surveyor. Columns D represents fixed order values or an estimate based upon measured schedules with applied rates. Column E is activated upon initiation of the cost centre and represents part of the budget that is uncommitted. Column F represents additional works instructed and paid for by the contractor extra to the committed contract value. If 'additional works' are carried out as client's variations, they are usually coded and issued in a separate report because the contractor will be reimbursed. Column G is a flexible assessment for manually inserting amounts to recognise works or scope not included in Columns D or E that the quantity surveyor considers is a contractor's responsibility. With this column, the CMS may have a facility where it is possible to create a brief description in a back up screen showing a method of arriving at the assessment. Because the assessment may be detailed, it will be for information only and not relevant to include in the progress report with the sums only included. Column I is the contractor's gain shown as + or – for a loss. Column J is for reference only and the sum must not exceed the Projected Final Account.

expenditure incurred is required. The advantages of tracking expenditure are that it provides:

- A snapshot of the progression of the project, i.e. £1 m spent of a £2 m project represents 50% complete
- An audit check because, if left unchecked, there may be times when expenditure exceeds the anticipated final account which may highlight errors in the payment process.

The quantity surveyor would be wise to track project expenditure regularly to avoid detailed investigations later on if errors become apparent that may have occurred months before and went unnoticed. Expenditure is tracked via an accounts ledger that shows the activity of project cost codes. In the event of errors being exposed, such as costing to an incorrect project or incorrect coding within a project, an accounts department usually has a method of cost code reallocation. This is carried out by entering the details on a form and crediting one code and debiting the other. For example, a brick supplier may have issued two invoices, each worth £10,000, for two sites but one site was incorrectly allocated the cost of both invoices. By tracking the expenditure, this error would come to light and be quite easily corrected by completing a reallocation form and issuing the details to accounts personnel to correct the error.

Accruals

An effective CMS will have a cost code structure that includes a summary of expense incurred against each code plus an accrual facility. An accrual is an accounting term used to describe the forecast of payments in the process of being paid which represent a contractor's liability. A CMS with this facility lists the expenditure incurred to date and adds an accrual amount. The accrual includes debts owed to supply chain members for unpaid amounts not claimed on invoices plus works in progress for the value of pending invoices and amounts in dispute. Accruals are usually input by a contractor's accounts department at the end of each month and are automatically reversed at the end of the following month. At the time of reversal, the actual payments made are recognised by the CMS and a new accrual added to update the liabilities. The accrual facility has a clear advantage over a system that lacks this option because it means the quantity surveyor is able to recognise current expense and it acts as a reliable source for tracking expenditure. For example, a project may have a budget of £50,000 for the supply of bricks and the quantity surveyor assesses that this is what the cost will be based upon the bulk orders placed. When all the bricks are delivered, a CMS with an accrual facility could show the expense incurred as £35,000 plus an accrual of £15,000. However, without the accrual facility, the CMS would show the costs as £35,000 and only recognise the remaining £15,000 once outstanding invoices were paid.

The logging of accruals involves allocating sums to a cost code which is referenced with a unique code to identify the supplier obtained from the CMS database. In addition, an accrual cost may be allocated by an accounts department for items deemed on-site costs or preliminaries, such as the renting of contractor's purchased assets and salary payments to supervisors and quantity surveyors, including the cost to employ. Without an accrual facility, project cost reporting in comparison with progress payment requests to a client will always be one month in arrears. This is because the progress claim is current, yet the expense for comparison is lagging a month. Table 6.7 shows a theoretical accounts ledger report for the cost of brick supplies using a CMS that has an accrual facility.

Information used to create accruals is derived from:

- Logging an invoice amount on the CMS once it is received
- Assessing the value from delivery notes and logging into the CMS
- An estimate calculated by the quantity surveyor based upon work in progress and logged into the CMS
- A valuation system where a percentage of a committed order is ascertained as works in progress.

Table 6.7

	Accounts Ledger		**- Project nr 1888 -**
B100-12 - Brickwork supply			
Month 1 opening balance			**£ 0**
Reference	**Date**	**Code**	**Amount**
B34887	Month 1	BL01	£ 1,483.00
113778	Month 1	BR55	£ 6,350.45
Accrual	Month 1	BL01	£ 2,700.00
Accrual	Month 1	CC01	£ 7,300.00
Month 1 closing balance			**£ 17,833.45**
Monthly movement			**£ 17,833.45**
Month 2 opening balance			**£ 17,833.45**
Reference	**Date**	**Code**	
Reverse accruals	Month 1	–	–£10,000.00
B32566	Month 2	BL01	£ 2,700.00
456678	Month 2	CC01	£ 7,300.00
Credit note 1	Month 2	CC01	–£ 450.00
244556	Month 2	BR55	£ 200.00
Accrual	Month 2	BL01	£ 1,400.00
Accrual	Month 2	DT01	£ 3,046.00
Month 2 closing balance			**£22,029.45**
Monthly movement			**£ 4,196.00**

Cost value reconciliations (CVR)

A disadvantage of logging, assessing and estimating accruals is that the process is prone to human error, which can produce inaccuracies with liabilities. A CMS with an integrated valuation system is not prone to error because accruals are generated automatically, with errors only occurring as a result of incorrect input to the value of works in progress. For example, if an order worth £100,000 is committed and 50% is valued as works in progress, the CMS will produce an accrual of £50,000. This accrual is a theoretical amount to pay a beneficiary with an allocated award set up in the cost centre, with the sum remaining on the CMS until the accrual is reversed. If £30,000 is paid without increasing the original 50% value, the new accrual in the costs for reporting purposes will be £20,000. This type of system may also calculate a value of the budget for works complete in comparison with the cost. This is known as a cost value reconciliation (CVR), and is a method of tracking expenditure compared with the works complete that form the budget. Thus, if a budget for a trade is £100,000, has a committed order for £95,000 and is valued as 50% complete, the value of works complete is £50,000 and the expense incurred will be £47,500. This facility is useful with preliminaries items, where no order value is input and expense is permitted to run against budget and may go unchecked because there is no committed order. Table 6.8 demonstrates a cumulative CVR that a CMS may provide for preliminaries to compare with the incurred expenditure.

Tracking expense on a CVR provides up-to-date information about the project's progress and permits action to be taken at strategic level if there are cost overruns. The information provided on the CVR in Table 6.8 would raise concern because of the costs incurred for management and staff (P101) and minor mechanical plant (P117), as the expense is high in comparison with the value. Questions to be asked based upon the information produced by the CVR in Table 6.8 could be:

- **P101** As this is a time-related item, has 15% of the project duration passed and, if so, why has more expense been incurred than envisaged and are the accruals correct?
- **P117** What is the basis of the cost and are any accruals overstated or incorrectly allocated? Is it possible that any invoices are duplicated? Are there any items of plant on hire that can be off hired?

Once answers to the question are ascertained, the quantity surveyor must alert the project manager as the findings may impact the final account if the trend continues. The objective of a CVR is to provide an holistical view of the current financial status compared with the budget. Furthermore, objectives of the reporting are to use foresight and envisage a realistic final account, and highlight any underlying issues that need addressing and which could be managed differently by the project team.

The allocation of expense for management and staff within the preliminaries is usually input by a contractor's accountant or business manager on a monthly

Table 6.8

Project Nr:		**P100 - Preliminaries - CVR**				
Cost centre	***Standard Description***	***BOQ allowance***	***Cumulative % valued***	***Cumulative value***	***Cumulative cost****	***Variance***
P100	Pre commencement	£ 25,000	100%	£ 25,000	£ 24,000	+ £ 1,000
P101	Management and staff	£ 140,000	15%	£ 21,000	£ 27,595	– £ 6,595
P102	Site establishment, etc	£ 20,000	90%	£ 18,000	£ 18,750	– £ 750
P103	Running costs	£ 60,000	10%	£ 6,000	£ 5,980	+ £ 20
P104	Temporary services	£ 10,000	75%	£ 7,500	£ 7,180	+ £ 320
P105	Temporary works	£ 15,000	0%	£ 0	£ 0	£ 0
P106	Security	£ 21,000	14%	£ 2,940	£ 2,610	+ £ 330
P107	Employer's Requirements	£ 5,000	90%	£ 4,500	£ 4,380	+ £ 120
P108	Contract conditions	£ 5,000	0%	£ 0	£ 0	£ 0
P109	Fees and charges	£ 10,000	60%	£ 6,000	£ 5,205	+ £ 795
P110	Insurances, bonds etc	£ 8,000	60%	£ 4,800	£ 4,200	+ £ 600
P111	Health and safety	£ 5,000	80%	£ 4,000	£ 3,780	+ £ 220
P112	Control and protection	£ 10,000	20%	£ 2,000	£ 1500	+ £ 500
P113	Site records	£ 5,000	0%	£ 0	£ 350	– £ 350
P114	Cleaning	£ 6,000	0%	£ 0	£ 0	£ 0
P115	Non-mechanical plant	£ 15,000	10%	£ 1,500	£ 1,305	+ £ 195
P116	Mechanical plant – major	£ 50,000	10%	£ 5,000	£ 5,000	£ 0
P117	Mechanical plant – minor	£ 20,000	25%	£ 5,000	£ 12,780	– £ 7,780
P118	Defect liability period	£ 5,000	0%	£ 0	£ 0	£ 0
TOTAL		**£435,000**		**£113,240**	**£124,615**	**– £11,375**

*Includes accruals

basis as an accrual. Here, the quantity surveyor usually has no control because no award or order value exists. The quantity surveyor has a duty to ensure that accruals or expense allocations for these items reflect the true level of attendance on a project which is straightforward to assess. For example, if during a given month, attendance was provided by a project manager, a quantity surveyor, a site manager, two foremen, etc, weekly or monthly charges should be comparable with the estimator's budget. However, because management and staff attendances may fluctuate, expense incurred should be monitored to ensure charges reflect the actual supervision attendances. The contractor's accountant or business manger responsible for allocating expenditure will usually have a 'pot of expense' on an accounts ledger to be dispersed as on-site overheads because, if not, they will remain off-site overheads. The quantity surveyor needs to ensure that time-related allocations reflect true project activity. This is because the accountant or business manager is not usually based on site and will portion expenses based upon information provided. The information provided may be in the form of time sheets which the quantity surveyor will need to check are allocated to the correct project and cost code.

6.6 Extension of time claims

Many standard forms of contract contain clauses that place responsibility on a contractor to issue a notice of delay when the contractor considers the project will not complete by the date stated in the contract or an amended date agreed after the contract was executed. If a notice of delay procedure does not apply because the contract is silent on the matter, the contractor must submit an extension of time (EOT) claim. The term 'claim' implies it is a request for additional money but, in reality, an EOT claim is one arising from a notice of delay that seeks to prolong the construction period and is different to a financial claim. However, a notice of delay or EOT claim could also involve a financial claim, and it is necessary to keep the two separate when submitting to the client's agent. In essence, a notice of delay or EOT claim is a contractor expressing its request to mitigate exposure to incurring liquidated damages when it considers it cannot complete on time because of circumstances beyond its control. If a contractor is of an opinion it cannot meet an end date by its own default, it must accelerate the programme at its own cost and should obviously not issue an EOT claim. Whether or not a contractor should issue a notice of delay when it is at fault will revolve around the requirements of the contract and, in most situations, a contractor would have an ethical duty to inform and advise on its mitigating actions even if not contractually bound to do so.

The JCT 2011 contracts include what are termed 'Relevant Events', which are grounds for a notice of delay. These include variations altering the works so considerably that the original scope cannot be completed on time, exceptional adverse weather, etc. These clauses are excellent examples of situations that can occur during the construction phase of a project and will settle opinions of

what constitutes a delay. This is because if a contract is silent on matters that constitute a delay, disputes may arise with regards to responsibility. Where Relevant Events apply which trigger a delay, a contractor must issue notice whether or not it contributed to the delay, because failure to do so is breach of contract.

One confusing aspect regarding the validity of a notice of delay or EOT claim is to do with client-authorised variations. A contractor must act responsibly if it considers it will be delayed as a result of variations or instructions, because the client's agent will only issue an instruction to prolong the end date, i.e. agreeing to delay the date of practical completion. It is not the responsibility of the client's agent to issue an instruction prolonging the critical path as this is for the contractor to manage. The value of any variations that increase the scope of the project may not be a reason to request prolongation of the construction period. For example, if a project undergoes agreed variations, increasing the contract sum by, say, 10%, the contractor cannot normally assume the project will be delayed by 10% in time. This is hearsay and proof is needed that the increased works will prolong the construction period. Furthermore, variations of any value requested early enough which alter quality may not be a valid reason for seeking a delay to the end date. To demonstrate, let us say a contract includes for a floor tile product from a set of standard colour choices which is on a 3-week delivery, and the colour selection is issued in week 10 of a 50-week programme for laying on week 40. If the client has a change of mind and on week 16 selects a new product on a 10-week delivery, the tiles are still possible to install on week 40. The cost of the tiles may well have tripled because the quality has increased but this does not mean the end date will change. By comparison, if a contractor is carrying out a construct-only contract and each floor of a 10-storey building doubles in thickness, it may constitute a valid claim to delay the end date because the quantities will substantially increase the contract works. In this scenario, a client's agent's initial response to a notice of delay or EOT claim may be that the contractor should provide additional labour and is a valid point. However, situations like this are on a case-by-case basis and the contractor must consider its position which would involve:

- Observing any float available in the programme
- Considering risks and suitable apace for storage of additional materials
- Assessing the availability of additional labour by communicating with subcontractors.

The contractor must demonstrate its attempts to mitigate circumstances by absorbing available float and providing input from subcontractors to the client's agent. Here, it would be unacceptable for a contractor to complete the works late even if the value of the variation is approved. An intention of issuing a notice of delay is to advise a client who, in the example with the change on floor thickness, may approve the changes. The contractor may choose to be

silent on the subject of extending the programme as it is unsure of the extent of the delay. In this scenario, it is not unreasonable for a client to assume the project will still complete on time as nothing to the contrary has been advised. However, if the contractor issues the variation with a notice of delay or EOT claim, the client can consider options and elect to use precast concrete in order to save time.

Normally, the quantity surveyor will not issue a notice of delay or EOT claim as this is usually a project manager's responsibility. In assessing the possible extent of any delay, the project manager may seek input from a planning manager to reassess the programme, and the quantity surveyor will provide substantiating documents as proof. This includes details of the Relevant Event (where applicable) including date(s), letters, instructions, document transmittals, etc, as evidence to substantiate the facts. The quantity surveyor may also be required to provide an estimate of probable cost associated with the delay. If there is a delay of, say, 10 weeks, the cost will be based upon time-related expenses assessed from the preliminaries budget or known running costs that will continue to be incurred for a period of 10 weeks commencing from the current date of practical completion. Once the charges are assessed, the project manager will decide if the delay is managable and may elect to commit the contractor to a fixed length of delay and advise the client's agent of the decision. If committing to fixed time, a client's expectation could be a commitment to associated costs. However, if not committing to time, the project manager might elect to issue the cost as a guide only, which is not binding. Even if committing to time, if the contractor is not contractually obliged to fix the time or cost, an estimate only of the cost can be provided. A notice of delay or EOT claim must relate specifically to the contract clause. Information provided must be clear and concise and free from personality to represent authenticity.

Once a notice is issued or EOT claim made, it is in the contractor's interests to update the client's agent on the status of a financial claim preparation, which may be dependent on the issue of information from third parties such as subcontractors. It is good practice to record delay claims in a register that includes:

- Reason for the delay
- Clause(s) of the contract supporting entitlement
- Date of issuing the notice or EOT claim
- Length of the delay claimed and whether it is committed or to be negotiated
- Date of response and what extension is granted.

The date of the response is important as it sets the basis for assessing any financial claim (often referred to as a loss and expense claim under the contract if the contractor will be out of pocket because of the delay).

A contractor may be faced with an EOT claim from any of its supply chain, and in particular subcontractors. Where applicable, the claim may have a direct

link to a claim under the main contract. However, if it is separate matter that places the contractor at risk without recourse from the main contract, the contractor should refer to the agreement in place and consider options which include:

- Accepting the request if the delay can be accommodated in the programme
- Rejecting the request and advising the supply chain member to reconsider with solutions
- Seek an alternative supply chain member by terminating the agreement in accordance with the terms and conditions of the contract.

If a subcontractor's EOT claim is valid and not a result of its default, the contractor must explore options to settle the matter as it may have no grounds to terminate the agreement. Even if the subcontractor is at fault and hindering progress, it maybe temporary and termination may do harm to the project. The subject of voluntary termination of subcontract agreements by the contractor is discussed further in Section 6.9.2.

6.7 Financial claims

It is possible for a contractor to face a financial or loss and expense claim on two fronts: under the main contract and by receiving a claim from a member of its supply chain. The quantity surveyor plays a vital role in dealing with these scenarios by ensuring project administration is impeccable. This is important because the reason why a client may reject a claim is often due to flaws in administrative procedures, when information is missing or the documentation is substituted with assumptions which are often exaggerated. Likewise, a contractor may reject a supply chain member's claim if the information provided lacks credibility. To reject a claim means denying payment of the full amount. It does not mean that the whole value of the claim is rejected. This could mean that the assessor considers the claim has grounds yet is missing evidence, and he/she may request further information or suggest the sum be negotiated for the parties to agree to settle on a different amount.

A financial claim is different from a variation even though it may be linked to one or more variations. To make a financial claim, the party seeking reimbursement must consider that an event or chain of events has caused it loss and expense and that, when paid, it would be back in the position it was in before the event and/or chain of events took place, ie, no worse off. The injured party must issue a formal request for payment but, in order for its claim to be successful, it must prove it did not contribute to the event and/or chain of events.

The settlement of a financial claim issued upon the terms and conditions of the contract is included in a contract sum adjustment. The contract sum will not usually be adjusted if there is damage to the works that are subject to an insurance claim and applies to the works under contract. Here, a client may

grant an extension to the end date, normally without costs, as any financial claim arising from an EOT claim is usually included within the insurance claim.

6.7.1 Claims under the main contract

Claims are generally unpopular in the construction industry. This is because contractors often lack experience in dealing with their preparation, and client's agents dislike reviewing them because they highlight design/documentation errors, mismanagement of the due diligence process or a mixture of both, and are time-consuming to review. A claim is usually presented to the client's agent, who must be forewarned of its arrival to give the agent time to advise the client of the situation. A contractor's presentation should be concise and straightforward, comprehensive but only elaborate on information where necessary in order to clarify matters. The claim must include independent proof such as drawings, instructions, programmes, etc, to demonstrate the root cause and reason why a contractor has or will incur expense it wishes to recover. As part of the assessment, the client/client's agent may engage a PQS to evaluate rates or measures, who would probably ask the contractor to supply further information which, of course, it must endeavour to do. The various types of claims are now discussed.

Contractual loss and expense claims: delay and prolongation

A financial claim leading from a notice of a delay or an EOT claim prolonging the end date must be issued in a timely manner. The contract may include a clause referring to the timeframe during which a claim is to be submitted after an occurrence giving rise to a claim, and refer to it as a loss and expense claim. A reason for including a loss and expense clause and timeframe in a contract is to ensure the client avoids surprises. Furthermore, it ensures that the contractor remains responsible for its duty to inform of a situation in a timely manner, which dismisses the culture that allows a contractor to pursue a claim as and when it sees fit, which serves no purpose to the client or project. It would not be in the interests of a contractor to issue an EOT claim and a financial claim at the same time because the length of time requested in the EOT claim might change. Neither is it in a contractor's interest to issue a loss and expense claim after the date of practical completion whilst incurring liquidated damages, in the hope the EOT claim will be granted including payment and refund of liquidated damages, as it will probably not happen. A contractor might not wish to commit to expenditure from a delay and in its defence might state that even if an EOT claim extending the end date is granted, it cannot issue an associated financial claim until the project is complete because it has no idea what the expense will be. Here, the contractor could have to commit to an expense in order to comply with the contract and will need to manage the cost.

Where prior notice of a delay is a contractual requirement, a claim for loss and expense must relate to the prior notice, i.e. the earlier issue of an EOT claim

not involving money. However, there is no onus on the client to request the issue of a financial claim from the contractor but, as a matter of course, if the contractor has issued an EOT claim that will incur costs, a loss and expense claim should automatically follow. If the extent of an EOT claim is under negotiation, the loss and expense claim may still be prepared and submitted and it is up the contractor to start the process. The form of contract may include clauses stating the method of presentation, which is an excellent starting point. The clause(s) might say that costs are to be calculated on a daily basis and state them to be as either working or calendar days which the quantity surveyor must comply with.

The format of a claim must demonstrate the delay and needs to be:

- Concise and clear in its wording
- Accurate, not describing incidents that have no bearing on the situation, as the intention is to identify, clarify, quantify and value the direct loss and expense.

The claim should show a list of main events contributing to the delay. These should be listed in chronological order, with each event described together with its effect on the works, and cross-referenced to the appropriate clause(s) of the contract. Each main event should include back-up information, i.e. a drawing register, site diary pages, photographs, instructions, etc, to demonstrate proof. Where a chain of events is linked to a main event, each event should be listed separately and cross-referenced to the main event, together with suitable back-up information. This information should not be duplicated with the main event as it would become overwhelming and repetitive. Once each main event and time delay is demonstrated with proof, the cost of the effect of the delay requires calculating. This includes:

- Contractor's preliminaries, i.e. idle plant, equipment and supervision
- Subcontractors' charges due to the delay
- Loss of profit
- Financing costs, i.e. interest on prolonged loans to fund the project
- Inflation costs on remaining works under the contract which are halted due to the delay.

If the quantity surveyor has sought assistance from a consultant for preparing a claim, the cost of hiring the consultant should be included as it is a direct cost. As the claim is a forecast, it will be necessary to separate actual from estimated costs which the contractor must manage for the length of the delay it is claiming.

Once costs are compiled, any savings produced by the contractor to mitigate the situation are credited, e.g. off hiring plant, relocating a site manager to another project, etc. The total cost is then divided by the number of days that were requested as an EOT, which equates to a cost per day and attracts no profit as the intention is to recover loss and expense only. However, the calculated

cost per day will include a sum to recover off site overheads, which may be somewhat difficult to apply. An approach is to consider the contractor's margin for the project and exclude profit, which is applied as a percentage and added to the cost. Another approach is to use the Hudson formula, derived from information published in Hudson's Building and Engineering Contracts:

$$\mathbf{Dl} = \frac{\mathbf{Os}}{\mathbf{T}} \times \frac{\mathbf{Cs}}{\mathbf{Cp}} \times \mathbf{Dp}$$

where, Dl = daily loss; Os = contractor's off site overheads; T = contractor's business turnover; Cs = contract sum; Cp = current contract period before the event; Dp = delay period.

Using this formula, if a contractor has an annual turnover of £50 million, incurs off site overhead expenses of £4 million, and undertakes a contract worth £10 million for 52 weeks and a 10-week extension applies, the daily loss per calendar day is:

$$\frac{\mathbf{£4{,}000{,}000}}{\mathbf{£50{,}000{,}000}} \times \frac{\mathbf{£10{,}000{,}000}}{\mathbf{365}} = \mathbf{£2{,}192\ per\ day}$$

Using Hudson's formula should be considered a last resort and the real cost of overheads the project would recover will need demonstrating. The items to include as cost are those associated with the running of the contractor's premises and assets as discussed in Chapter 3, Section 3.1.1.

A contractor may already be in negotiations with the client/client's agent regarding an EOT claim, if a significant amount of money is involved and because of the complexity and value in question, it could appoint a loss specialist.

If a client wishes to retain a date of practical completion and does not wish to go down the path of an EOT claim and an acceleration clause is included in the contract, the contractor should withdraw the EOT and loss and expense claims. These should be substituted with a new loss and expense claim caused by disruption of the programme and include acceleration costs for approval to recover the lost time.

Contractual loss and expense claims: disruption and acceleration

Disruption is a term used to describe an intervening event causing a loss of production. A disruption creating a delay to the end date could be interpreted as prolongation of the construction programme and included as an EOT claim. However, it is fundamentally different and should not prolong the date of practical completion if works caused by the disruption are accelerated.

Disruption is the loss of productivity part way through a project caused by an event that delays a part of the works and lengthens the critical path. To

justify a disruption claim, the contractor must establish that the project programme is hindered and identify the event causing the disruption by stating it as either a breach of contract by the client or a result of events written into a contract that give rise to an EOT claim.

For a claim to be valid, a contractor must demonstrate that a specific disruptive influence hinders *actual* progress and not *planned* progress. Isolated variations alone of a minor value in comparison with the value of the project do not usually hinder planned progress because they can be mitigated by supplying additional resources with any disruption considered trivial. However, if a client issues a series of variations that are urgent and groups of trade workers frequently postpone their contract works to deal with the urgency, a contractor could claim for loss of productivity on the contract works because of continuous disruptions. A contractor must take care before issuing a disruption claim and first examine all the facts. For example, disruption might occur because of the late issue of design information. However, a client could avoid liability of disruption if a contractor fails to give notice of intention to suspend the works or make a request for the issue of information if these are terms of the contract.

The presentation of a claim for disruption is similar to a prolongation delay for an EOT claim. For preparation purposes, the quantity surveyor is not expected to observe or record the disruption information as it is normally the responsibility of the site or project manager. However, the quantity surveyor may be expected to assess expense incurred resulting from disruption and, to permit this, it is necessary to be provided with the following:

- Information on the type of works disrupted
- Reasons for the disruption to confirm it is not a contractor's responsibility
- Mitigating attempts adopted by the contractor to reduce the disruption
- The delay to the programme as a result of the disruption.

For example, let us say a project manager advises the quantity surveyor that formwork gangs are being instructed to carry out variations elsewhere on a project at the request of the client. As a result, formwork operations under the contract are sporadically abandoned by the gangs as they carry out the variation works without additional labour resources available to either take over the abandoned works or carry out the variations. The scope of works under the contract affected is formwork to the soffits of slabs totalling 500 m^2 that the project manager advises was on a four-week critical path that will now take six weeks. Because disruption involves time, a starting point for the quantity surveyor is to recognise the financial allowance in the contract sum to pay for labour and plant time for the works affected. This may be found in the project bill of quantities which states:

Formwork to soffit of slab including strutting over 3 and up to 4 m high

500 m^2 @ £150.00 m^2 = £75,000

As this sum represents labour, plant and materials, it is necessary to ascertain the labour component because this is the part affected by time and the delay. In order to assess the labour content, the contractor's estimator can advise the amount or it may already be noted in the estimator's handover file issued at the start of the project. If the split is found to be 60% labour and 40% materials, in broad terms it means that payment for labour for a four-week period without disruption would be 60% of the total costs, i.e. £45,000. If the two weeks of variations accrues £25,000 of payable labour, the disruption claim would be the loss of productivity, which totals £20,000, and represents the shortfall that would have been earned if the works had not been disrupted. Furthermore, props as hired plant used for strutting on a prolonged hire period should also be included in the assessment.

With a disruption claim, a contractor must demonstrate methods it has adopted to mitigate the event, such as off hiring items during a redundant period, as well as methods used for obtaining additional labour and any concessions. In the formwork calculation example, concessions would be required because the amount is assessed from the billed rates without conceding inefficiencies in construction management or acknowledging the rate payable to the subcontractor. When compiling the claim, it must be a true reflection of the disruption and costs incurred and presented as a loss and expense claim because the exercise is to recover out-of-pocket expenses only, which excludes profit.

Acceleration is the antidote to disruption and would put the programme back on track to achieve an end date without a need for an EOT claim. Disruption costs and acceleration costs are two different matters and require addressing differently. If the contractor is not responsible for the acceleration and the client has liability, acceleration costs are the extra overcost of additional resources that require submitting as a variation quotation in lieu of a claim as the decision to accelerate rests with the client. The quantity surveyor assists the process by scheduling the requirements advised by the project manager or possibly obtained from a revised construction programme which are charged at suitable rates. If the contractor is not at fault with the delay and the client wishes the programme to be accelerated, an instruction must be received before commencing the works and, until such time, the EOT claim is sustained. As with all claims under a contract, it is important to recognise submission periods, which are generally before the date of issue of the final payment certificate. This is to ensure claims are recognised and included in the final account or, if inconclusive, referred to dispute resolution under the terms and conditions of the contract.

Common law

A contractor may make a claim at common law through the courts when there are no provisions within the contract for remedy, and this generally applies when there is breach of expressed terms. Common law claims are claims for

lump sum payments awarded as damages by a court because of negligence, breach of contract or statutory duty and tort. A contractor could choose to make a common law claim in lieu of a contractual claim based upon the same facts if there are grounds for remedy at common law. However, progress towards resolving the matter may not be as swift as a claim under the contract. If making a common law claim, the client and client's agent must be informed that a claim is not being addressed as contractual because the contractor cannot claim the same amount twice. If a court awards damages in favour of the plaintiff (contractor), the client's payment is separate to the contract and the contract sum is not adjusted.

Ex-gratia

This term is a request for payment in good faith that has no basis for a claim under the contract or common law. A contractor may submit an ex-gratia payment request as a result of financial hardship arising from a business problem that is beyond the contract. It is inaccurate to perceive the request as compensation for loss and expense to avoid issuing a loss and expense claim or the settlement of a dispute prior to involving a third party such as a court, as this would be arbitrary. Any application should be in writing, stating the grounds for the request with supporting documentation. Preparation of a claim should not be exhaustive as the intention is to sell nothing and demonstrate the situation in a genuine manner. A client may refuse to pay a claim and is perfectly entitled to do so and stand by the decision. However, if wishing to pay something that may be in part or for the full amount, it will usually involve a benefit in return. For example, a contractor may be on the brink of insolvency because of an insolvent debtor and seeks financial relief from all other debtors. A client may not wish to risk the possibility of an insolvent contractor and in the spirit of the request and along with other debtors may issue a payment in return for anticipated performance which is not conditional. The payment is usually final and not considered a loan or repeat process and the contract sum is not usually adjusted.

6.7.2 Claims from the supply chain to the contractor

Any member of a contractor's supply chain can issue a claim to a contractor using contractual methods. They may also make an ex-gratia claim or access the legal system with a common law claim against the contractor. It may be a condition of the agreement for a supply chain member who is preparing a contractual claim to forewarn a contractor of the pending issue to avoid the contractor being surprised when it is received. A claim in this manner is usually addressed to the project manager or quantity surveyor and, upon receipt, action rests with the contractor. However, the contractor must consider whether the claim is authentic and, if so, where the root of responsibility rests, either with the main contract or solely with the contractor.

Main contract claims

If a contractor has a claim under the main contract, it may include claims from one or more supply chain members. Indeed, a contractor could require input from one or more supply chain members whilst preparing its claim under the main contract, which would usually be restricted to subcontractors. A contractor must take care when handling claims from supply chain members that form part of a claim under the main contract because clauses addressing the claims may differ. A carefully drafted back-to-back contract with a subcontractor that mirrors the clauses under the main contract may appease a claim from a subcontractor. However, if a contractor is in dispute with a client because of a claim involving a subcontractor's claim, it does not mean to say the subcontractor is bound by a pending outcome and the quantity surveyor will need to look at the individual agreement(s). The general exception is when the client becomes insolvent and the contractor's claim is against the client's estate. Here the supply chain member's claim is for a project involving the same client and it will have no recall whatsoever.

If a contractor decides to commence legal proceedings against a client and include supply chain members as co-plaintiffs, it must notify the appropriate supply chain members. Prior to this, the contractor is in no position to state that payment is to be made upon settlement of the claim it has with its client because it is a different issue and may constitute breach of contract with the supply chain member(s).

Contractor's liability

A claim could be circumstantial, relating to a particular event, or it might arise from disruption to a supply chain member's performance as a result of the contractor's site management or interruption to the subcontractor's works by other trades. If a subcontractor's claim is a direct result of another subcontractor's actions, the claim must be presented to the contractor. This is where the responsibility rests as there is usually no tripartite contractual link between subcontractors and a contractor. However, freedom of contract legally permits parties to contract as they wish, with the proviso it is legal, and if two subcontractors form a binding agreement, it is generally of no interest to the contractor. If a sub-subcontractor has a claim against a subcontractor appointed by the contractor, it is of no interest to the contractor who should reject any such claim if it is presented. These types of claims may be hearsay or common law claims which have been misdirected. Even if they are redirected to the contractor, rarely will a quantity surveyor be involved with a common law claim as the contractor will usually refer the matter to its lawyers. Once the quantity surveyor is satisfied receipt of a claim is a contractor's responsibility to review, the task involved is to understand if the contractor has a liability and take the appropriate action.

Consultants engaged on a design and build project may submit claims if they are of an opinion they have carried out a service beyond their fee proposal. The claim may be presented in the form of a pleading and include:

- Additional visits during the construction phase beyond the agreement
- Abnormal number of drawing and specification revisions
- Excessive reviews of 'As Built' information provided subcontractors. Such claims must be addressed by the design manager.

A claim from a supply chain member may lack detail, with the party issuing the claim often relying on informal conduct. This is usually restricted to subcontractors who are at the interface with the works when preferable procedures do not always go to plan, and then it is necessary to address each claim on its own merits.

Upon receipt of a claim, the quantity surveyor must first inspect the evidence submitted, which should include site instructions, photographs, contractual clauses, etc, to assess the validity of the claim and the amount requested for payment. It may be possible for a quantity surveyor to recognise a sum of, say, £10,000 from a claim of £20,000 as a contractor's liability because there is credible evidence. However, the balance might be in doubt, and the quantity surveyor will not be in a position to acknowledge the contractor's full liability and must under no circumstances process a payment of any amount until it is authorised by the project manager.

The process towards settling a claim may commence with a meeting involving the project and site managers and claim issuer, and the quantity surveyor should be proactive in promoting this encounter instead of leaving the matter to chance. A meeting may bring to light the existence of verbal discussions or agreements, and it may be wise for parties to attempt to settle for an amount in the spirit of the meeting whilst the claim is fresh in people's minds. A worse case is one where there is no agreement and the meeting adjourns with the debt unresolved and then, months later, the project is complete and the claim resurfaces. It would certainly be in the interests of the contractor and claim issuer to address the situation at the earliest opportunity and seek a win–win scenario instead of procrastination of the matter.

Ex-gratia requests tend to be more commonly issued from the supply chain to the contractor than from the contractor to a client. This is generally because of the number of supply chain members engaged by a contractor and the transfer of risk when concluding an agreement. If an ex-gratia claim is received, a contractor should consider what effect rejection of a claim would have, taking into account its responsibility under the main contract, and what benefit might be gained if it negotiates and receives something in return. An ex-gratia claim from a subcontractor might be issued when their profits are diminished or possibly they are even operating at a loss because they overlooked details in the tender documents, and what started out as a lucrative scheme has failed to transpire. A contractor would have every right to reject such a claim, but should consider each submission on a case-by-case basis. For example, what should a

contractor do if a block-laying subcontractor with a supply and construct contract at 95% complete issues an ex-gratia request for £10,000, based upon a contribution to a £20,000 retrospective increase in the cost of materials that it cannot recover under the contract? If the subcontractor provides proof of the price increase with a letter from a supplier, the contractor could make its decision based upon performance and collaboration with the project team. In other words, when considering a payment, the decision may be influenced by the spirit of the project and the quality of the subcontractor's work completed. If deciding to pay anything, the contractor might request the subcontractor to complete the remainder of their contract works to programme, exclude disputed and further additional work payment requests unless expressly instructed, and include the ex-gratia claim in a final account which the contractor will pay. This promotes collaboration and may be an effective negotiation tool to complete the trade works.

6.7.3 Claims from the contractor to the supply chain

A contractor issuing a claim against a member of its supply chain might wish to deduct the amount from one of their payments as full and final settlement. Alternatively, a claim may be issued separately and left in abeyance until agreed, and this is appropriate if it is a counter-claim against a claim issued from a supply chain member to the contractor. If the contractor opts to reduce a payment to settle a claim, the reduction is usually permanent and the contractor refers to this as a 'contra charge' or 'recharge'. Alternatively, the contractor could issue an invoice but there is no guarantee it will be paid. The permanent withholding of money is not to be confused with cash retention, which is the agreed temporary withholding of funds from a subcontractor to ensure it performs its duties and is eventually paid. Neither should permanent withholding be confused with reducing an amount on a progress claim (or invoice), when the quantity surveyor amends a sum and issues a 'pay less notice', stating the reasons. This is because the contractor has a liability under the agreement to pay an amount upon completion of the works unless reimbursement is on a schedule of rates and the price is not a fixed sum. However, if the quantity surveyor agrees to pay an invoiced amount and wishes to reduce payment by a permanent amount, the supply chain member must be advised with a 'pay less notice'. Where works are carried out as 'construction operations' as recognised by the Construction Act, it is legislative requirement for the contractor to advise the supply chain member of any reduced amount it will pay after an invoice is received.

A claim from a contractor to a supply chain member needs to be issued with the same proof as if the supply chain member were issuing a claim to a contractor. The claim must be substantiated with photographs, site instructions, etc, for authenticity. A counter-claim could take time to prepare and be negotiated at the same time as the supply chain member's claim against the contractor. However, claims as contra charges can be minor in value and time-consuming to verify, prepare and issue. In order for the quantity surveyor to identify who

is responsible for receiving a claim, there must be communication in writing from site management and to the registered offices of the supply chain member receiving the claim. With small-value contra charges, works executed by others must be authorised by the contractor's personnel, using either a site instruction or daywork sheet that records the cost of labour, plant and materials. To be effective, the instruction/sheet must state that the works are to be contra charged and specifically name the supply chain member that is to incur the charges. For example, dayworks might be authorised to a plumbing subcontractor to repair damaged pipe work caused by nails that punctured the pipes when plasterboard lining was applied to a partition wall. Here, the daywork sheet may state that the costs of works the plumber will charge the contractor are to be a 'Contra charge to 123 Wall Liners Ltd'. This is of no interest to the plumbing subcontractor and is for the quantity surveyor's information when in receipt of the plumbing subcontractor's request for payment.

The quantity surveyor must ensure that a contra charge is genuine and not the result of the contractor's inefficiency. This must be ascertained prior to advising the appropriate supply chain member of intention to deduct an amount from its future payment. When communicating the intention, the quantity surveyor should reserve the right to apply a proportional administrative charge for preparing the claim and request a credit note or a reduction on a subsequent progress claim to acknowledge the contra charge. If a supply chain member contests the validity of a contra charge with the quantity surveyor, they must be referred to the person authorising the instruction and the quantity surveyor must not agree to mediate. Of course, the supply chain member will have access to dispute resolution options if it wishes to go down that route. However, if a contra charge is a minor amount, it would not usually warrant intervention and is best resolved by the contractor either negotiating or standing by its decision. Alternatively, the recipient of a contra charge may involve their insurance company if they want to make a claim, which is generally of no interest to the contractor. However, the contractor should permit access to the works by any insurance representative wishing to investigate the circumstances.

6.8 Settlement of disputes

In general, a dispute arises when a claim (whether or not of a financial nature) is rejected, and the party receiving the rejection officially objects to the decision. In order for a dispute to arise, the objection must be recognised; silence would not constitute a dispute and would be considered acceptance of the rejection. For example, a contractor might have a claim rejected by a client's agent, with grounds for the decision. The rejection may be blunt or seem open to negotiation. However, it is still a rejection, and if the contractor falls silent on the matter there is no dispute. If a contractor has its claim rejected and raises an objection, it must seek to remedy to the dispute as it sees fit, and explore remedial pathways open to the parties in an attempt to settle the matter.

If a contractor's claim is rejected by a client's agent, it may not be based on intention and is possibly due to inaccuracies within the claim, or there being no clear remedies expressed in the contract to address the claim itself or the method used in its presentation. This can be frustrating for a contractor if a rejected claim involves money, especially if the client is aware the contractor is entitled to payment yet the value of the payment cannot be accepted, resulting in a decision to reject the claim without of the possibility of negotiation. A client's agent may fail to recognise a contractor's and client's common law rights, and because he/she might not be a legal expert, he/she is probably not in a position to give legal advice. Possibly, the only action is to advise the client of the situation, which may be to seek legal advice. However, if the contract permits the action, a contractor can elect to issue the claim direct to the client and bypass the agent. This could prove beneficial as it opens up the pathway to negotiations towards resolving the matter instead of being stifled by contractual requirements that a client's agent is compelled to, and has an obligation to, administer.

A contract should include one or several methods for settling disputes which the contractor ought to check in the first instance after an objection. Any claim submission, rejection or conduct by the parties which is considered criminal must be referred to the criminal courts and is beyond the civil contract. As a last resort, and if civil law is to apply based upon advice received, the parties may seek resolution by litigation through the law courts. This is known as legal proceedings; it is a legal right usually acknowledged by the contract and which the parties are entitled to adopt to settle a dispute. This involves one party enforcing the claim (the plaintiff), and the party resisting it (the defendant).

There are advantages to litigation which include:

- Judges in cases of disputes are experts about the law
- A judge is impartial to the construction industry and refers to case law and statute for guidance
- Decisions are final as a win–lose outcome and binding unless overturned on appeal
- The legal system is reputable for providing a fair outcome using natural justice.

Disadvantages include:

- Expensive, and the legal proceedings may take a long time to get to court
- Judges might not know much about technical aspects of construction issues and rely on the parties calling on character or expert witnesses to aid their case, which adds time and cost to the proceedings
- The case is public and could interest the press, which the parties may wish to avoid because it could tarnish their corporate profiles irrespective of the judicial outcome
- Unlike other dispute resolution methods, it is a win or lose jurisdiction with nothing midway.

Because the parties in dispute choose to enter the litigation arena, they take on uncertainties and a final ruling may be different than either expects. For example, if a contractor as plaintiff sues a subcontractor to recover expenses incurred in rectifying the subcontractor's defective work that it refused to repair, it may be straightforward for a judge to decipher that the subcontractor is proven negligent. However, even if the contractor obtains judgement in its favour, a judge could recognise grounds for proportioning courts costs to the contractor if the contractor breached the contract by choosing to ignore other dispute resolution methods. Here, in summary, a judge could consider the hardship it would cause the subcontractor if it pays legal costs, because alternative dispute resolution methods would have been cheaper. The legal costs alone may be in excess of the damages awarded to the contractor, making the situation one where both parties lose and that should not have resorted to litigation in the first place.

In the United Kingdom, legal proceedings involving construction cases may be referred by counsel to the Technology and Construction Court (TCC). This is a subdivision of the Queen's Bench Division and part of the High Court of Justice which expedites litigation procedures. As the title suggests, TCC litigates on complex technological issues involving disputes in the information technology, engineering and construction industries. The Ministry of Justice issues a list of Civil Procedures Rules (CPR) and CPR Part 60 includes the type of claims that can be managed and run by the TCC. These include claims by and against builders and consultants and challenges to decisions made by other dispute resolution methods. The rulings apply to England and Wales with courts established in various locations to assess cases.

6.8.1 Alternative dispute resolution (ADR)

The Chartered Institute of Arbitrators (CIArb) is a not-for-profit, UK-registered charity working in the public interest with individual members who have training in private dispute resolution. The CIArb 'Jargon Buster' defines alternative dispute resolution (ADR) as 'an umbrella term used to describe alternative, more conciliatory solutions to litigation'. The term requires recognising as access to any of the methods available, excluding litigation, that provide resolution to a dispute leading to settlement.

Various types of ADR are adopted by standard forms of contract. Where a contract is silent on dispute resolution or has a clause stating that determination is to be based upon the client or client's agent's decision, the parties may elect a pathway should a dispute arise. If one party remains reluctant to follow any suggested pathway, the other should sue, using litigation because it is a statutory right.

In this section, ADR does not apply to a situation where an independent person or persons is involved as a character, expert or judicial witness acting in a judicial or semi-judicial process in a purpose-made industrial tribunal or other settlement process. Furthermore, the term is not used with reference to a

party who issues a complaint to a professional body regarding the conduct of one of its members. In this case, the professional body might appoint an ombudsman to investigate a complainant's grievance which, if accepted by the complainant as misconduct, becomes binding on the institution who may then seek remedy using a method of ADR discussed later in this chapter.

With the exception of negotiation, all forms of ADR involve a third-party neutral. A third-party neutral is a person skilled in the appropriate field of ADR and deemed to have suitable credentials in order to understand the industrial complexity surrounding the case. When choosing a third party neutral and type of ADR, the contract form may state a nominating body such as the RICS, RIBA, CIArb, etc. Where nomination of a body is not stated, the parties should select one that has a solid reputation in the industry, with panel members who are qualified to represent it and the type of dispute resolution service. The selected third-party neutral must have no conflict of interest with the parties, be impartial and be acceptable to each party.

When ADR is included in a contract, it may state more than one method in the event of the parties failing to reach an amicable outcome. Should this occur and further intervention considered necessary, the parties may commence a further round of ADR using one of the different methods stated that would be more intense. When adopting this mechanism of the contract, the parties must restrict themselves to the ADR methods stated in the contract and no other, as seeking another and subsequent appointment would create a breach of contract.

Advantages of ADR to litigation include:

- It is generally less expensive
- The process and outcome can be rapid, although this depends on the dispute and type of ADR
- The arbiter is usually experienced in construction matters and will relate to the facts
- The case is private
- There are options available to the outcome that seek win–win and win–lose rulings.

Disadvantages include:

- The outcome may overlook common law matters
- If a win–lose outcome is sourced, choices of ADR are restricted and usually more expensive.

Appointment of a third-party neutral is through a third-party agreement that outlines the scope of services, including an understanding that confidentiality is maintained throughout the proceedings and the outcome. It is preferably arranged as a tripartite arrangement and executed before proceedings commence. A method of reimbursing the cost of the service needs clarifying in

the agreement, and this may be separate because of affordability and the value in question, or may be equally shared.

6.8.2 Negotiation

This type of dispute resolution is the only method that excludes involvement of a third-party neutral. It is an initial process where the parties are encouraged to resolve the situation themselves. It is a low-cost procedure which commences in the early stages once a dispute arises, and is suitable when the parties wish to have an ongoing business relationship beyond the dispute and where each party has similar bargaining powers. It is also suitable when the value in dispute is an amount that the parties consider is suitable to negotiate and it can involve time, money or both. Where negotiation is included in a contract, it is more of an act of encouragement for proactive action by the parties; if inconclusive, it can lead to an ADR method involving a third-party neutral.

With this approach, a disputing party usually serves notice on the other of its intention to appoint its senior executives to negotiate the dispute and invites the other to do similar to enable the process to be initiated. The notice will usually state a timeframe for response and the date or length of time after which negotiations are to commence. The intention of the timeframe is to permit senior executives to become acquainted with the dispute so that, when commencing negotiations, they will be able to demonstrate awareness.

6.8.3 Mediation

Mediation is widely adopted by standard forms of contract in the event of negotiations failing, and is a recommendation suitable when parties consider intervention will aid the resolution process. It is a voluntary arrangement that seeks to obtain a win–win situation, and is where a mediator facilitates and evaluates a dispute that may stem from negotiation or immediately a dispute arises if the parties bypass a round of negotiation. The intention of the process is for the parties to:

- Stop, look and listen
- Reflect on the dispute and recognise what harm it has done to their business relationship
- Consider what an unresolved dispute may do to their future business relationship.

The mediator structures the proceedings by understanding each party's position, and presents each with their differences in an attempt for them to clearly identify the dispute and seek an amicable agreement through reconciliation. The approach has probably more human influence than any other type of dispute resolution method involving intervention, because it focuses on issues each party values and which they may lose if they progress to other

more intrusive methods of ADR. The approach separates proceedings from the contractual aspects so each party can see the benefits of a win–win situation. The mediator first holds separate meetings with the parties, and then expands the dialogue to combined meetings once the facts become exposed and a level of trust has developed. If money is involved, the parties may agree on a preliminary settlement based upon the later performance of one or both parties. If the dispute involves a project that is under construction with both parties required to perform under the contract, the mediator will advise on the implications of any agreement. If the agreement includes the recommendation of a set of terms and conditions, one party's lawyers will draft a preliminary agreement to include the terms and conditions to be effective for a later round of mediation. In summarising, a mediator provides a judgement which is not binding, and will advise the parties about potential pitfalls they could encounter if they wish to proceed to another type of ADR.

Mediation is a non-binding process and any written communications leading towards agreement must commence with a heading stating the document is issued 'without prejudice'. This means that any subsequent dealings involving another third-party neutral who seeks to make a determination involving written evidence is not presented with earlier negotiations for consideration. If a party issues a copy letter in error at a subsequent determination process that includes the heading, it will not be treated as evidence and an experienced third-party neutral will dismiss its relevance because of the reference.

Mediation has advantages over other types of ADR as it is of medium cost, not usually prolonged and suitable for uncomplicated disputes. A disadvantage is the loss of some legal and contractual provisions that harvest the basis of contract law and the putting aside of the formal contract that may have taken some time to negotiate and conclude.

6.8.4 Conciliation

Conciliation is similar to mediation, with the exception that the conciliator conducting the procedure is more coercive than a mediator and will give opinions for the parties' consideration. The personality of the individual acting as conciliator or mediator does not play a part in the process, and it is the process itself that creates the distinction. Whereas a mediator prompts disputing parties to create ideas towards gaining agreement, a conciliation officer will make suggestions and/or give contrary opinions to the ideas put forward. This is carried out during the facilitation and evaluation stages in an attempt to lead parties to a resolution. As a result, a conciliation officer's judgement may not be a surprise, whereas a mediator could present innovative options and leave the parties to ponder over items for a further round of mediation. Conciliation is therefore understood to be a more direct approach, with officers usually appointed on projects that involve specific matters. For this reason, a form of contract could include the services of an officer who has specific knowledge of the type of project to aid the dispute resolution process.

6.8.5 Early neutral evaluation

When disputing parties elect to commence a binding decision process such as litigation, one or both may appoint a third-party neutral to assess evidence and submissions in order to gain an insight to the possible outcome. The person appointed as assessor must be a legal expert and experienced in matters relating to judicial decisions. Furthermore, the person must be deemed competent and qualified to provide an impartial early evaluation which focuses on the legal implications of the dispute towards resolution and, to a lesser degree, with the industrial context. The process will involve a hearing of limited scope and timing in a tribunal court with an evaluation of probable outcome for advice only which is not binding on either party. The advice can prove a good investment of time and money because it may prompt the parties to settle their differences prior to commencing their elected dispute resolution pathway and to 'cut their losses'. If a pending case involves a large amount of documentation, it will require time and effort to create the evidence and submissions for the evaluator to review and is a disadvantage of the process. Early neutral evaluation might be selected as part of a negotiation procedure and may strengthen the parties' understanding of a potential outcome. It is rarely included in a contract as a type of ADR, generally because the procedure is one for advice only that may deter the parties from being involved in a prolonged method of ADR or litigation.

6.8.6 Expert determination

Expert determination involves the appointment of an impartial expert to assess a dispute and apply a determination based upon facts using legal and industrial means. A characteristic of this type of ADR is that it is binding, and if the parties elect this method, they can only do so if it is part of the contract.

The expert and/or parties may request a hearing of the dispute in order to outline the case. This involves the expert hearing each party's version of the dispute in a non-intrusive manner without cross-examination as the intention is for the expert to fully understand the case towards making a binding decision. The expert is a contractual adjudicator who has legal training and credentials as well as experience appropriate to technical matters surrounding the case. Expert determination can be a rapid process, one reason for including it in a contract as it can aid the resolution process, saving time and money compared with other binding determinations. This route is advantageous when:

- Answers to questions raised upon points of law are straightforward
- The contract between the parties is comprehensive
- The parties have confidence in the expert's capabilities surrounding the facts of the case.

A disadvantage of the process is that because the decision is final, any attempt by a losing party to overturn the determination will take time, effort and money.

Furthermore, an appeal can only usually be instigated if the losing party considers aspects of contract law are not considered, e.g. the determination did not enforce certain expressed terms because of their implications elsewhere in the contract.

Expert determination is not to be confused with the services of an expert witness, which is when disputing parties appoint an expert to provide an independent report addressed to an arbitration or litigation court to aid a decision. Neither should the process be confused with an expert appraisal, which is an impartial, independent assessment to assist a dispute resolution process that focuses on anything of a technical nature. An expert appraisal, however, may be supplied as evidence with any type of ADR including expert determination, e.g. if a contractor is in dispute with a client regarding defects to a completed building, the appraisal will be used as evidence and is usually restricted to technical matters with any stated judicial experience considered as reference only.

6.8.7 Adjudication

Also referred to as statutory adjudication, this type of ADR empowers an independent adjudicator to issue a provisionally binding determination based upon facts and law as stated in the Construction Act and the Local Democracy, Economic Development and Construction Act 2009.

An adjudicator is introduced when legislated payment procedures are considered breached. Usually the party owed money is the one that lodges a claim and becomes the claimant, and the party defending the right not to pay the full amount is the respondent. Grounds for a claimant activating the situation arise when the respondent does not pay a debt on time without communicating reasons, or by rejecting the payment request that the claimant considers is in breach of legislation or objects to the rejection. Of all the ADR methods, adjudication is most probably the one a quantity surveyor is likely to encounter because it deals with the flow of payments both to and from the contractor on a construction project and is usually the quickest summary judgement for determinations.

Main contract forms may include provisions for parties to nominate an adjudicator from a selective list called Adjudicating Nominating Bodies (ANBs). However, the parties can access an ANB to appoint an adjudicator even if it is not written into a contract because adjudication is a statutory right.

Time is of the essence with the process and commences when one party notifies the other of intention to commence proceedings. Once an adjudicator or ANB has been contacted by the party giving notice, he/she issues notice to the parties within one calendar week of receipt of the nomination request either accepting or declining the request. If accepting, the adjudicator then has four calendar weeks to make a summary judgement. During this time, the adjudicator will collect information from the claimant and respondent and give each the option to comply or reply, in which case each must copy the other with the information provided. The most widely-used communication procedure is

documentation only. However, at the adjudicator's request and in the interest of time and impartiality, interviews may take place with the parties present. The assessment period can be extended by up to two calendar weeks if the party initiating the process agrees. Communication on a decision is issued to each party, usually at the same time, with the adjudicator giving reasons for arriving at the decision.

This type of ADR is advantageous as it is quick and relatively inexpensive, being approximately 10% of the cost of litigation. A disadvantage is the parties' general lack of faith with justice when adjudicators apply rulings that appear shallow and possibly weighted in favour of the adjudicator's instinct. Rulings may have flaws in relation to law unbeknown to the parties and adjudicator because of the vigorous timing imposed by the Act which requires a rapid decision. The rapid decision may not consider the terms and conditions of the contract on balance and only observe time based upon legislative requirements that may be not on the side of fairness. The timeframe for issuing a response to an adjudicator's request is restricted and may be inconvenient, especially if close to holiday periods when the parties are unavailable, and may result in a missed opportunity to provide vital evidence. When a claimant wins a case, the loser might consider they have been ambushed by the system. However, as this is not a finally binding judgement, the loser can resort to arbitration or litigation to avoid payment. Decision makers with arbitration and litigation may scour involvement with an appeal against an adjudicator's decision and the loser should refer the matter to the appropriate ANB (if it was an ANB that appointed the adjudicator). A contract may define arbitration or legal proceedings following an adjudication determination not as an appeal against the decision, but as consideration of the dispute or difference as if no decision has been made by the adjudicator. This seems to imply that any further proceedings brought about by the losing party attempting to overturn a decision will only be heard as a different dispute.

Some interesting statistics have been provided in reports issued from the Adjudication Reporting Centre set up by the School of the Natural Built Environment at Glasgow Caledonian University. The 10th report issued in June 2010 is available on www.adjudication.gcal.ac.uk and is based upon the return of completed questionnaires provided by ANBs and a sample of individual adjudicators to acknowledge a 10-year milestone since adjudication was promoted by legislation. Observations of the statistics include:

- For the period 1998–2008, over 15,000 adjudications were reported by ANBs
- For the years 2002–2008, an average of 86% of adjudicator sources were through ANBs
- For the years 2002–2008, quantity surveyors were the primary adjudicators, deciphering an average of 37% of the number of cases ahead of a growing number of lawyers
- Between 2000 and 2008, complaints made against adjudicators' decisions through ANBs averaged 1.2% with 0% upheld

- Between 2004 and 2008, the primary subject of disputes with the heaviest weighting was the valuation of final accounts followed closely by failure to comply with payment provisions
- Between 2001 and 2008, the value range of sums in dispute with the heaviest weighting was £10,000–£50,000
- Indications are that half of all disputes are between main contractors and domestic subcontractors
- In excess of 80% of disputes are initiated after a date of practical completion. This is contrary to the Act that promotes to settle disputes as they arise.

In 2011, amendments to the Construction Act following changes to the Local Democracy, Economic Development and Construction Act 2009 became enforceable, meaning that forms of contract must comply with the legislation. This involves:

- A modified payment regime, e.g. the existing 'withholding notice' is replaced with a 'pay less notice'
- A new default notice process
- Changes to the statutory adjudication process where a determination can be made upon an oral agreement as well as a written agreement
- Enhanced rights for the suspension of work for non-payment and right to claim loss and expense.

Adjudicators are trained to deal specifically with disputes and this legislation empowers their discretion. Where applying it, they are the most suitable arbiters to address the quick summary judgement compared with other types of ADR.

6.8.8 Arbitration

Arbitration is perhaps the oldest form of ADR and occurs when consenting parties agree to ask a third-party neutral to settle a matter with a binding decision. For settling disputes in the construction industry where a lot is at stake, it is the suitable alternative to litigation. It has an advantage over litigation in that solicitors, barristers and expert witnesses are chosen for their knowledge of the law and technical expertise, meaning a hearing is balanced or even weighted towards industrial technicalities instead of legal issues.

The governing Act for arbitration in England, Wales and Northern Ireland is the Arbitration Act 1996, and in Scotland the Arbitration (Scotland) Act 2010. The Acts respectively have general and founding principals based on themes of fair resolution of disputes by impartial tribunal where parties are free to choose arbitration methods which must be subject to safeguarding public interests and restrict intervention from litigation courts. In effect, the Act(s) prevents one party from seeking resolution through a litigation court, meaning that a contract must involve arbitration or litigation and not both. Even if a contract has no reference to arbitration, it may be possible for disputing parties to refer their

dispute to arbitration. However, due to the cost involved, parties should seek legal advice and consider options prior to going down this route.

An arbitration ruling is called an award and will involve a losing and a winning party. Appeals are limited and, in the event of the loser wishing to take this pathway, proceedings can only commence based on a point of law. Thereafter, the case must go through litigation courts which will make it public and possibly contrary to the parties' desires. When requested to enforce an award, the litigation court may only assess the procedure to ensure the Act(s) have been complied with and will confine enquiries to the conduct of the proceedings. In general, a court will not open up the proceedings and hear a new case if the award is considered valid.

A clear distinction between arbitration and litigation is that arbitration is consensual and cannot be imposed by one party. The parties to arbitration do not need to have legal representation and can represent themselves, although they tend to avoid this due to the process and resort to legal assistance. Arbitration may be referred to at any time during a project, which the parties may agree to leave until after a date of practical completion. However, if a contractor is in dispute with a subcontractor without client involvement, arbitration proceedings are better commenced after completion of the trade works as the date of practical completion may be too distant.

If a project is of long duration and the parties decide to commence proceedings during the construction phase, each party is obliged to continue with their performance under the contract and the contract is not invalidated, which means works and payments continue as if there were no dispute. If works are suspended because of arbitration which is included in the contract and the winning party is the contractor who suspended the works because of the dispute, then the contractor should be able to recover costs and be permitted to prolong the construction period and be paid associated costs. If the client wins the case, the contractor must recommence works and accelerate the programme so the project can complete on time.

ADR is beneficial to the construction industry and ongoing business relationships when parties are willing and determined to settle their differences rather than resort to litigation. This has filtered through the industry with appropriate legislation and it would be wise for any parties in dispute to explore options available to them before taking a plunge with litigation that may turn out to be something neither expects.

6.9 Voluntary and involuntary contract terminations

During the construction phase, the quantity surveyor will administer the main contract and contracts outlining agreements with its supply chain. In the process, he/she may have to deal with contract terminations which may be voluntary or involuntary. Termination can be voluntary when one party ends an agreement or it may be terminated mutually. A major cause of involuntary

termination is insolvency, which is the inability of a business to pay its debts when they become due. Insolvency is a generic term applied to a company that is cash starved: its assets do not accrue to a sufficient amount that, if sold, would pay its debts with the business wound up. To avoid insolvency, a business might be placed in administration and, if it has an agreement with a contractor, the administrator will inform the contractor about the administration. In general, administration occurs when a business is struggling and acquires a loan to remain solvent. Here, the lender will appoint an administrator to overview the borrower's business arrangements until it has sufficient equity or assets to operate independently. A struggling client or supply chain member that has an agreement with a contractor may elect to be open in discussions regarding its situation and inform the contractor of pending administration. In general, the administrator will abide by the contract and may suggest assignment if this is acceptable. When this occurs, the administrator could be a parent company and attain the same obligations, rights and responsibilities of a client or supply chain member to a contractor so the works under contract may continue. The contract terms may be specific on this matter and the contractor must consider its position and what it may lose if not accepting the proposal.

A wise contractor will carry out credit checks on a potential client and its supply chain members prior to executing any contract in order to safeguard its interests and be satisfied with the viability of the businesses it intends to deal with. Unfortunately, poor client credit rating is not a good sign nor is a low price tender with rapid payment terms issued by a supply chain member, as this may be an attempt to secure an award and obtain cash flow to remain in business. With the insolvency of a supply chain member, the contractor pays an ultimate price for not vetting the business and understanding commercial awareness that disguised a problem. Similarly, a client becoming insolvent and owing money to a contractor is a recipe for the project being a financial burden, as it may take time for the contractor to recoup losses from the client's estate, if anything at all.

To be effective, reasons giving rise to voluntary or involuntary termination must be stated in the contract and these must be cited as reasons in a termination notice. Failure to issue these reasons or state others as grounds for termination when performance under the contract is still possible is a breach of contract.

A contract can be terminated when frustration with an intervening event makes the remaining obligations under the contract so radically different that the performance each party intended to carry out is not considered possible. Before a party considers frustration has occurred and the contract terminated, the facts require examining to confirm frustration exists. This is because the hindrance of frustration may be contrary to the parties' belief, e.g. a natural flood or a lightning strike resulting in repairs might delay a project without frustrating it because it can still be completed after the repairs. Therefore, each event requires assessing on a case-by-case basis and the contractor should resort to legal advice if a contract is considered frustrated.

6.9.1 Main contract termination

Voluntary termination

Probably the most humiliating situation a contractor can endure is a client's voluntary termination of the contract. The client's agent cannot alone terminate the contract although can issue the termination on behalf of the client. The termination must cite reasons and refer to previous written instructions or written communication. With this type of termination, the quantity surveyor must follow procedures strictly in accordance with the contract as the contractor may have rights for possible breach. Once the notice is received, the procedure usually involves the contractor issuing a statement of what it considers is due, and the same applies if the contractor voluntarily terminates the contract. If the contractor is of an opinion a termination is in breach of the contract, the statement should include a loss and expense claim identifying the risks and opportunities the contractor would have endured if it fulfilled its obligations which may be referred to in the event of dispute resolution. In the meantime, the client may or may not choose to continue with the works and could counter-claim a request for payment with any cash retention fund remaining in the client's possession until settlement of the claim.

Involuntary termination

If termination of the contract is involuntary because of a client's insolvency, the contractor must act practically and officially terminate the contract. If a contractor is fortunate enough to be in a position to negotiate a new contract with a new party to complete the works upon notification of a client's insolvency, it may decide to retain the site accommodation. This would then be subject to a new contract and recommencement of the works. If negotiations are not possible, the contractor must mitigate costs for its own benefit by removing its presence from site. The contract may state a contractor's duties in this event and will usually involve the removal of unfixed materials from site. Although not a contractual obligation, the contractor should inform subcontractors to do the same with the exception of any unfixed materials paid for by the contractor.

After a client's insolvency, to a stated timeframe written into a contract or to a reasonable time where not, the quantity surveyor must issue a statement to the client's trustee or receiver stating the value of completed works. The statement should also include a loss and expense claim to claim a final account. The final account will demonstrate a client's financial liability to a contractor less an amount already paid, producing the balance due to the contractor or, in a rare event, an amount due to the client. The final account should also request release of any cash retention fund as this belongs to the contractor and is kept in a separate fund, and theoretically is immune from a client's insolvency. However, the contract may not distinguish voluntary termination from insolvency and the funds may not be readily available, which may require some effort to obtain through the receiver or trustee.

If a final account shows the contractor is owed money, the balance due is claimed from the client's estate. Thereafter, the contractor may be invited to attend meetings chaired by the insolvency practitioner who will provide information about the distribution of any available funds derived from sell-offs after prioritised payments are made. Generally, the priority of payments are:

- Insolvency practitioner's fees
- Secured creditors with fixed charges, i.e. banks
- Other costs and expenses of insolvency
- Preferential creditors, e.g. Inland Revenue, Value Added Tax payments, etc
- Secured creditors without fixed charges followed by unsecured creditors.

The value of the estate will be diminished by prioritised payments. The contractor will probably be an unsecured creditor and receive a proportion of the balance claimed that may take some time to retrieve.

As the main contract has ceased and officially terminated, subcontractors will generally have no recall on the contractor for loss and expense. A wise contractor will include this as a condition of the agreement irrespective of whether termination of the main contract is voluntary or involuntary. A contractor is usually responsible for payments due to subcontractors for their completed works and expenses in connection with the completed works. However, nominated subcontractors could have a claim on the client's estate if there is an insolvency clause written into their contract, which may mitigate a degree of risk to the contractor. Needless to say, if the contractor becomes insolvent, it is the client and/or client's agent who addresses the situation.

6.9.2 Supply chain terminations

Voluntary termination

Rarely will a supply chain member seek termination of the agreement it has with the contractor and, if voluntary termination is to take place, it is usually on the contractor's instruction only and not upon an instruction from the client's agent. However, a form of contract may include provisions for the issue of a client agent's instruction giving the agent the right to request the exclusion of a person(s) from the works. Issue of this type of instruction and action by the contractor should not be seen as a reflection on a supply chain member's performance in engaging the person(s) to be removed. Removal is not necessarily grounds for the contractor to terminate the agreement as such conduct may be drastic.

A contractor must perform under its contract and will rely on its supply chain to do the same. This is because grounds for a client's voluntary termination of a contract include a contractor's failure to perform regularly or diligently with the progression of works or design if the contractor has design responsibilities. If a supply chain member is not performing, it may be due to

its pending administration or, if a subcontractor, reluctance to admit it has an overstretched workforce and is unable to service the contractor's needs. A flaw of some contractors is that supply chain members, and particularly subcontractors, may be expected to perform 'at the drop of a hat', perhaps because a programme or arrangement has not been communicated with the contractor in a temporary state of disarray. If there is genuine concern about a supply chain member's performance, and the project team considers it is impeding the works with the delay not critical but nonetheless noteworthy, the contractor must exercise its rights under the agreement by issuing a letter, email or fax expressing its concern over performance. The letter should confirm verbal requests or attempts by the contractor to communicate by telephone or other means and not be of a contractual nature, although it should include a note of the obligations to perform under the contract. This is so the contractor can give the benefit of any doubt. The letter should also state that a written response is required within a timeframe which must state the supply chain member's intention of maintaining the programme to rectify its shortcomings. The contractor may be surprised at the response it receives, with the supply chain member recognising its shortcomings and committing to an immediate improvement. Should the supply chain member not respond, or issues a defensive response leaving the contractor none the wiser, the project team must consider its position before termination and the quantity surveyor should be consulted. This is because the quantity surveyor is a suitable member of the project team to consider the short- and long-term implications of termination. A method of recognising the consequences of termination could be considered by examining the following questioning:

- Is the defensive response justified and does it highlight a shortfall in the contractor's performance?
- Has the supply chain member been paid in accordance with the agreement?
- If addressing a subcontractor, are areas ready for their works to commence?
- Is the contractor at fault and does it consider it could lose in any dispute resolution process?
- If termination is the only option, will this be in breach of contract?
- What time will be lost by terminating the agreement and seeking a new supply chain member?
- What costs are involved with a replacement?
- If seeking to terminate a named/nominated subcontract agreement, has the client been informed?

In general, quantity surveyors dislike dealing with this type of termination because the contractor may make a hasty decision without exploring the risks involved. If answers to questions in the above listed bullet points are inconclusive, termination must be treated as the last option.

In the event of termination by the contractor, the quantity surveyor must ensure it is contractual and served in writing. Thereafter, a final account should

be issued with a statement of what, if anything, is due to the supply chain member from the contractor or vice versa. If a supply chain member disputes the grounds for termination and is a subcontractor, it must accept the contractor's decision and remove itself from site. In the aftermath of this type of termination, the contractor could be issued with a loss and expense claim, which must be reviewed and either formally accepted or rejected. If rejected, and the subcontractor objects, it is up to the subcontractor to commence any dispute resolution process.

Depending on the circumstances of termination, it may be necessary for the quantity surveyor to prepare a Scott schedule. This is a scheduled list of items that represent defective workmanship and materials installed in the structure and unfixed materials that appear defective which are paid for by the contractor. The schedule lists the items with an estimated cost to repair the works or replace the goods, together with comments, and is signed off by both parties. Later, it could be independently assessed by a third party such as a tribunal if necessary. This approach applies when it is considered practical and does not need to be considered final because oversights are possible with defects that may only become apparent at a later date.

Involuntary termination

Termination may be considered involuntary when a supply chain member succumbs to insolvency. A contractor cannot voluntarily terminate a contract because the other party is in administration, thinking it is about to become insolvent if it performs under the contract. However, termination can take place if the supply chain member fails to supply goods or goods and services under the terms and conditions of the agreement. An astute contractor will observe signs of when a supply chain member might be facing insolvency. This is with particular reference to subcontractors, whose conduct may be different than usual if they have been operating for some time on a project. Indicators to beware of include:

- Receiving complaints from a subcontractor's material supplier who is not paid
- The failure of labour and/or materials to arrive on site at agreed times
- The subcontractor reducing labour supply not instructed by the contractor
- Ex-gratia payment request(s)
- Pleading for revised payment terms to shorter periods than stated in the agreement.

In general, upon receiving notice of insolvency, the contractor must reappoint an alternative as quickly as possible in order to maintain the programme and mitigate the possibility of a delay in site progress. Upon notification, the quantity surveyor must do the following:

- Ensure no further payments are issued to the insolvent business
- Attend to any requests issued from the receiver dealing with the insolvent business's accounts who will probably seek payment for outstanding debts.

Payment of outstanding debts would normally be denied, which must be stated in writing to the receiver with reasons why payment is withheld. This is usually until works included in the award to the insolvent business are complete which, of course, will be carried out by others

- Ensure unfixed materials for the permanent works paid for by the contractor are stored in a location known to the contractor
- Ensure surplus materials unpaid for by the contractor and plant owned or hired by the insolvent subcontractor are put aside for claiming by the receiver. If these are to be collected, the receiver must state in writing to the contractor the capacity of the collector and contents for collection. An insolvent subcontractor might have hired plant and the hire company may wish to recover their assets, which the contractor cannot permit without authority from the receiver.

In the aftermath of insolvency, the contractor might decide to appoint a lawyer to protect its interest, and the quantity surveyor will need to prepare a notional final account to assist the process. This is required to assess a contractor's liability to the insolvent business or vice versa, and the implications the insolvency has on the contractor's performance under the main contract. This account recognises the cost incurred by the contractor at the time of insolvency plus a cost to complete using whatever means needed. From this amount, the sum committed in an award is deducted to produce a liability. The difference between the value of the award to the insolvent business and the liability is a balance due to or owed by the contractor. To demonstrate, let us say a formwork subcontractor has an award valued at £500,000 plus Value Added Tax for supports to in situ concrete floor slabs with associated columns, and becomes insolvent. At the time of insolvency, formwork is substantially complete with payments made and one invoice for works in progress is not paid for which the receiver is requesting payment. Table 6.9 is an example of a notional final account summary for issue to the receiver or contractor's lawyer to assess the liability.

The notional final account must put the contractor back to the position it would be in if it were not for the other party's insolvency. In the example used in Table 6.9, the liability of Builder Co Ltd is based upon payments it has already made at the time of insolvency plus the estimated expense that will be incurred for completing the works using rates from the bill of quantities. This example demonstrates the benefits of withholding cash retention from payments because it mitigates a contractor's exposure. Where no cash retention is withheld and a bank guarantee is issued in lieu, the contractor must contact the issuer and present the document.

When issuing a notional final account, the contractor must make its position clear: that any payment due to the receiver will only be issued upon completion of the works and/or the right to amend the account giving periodic notices until the cost to complete is affirmed. This is because the cost to complete assessment is risk to the contractor and based upon an estimate that will be confirmed once a commitment is made to others for completing the works. Once

Table 6.9

NOTIONAL FINAL ACCOUNT SUMMARY

PROJECT: **NEW MULTI STOREY CAR PARK**		
CONTRACTOR: BUILDER CO LTD SUBCONTRACTOR: FORMWORK CO LTD		
Agreed contract works value		£500,000.00
Agreed additional works		£ 25,000.00
Builder Co Ltd commitment to Formwork Co Ltd upon completion of the works		£525,000.00
Builder Co Ltd liability to carry out the works Nett payments to Formwork Co Ltd as works in progress	£361,000.00	
Plus the cost for work to be completed by others: Formwork Type A class finish to soffits of suspended slab and beams over 200 mm thick Including strutting over 3 and up to 4 m high 660 m² @ £150.00	£ 99,000.00	
Formwork to faces of isolated columns 180 m² @ £175.00	£ 31,500.00	
Making good and preparing surfaces incomplete by Formwork Co Ltd 150 hrs @ £75.00 (Gang rate)	£ 11,250.00	
A. Total Cost of the works	**£502,750.00**	
B. Builder Co Ltd commitment to Formwork Co Ltd	**£525,000.00**	
C. Builder Co Ltd Gain / ~~Loss~~ (A – B)	**£ 22,250.00**	
D. Cash retention refund to Formwork Co Ltd	**£ 19,000.00**	
E. Amount ~~due to~~ / owed by Build Co Ltd upon completion of the works	**£ 3,250.00**	

All figures exclude Value Added Taxation.

works are complete or the remaining works committed in a new contract with others, the notional account is put aside and a final account issued with any amount due to the insolvent business paid to the receiver. If the final account demonstrates an amount due to the contractor which cannot be recovered through the retention fund or bank guarantee, the contractor will need to register itself as a creditor. In this situation, the contractor will probably be an unsecured creditor and only be paid from what finances remain after payments have been made to secured creditors, the liquidator and preferential creditors.

Extreme and unfortunate situations may occur following the insolvency of a supply chain member that prevents a contractor from achieving a date of practical completion, resulting in liquidated damages . With this scenario, a contractor's final account needs to include a loss and expense claim to recover the damages which must prove the insolvency as the root cause of the delay.

The quantity surveyor may need to educate other project team members that the likelihood of receiving anything from the receiver is remote. Anything that is forthcoming will take time and effort to obtain and will probably not be what a contractor considers it is entitled to.

When a contract names or nominates subcontractor(s) who succumb to insolvency, generally the client will instruct the contractor what to do. This will involve either renaming or nominating new subcontractors or instructing the contractor to take over the trade works or omitting the works to be completed. The contractor will be entitled to an extension of time and loss and expense if the client delays the renaming or nominating process. Preparing a notional final account involving renaming/nominating subcontractors could be a complex issue. This is because the value of any provisional or prime cost sums may be deleted, with a variation substituting the sums to the value of an insolvent subcontractor's package when works are only part complete. In the absence of specific clauses, the contractor could argue the right to seek a variation for the difference. However, if the contractor agrees to carry out the works and receives an instruction, it must mitigate the expense as it no longer becomes a client's responsibility. Naturally, if a contractor succumbs to insolvency, it is the client and supply chain members who must act and deal with the receiver.

6.10 Project reporting

Senior management and directors of businesses operating in the construction industry may seldom see the activity of their ongoing projects. Reasons for this could be the distance of a head office from a project and the distractions of running a business, including securing new work and dealing with recruitment. Shareholders and project stakeholders will of course be interested in the progress of every project on their order books and the impact it is having on the business. Senior management and/or directors may have been involved with the initial tender and negotiation period of a project and want to see if their business intention for securing the work is proving worthwhile. This can be provided by project reporting. Normally, executives of large contracting businesses are not involved with the day-to-day running of projects and delegate the responsibility for delivery and reporting to a project team. Periodically, this team will present a report on the status of a project for advice on the direction it is going.

Contractors vary in their requirements for the contents of a report. Some are interested in the bottom line restricted to finance, health and safety issues and completion dates, while others adopt a thorough system to include a broad range of topics. Contractors requiring a large amount of information may have reporting templates in a database as part of their project administration so that the reporting system for all projects follows an identical format. From the executive's perspective, the use of a standard reporting format makes sense. If each project team produced their own format, it would create an unorthodox system and the intent is for a reporting style to be uniform.

A report required to provide detailed information should comprise a cover page stating the project title, date of issue, description of the scope of the project and commentary on the status of building works at the time of reporting. It should also include the project team members' names and position titles together with a list of topics and contents. A list of topics and their contents to include is:

Contractual

- Contract sum and amount claimed for payment
- Value of variations and amount claimed for payment
- Start and finish dates of the project
- Current construction programme indicating the build status by group element (i.e. substructure, superstructure frame, services, etc), with anticipated completion dates for each
- EOT claims and the likelihood of achieving the agreed completion date
- Statement of claims and disputes under the main contract and with the contractor's supply chain
- Status of the supply of 'for construction' documentation
- The contractor's industrial relations with the client's team and/or contractors
- Status of insurance and contract securities
- Status of the supply of warranties.

Health and safety

- The number and type of accidents and record of near misses
- Contractor's relations with the CDM coordinator
- Comments on amendments to the construction phase health and safety file
- Status of the supply of subcontractors' health and safety files with comments on shortfalls to the contents and actions in place to rectify.

Commercial and finance

- Status of awards issued to the supply chain and those yet to be awarded
- Cash flow report
- Summary of additional work payments to the supply chain
- Cost value reconciliations through the cost management system with comments on losses and profits and the anticipated final account.

General

- Neighbour relations
- Environmental issues
- Risk and opportunities for the contractor which may or may not involve finance
- Total number of hours worked by operatives recorded from site attendance registration in the health and safety records or the site diary.

The quantity surveyor is normally responsible for the contractual, commercial and financial elements of the report, as well as risk and opportunities in the General section. It is therefore important to dedicate time to ensure information is correct for inclusion in the report and coordinate with other team members in the process. Creating a standard template for the report may be carried out as part of project administration at the start of a project. However, if it is retrievable in a standard format from the contractor's database, it can be created whilst running the project.

Failure to issue a report on time is not an option and would serve to undermine the project team's pride in the job. The report should be informative, completed without missing parts, concise, clear and accurate and give advice on the project's true status. It cannot be a figment of the imagination and needs developing from available data. Comments in reports that come from gut instinct and are either too optimistic or pessimistic should be avoided. Furthermore, where assessments to possible outcomes can be quantified, the risk and opportunities section should be exploited as it identifies potential outcomes for discussion and action. For example, on a design and construct contract, a contractor may wish to change the perimeter walling on a building from in situ concrete to precast, which might save time yet perhaps cost more, and the benefits of saving time versus additional costs can be explored.

An intention of the report is to provide executives with a snapshot of the scheme so they can gain an understanding of the status of a project and the liabilities and responsibilities forecast by the project team. In general, project reports are issued to recipients electronically to enable them to read them through before requesting project team members to attend a meeting to discuss the details. The meeting will be an experience for those involved. It could also lead to some interesting discussions and debates, with participants encouraged to contribute and be proactive and not reactive to any points of concern. The general topic section might be a chance for the project manager to discuss specific points raised by project team members, and for the project team's participation in the meeting. This will make the report unique and is also a chance to include photographs of the project in progress.

In addition to a contractor's internal report, it may be required to issue regular progress reports to its client. This is not usually requested after works commence and the format and contents of the report are usually included in the tender documents. Normally, regular meetings are held at the client or client's agent's offices to a series of scheduled dates with a minimum of one person representing the contractor, usually the project manager. The project manager may request the site manager and/or quantity surveyor to attend from time to time, depending on the contents of the report. Naturally, contents issued to a client are the topic of discussion and the contractor's report issued to its executives plays no part in the meeting, although some information provided such as the contract sum, date for practical completion, etc, may be identical.

7 Project Completion

7.1 Sectional and practical completion

The time leading up to a date of sectional or practical completion is a busy one for the project team, who will be finalising works in anticipation of receiving a written statement of completion confirming the works as complete. Part of the finalisation procedure involves the contractor's supervisors preparing a pre-handover checklist as part of its quality control where 'snagging' takes place. 'Snagging' is a term used by builders to describe spot checking items of works considered complete or near complete to identify missing items, flaws, errors and unacceptable finishes. It involves the physical examination of each room or common area such as a landing, stairs or car park using a checklist of items stating the works as either complete or incomplete. Where works are incomplete, the checklist includes comments on requirements needed in order to make them complete.

The contractor's supervisors will normally advise supply chain members of incomplete works, and they must endeavour to correct the details in accordance with the contractor's request. In general, the contractor is responsible for 'snagging', which does not involve the client, and only the contractor can enforce the requirements of the contract to its supply chain. However, it may be a contractual duty for the contractor to snag any item requiring attention that has been installed by a client-engaged contractor.

Snagging cannot raise new items and, if it does, it is a request for additional works and usually applies to a subcontractor or client-engaged contractor that may seek reimbursement once completing the works. This is something the quantity surveyor must understand because it will involve additional expense at a late stage of the project that may not have been envisaged. Once a supply chain member advises the contractor it has completed its works, the supervisor(s) will normally either confirm the works as acceptable or reject the advice.

The rectification of snagging items is in anticipation of a handover meeting held with the client and client's agent prior to the date of sectional or practical

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completion. At the handover meeting, the client may visually accept the condition. However, this does not constitute sectional or practical completion because it is usually the client's agent's responsibility to issue the certificate and the client cannot intervene. Only the client's agent or a title named in the contract can issue the statement of completion. A statement or notice from a clerk of works or even the client will have no standing if they are not mentioned in the contract as a certifier, and any issue will mean they will have exceeded their authority rendering the statement worthless. When works are in sections and statements of sectional completion are issued, it will be necessary for the contractor to obtain a completion statement at the end of the final section to formally complete the project.

7.1.1 Definition and effects of practical completion

What defines practical completion is rarely stated specifically in a contract and is often discretional, with some contracts stating that works are considered complete when 'in the opinion of …' , giving the title of the certificate issuer empowered to define the status. In general, the word 'practical' is the driving force behind the decision and is usually based upon the physical condition of a project when the certificate issuer considers works are complete and the works practical for use with the relevant paperwork in place. A minor outstanding item preventing the function of a component may mean the building or project is impractical for use and a certificate of non-completion would be issued. On the other hand, a significant item of work may be noticeably incomplete yet does not restrict or impair the primary use and the certificate of completion could still be issued. For example, a building may have an impeccable physical presence but be without a water supply, and might be considered impractical because water is an essential service. By comparison, a building may have essential services operating with landscaping outstanding, meaning the building is still practical for intended use because the landscaping is ornamental and not considered essential.

The project team will show interest in the handover procedure as the goal is for a contractor to receive a completion certificate that triggers contractual requirements and the relief from certain obligations. To a contractor, the effect of a certificate of practical completion means the following:

- The liability for liquidated damages ceases
- The effect of an outstanding claim for an extension of time can be ascertained that influences the amount of any liquidated damages
- The defects liability/rectification period commences
- The contractor's contract works insurance liabilities cease
- The defects liability insurance commences
- The final account can be prepared
- Half of the cash retention is due for release or the return of one bank guarantee.

It can be seen that obtaining the certificate is certainly a breath of fresh air for the project team and constitutes to a job well done.

7.1.2 Final certification

In order for a contractor to receive a certificate of practical completion, the contract usually requires the contractor to issue the client with a health and safety file in accordance with the CDM coordinators requirements. This includes:

- Design and specification criteria
- Information reasonably foreseen which will be needed for the health and safety of operatives who construct, maintain or clean areas inside and outside of the building once it is in use
- Details on products, substances and manufactured components used to construct the building.

Furthermore, it is usually a requirement that the contractor obtains certification confirming the completed building complies with the Building Regulations and, if it is for public use, meets appropriate health and safety requirements. This is normally supplied from a design consultant who certifies the design portion of the works, and self-certification by the installers of the designed and specified components. For example, a completed sports stadium might look physically excellent, but how is the certifying officer to know that the foundations are suitably constructed or that newly installed spectator seats pose no risk to health and safety? In this situation, the subcontractor that constructed the foundations submits test results of concrete and any other required testing to the contractor who issues them to the structural engineer for approval. If the structural engineer is satisfied with the results, a certificate is issued to the contractor. With the seating arrangement, the subcontractor that installed the seats will provide self-certification which must be in accordance with the specification. If design certification is also required, this will be provided by the designer.

Where a contractor has itself carried out some works, usually self-certification is provided. This certificate and any other issued to the contractor as part of the certification process must be titled 'Certificate' and state 'I/We Certify, …' . It must then state the scope of works and what the certification stands for, i.e. workmanship and materials carried out to British Standards with the relevant number and part of the standard, if applicable, and the year the standard came into effect. The certificate must also include the project title and the name and registered business address of the company issuing the certificate. The certificate must be dated and signed by a qualified person who is competent to certify the scope of works or services completed and not a public notary who may not possess the qualifications required to make the certificate valid. Once a contractor is in receipt of the certificates, the originals should be sent to the certifying officer.

The quantity surveyor has an important role in this process. He/she must ensure that subcontractors' and possibly client-engaged contractors' test results and certificates are issued to the contractor in a timely manner. In order to meet deadlines, it is important to liaise with the certifying officer for the requirements some time before the date of practical completion, which can be up to three months beforehand although this will depend on the project. The certifying officer may be an architect or an independent body and often assists the process by supplying a list of information required in order for a certificate to be prepared.

In addition to design and self-certification, a client may require independent certification of some works by a nominated certifier. This can be a minefield for a contractor who may not agree to undertake the responsibility. Then the obligation becomes the client's and is excluded from the contract, meaning the client cannot impose the requirement on the contractor as an afterthought. The issuing of independent certification may not prevent the issue of a certificate of practical completion which will come as a relief to the contractor. Any flaws in the works beyond a date of practical completion highlighted by independent certification will become a defect and generally included as a rectification item, which must be put right before the end of the rectification period stated in the contract.

7.2 Operating manuals and As Built information

Operating manuals describe how key components of installed items and systems in a building are operated and maintained to ensure the building meets its full potential. A building may be divided into subdivisions or parts for private use by tenants or owners, e.g. apartments in residential construction, and it is usually a contractual condition for a contractor to provide a manual for each part. These manuals generally comprise:

- A contractor's cover letter stating the project title
- Subcontractor/installers' names and contact details
- Manufacturers' instructions and warranties
- Product name(s), codes and illustrations for operating parts
- Help guides including general maintenance and cleaning responsibilities of owners.

Any other areas of a building for common use, such as lifts, corridors, basements, facilitating plant, landscaping, etc, are normally under the control of facilities or property managers. These managers are responsible for the ongoing maintenance of the building or works after practical completion and are provided with a unique manual that includes operational and maintenance information.

A well-prepared contract will include a condition that the contractor is to provide facilities/property mangers with two sets of keys for all lockable components and a schedule of spares. A schedule of spares is a defined quantity of requirements in the event of breakage or damage and applies to items such as tiles or carpets. Items included on a schedule are usually special products purpose-made for a project, meaning that managers will have a limited supply of spares in the event of an accident or wear and tear.

It is a usual condition of a contract that manuals are examined by the consultants that designed and specified the works and approved shop drawings for the project. After examination, the consultants normally sign off the manuals confirming they contain sufficient information for the operation of parts and are an accurate guide to the designed and installed works. A contractor will rely on its subcontractors to provide manuals that should be an expressed term of each agreement where the supply of manuals is required. The agreement should include a request that an engaged subcontractor has a duty to amend details of any submitted manual if requested by the consultant for resubmission until such time it is approved at no extra charge to the contractor. Subcontractors may develop manuals by coordinating directly with the contractor and consultants to confirm the final requirements, the idea being to approve each manual on its first submission. The preparation of manuals is usually progressive and carried out during the construction phase to allow them to become available as close as possible to the date of practical completion. The quantity surveyor is normally a coordinator in the process and ensures that subcontractors provide their manuals in a timely manner.

Manuals for facilities or property managers will include details of specific components and technical information of installed works such as pipe/cable sizes, etc, together with a maintenance schedule of parts and level of responsibility for servicing the parts, i.e. owner or trade contractor qualified to service the parts. The schedule also includes periodic maintenance requirements for maintaining or servicing each component or part. Items that require weekly or monthly attention may belong to the same component yet are different by nature and have different maintenance requirements. This is termed as planned maintenance requirements of a major component that has the aim of preventing systematic breakdown of the component, known as preventative maintenance. The facilities manager must comply with this requirement as it may be a condition of warranty for the works and a statutory requirement, i.e. maintenance of fire/smoke detection and fire-fighting systems in a building. The manual may also state that certain products must be maintained under a maintenance contract provided by the installer during a warranty period with the owner reserving the right to negotiate a service contract thereafter. The manual must also include copies of any collateral warranties from subcontractors as required under the terms and conditions of the main contract.

Where the issue of operating and maintenance manuals is a contractual requirement, it usually includes a condition that the contractor must provide As Built information, which may be referred to as Work as Executed Plans.

Information is provided in prints and soft copies on a compact disc, with the soft copies produced as AutoCAD exchange such as .DWG or .DXF files. The drawings represent the true aspect of the completed building by discipline, i.e. mechanical, electrical, etc. They may differ from the contracted design because of variations and therefore are the blueprints for accessing the location of installed components. Assignment of any copyright of the drawings is not required if the intention of their issue is for operating and maintenance only. However, the author of the drawings can condition the copyright by including a proviso that information supplied cannot be used for a new design on other projects. Furthermore, the author may wish to state that the proviso extends to the manufacture of spare parts or components unless they are required for the repair of works under the contract.

As Built information does not need to include confidential manufacturing details or design knowledge used to create parts of a building or calculations, and if calculations are requested and supplied, they would be for information only. This allows installed components to be appraised so that the building's owner can amend, add or substitute the works in the future when they are not part of the contract, relying on the supplied calculations for any new design.

The issue of As Built information is usually required before a date of practical completion and should accompany the operating manuals. However, in the absence of any information that may be under review, its supply should not delay a date of practical completion and the balance of any information will become a defect. On becoming a defect, the contractor must attend to the matter within the defects liability/rectification period. Costs associated with the preparation of manuals and As Built information are usually included within the preliminaries.

7.3 Defects

In general, defects or defective work occur when the standard of completed materials and/or workmanship or obligations fails to meet the specified requirements in the contract documents. Due to the nature of construction works, most contract forms contain provisions how to address defects and the responsibilities of the parties to a contract within a defects liability/rectification period (possibly called the maintenance period). However, the term 'maintenance period' is misleading because it can be a term referring to the maintenance a building owner undertakes when following instructions in maintenance and operating manuals. It can also refer to a specific contract term in relation to a project or part of a project when a contractor maintains parts of a project for a defined duration that commences upon expiry of the defects liability/rectification period. Where parts of a project are handed over in sections, sectional defect periods are so stated in the contract meaning a number of periods of varying lengths may be ongoing simultaneously.

7.3.1 Patent defects

Patent defects are defective items identified from observation or following investigation that are confirmed by test results to define a shortfall in the function of a building part. This may be as obvious as a leaking roof or taking a core sample of spalling concrete which is detaching itself from the structural component to check if the material complies with the specification.

The rectification of patent defects is generally a contractor's responsibility. If a project is procured as a design and build contract, the contractor will also have design responsibilities. In general, a contractor is responsible for repairing defects in works it has carried out within the specified period at its own expense. This will also apply to frost damage if this is found to be the root cause of a defect caused by freezing and thawing before practical completion. However, the client would be responsible for frost damage if it occurred after this date, because a building's owner is responsible for ensuring the structure is adequately heated and ventilated as part of general maintenance.

The contract may stipulate the client's right to approach the contractor at any time during the specified period and issue a notice of defect(s) and a timeframe in which the contractor must respond and repair the works. In reality, the process involves the client's agent preparing a defects list at a time close to the end of the period which is issued to the contractor for action. A usual notice is one month prior to the end of the period, giving the contractor time to make a presence and rectify the works. A contract may state that a contractor must rectify defective works on or before a specified date which is the end of the period plus a flexible allowance stated in days thereafter to allow for items such as gaining access and ordering materials.

Where there is fair wear and tear, rectifications should put the finish in a condition it would be in if it was not for the defect. The client cannot expect the rectification to put the finish back to the condition it was in at the time of practical completion. Where the client's engaged contractors are involved, the contractor will usually coordinate and supervise the works only. Where the defect is a result of the design and the project was a construct-only contract, the contractor is not obliged to make the adjustment unless the client issues a variation. A contractor must understand its design obligations with defects. If a client considers a defect is due to an insufficient design or undesirable specification, the contractor is not concerned if the works were executed in accordance with the construction documents on a construct-only contract. In general however, it is a different case with a design and build contract, when the contractor completes a design for a client and must rectify the works at its own expense.

During the defects liability/rectification period, the contract is very much alive, and a contractor's lack of response to requests to carry out rectifications may be grounds for the client to terminate the contract. At such a late stage, this would be exceptional conduct, because the client will be anxious to resolve defect issues with the minimum of fuss without resorting to engaging others to

carry out the works. A client cannot employ independent contractors to repair defective works that are a contractor's responsibility and deduct money from a final account without giving prior notice that a contractor consents to. However, if a contractor fails to comply with a request to repair a defect that is of its creation, the client's agent can appoint others to rectify the works. If electing to appoint others because of the contractor's default, the contractor must be given notice in accordance with the contract or to a reasonable time if nothing is stated. If a contractor consents to works being carried out by others, the quantity surveyor will need to question the pending costs. This is because an argument may arise after the event when the client advises the works are complete and later provides costs that come as a shock to the contractor. The quantity surveyor should aim to mitigate this scenario by assessing what the cost should be before works commence so the client can deduct an agreed amount from monies owed. Of course, it makes sense for a contractor to repair its own defects, but sometimes a project may be in a remote location with the contractor specifically locating itself there for the construction phase only, and therefore decides it will accept the charges.

Some contracts include a provision to extend the length of the defects liability/rectification period. This must be for a specific duration and applies when replacements or the renewal of parts are necessary following the 'teething' of new special mechanical plant. Where applicable, it will usually trigger a separate period commencing on the date of completing the last installation of replacement parts.

At the end of the period and subject to all works being rectified to the client or client's agent's satisfaction, a certificate of making good is issued. The contractor must retain this document as it is required for the release of final cash retention or return of the last bank guarantee. If not released or returned automatically, the quantity surveyor should make a formal request when in receipt of the certificate or make a request in the final account.

7.3.2 Latent defects

Whereas patent defects are obvious or discovered through investigation, latent defects are not so obvious. These defects come about by flaws in design, workmanship, materials or a mixture of all three, which only become apparent over time and were missed or could not have been foreseen at the end of the defects liability/rectification period.

In general, a contractor is not contractually obliged to attend to defects occurring after the end of the defects liability/rectification period stated in the contract. In fact, after this period has lapsed and a certificate of making good has been issued, a contractor can refuse to carry out a rectification even if the materials and workmanship are part of the contract. However, it serves no purpose and damages pride in the project if the contractor refuses to repair anything it has produced because the contract appears to provide relief of responsibility. A defect can occur due to the extraordinary wear and tear of a

component or part of a building because of a client's use, with the contractor attending to the defect during the liability period and ceasing to attend to it upon expiry of the period. If the contractor refuses to attend to a defect after the period has expired and it becomes a latent defect, the owner can employ others to complete the repairs. This would be at its own costs if the final account is agreed and paid, the certificate of making good issued, financial securities released and the contract discharged. To recover expenses, a client would not need to resort to legal action because the dispute resolution mechanisms linked to the contract would still apply as long as a defect originated from the contract works. However, this would need to be proven if it is not obvious, e.g. whether the contractor or a client- engaged contractor carried out the works that have become defective. A contractor's liability does not stop here. If the latent defect is a breach of contract through the contractor's negligence, the client has remedies at common law with the limitation period for commencement of legal actions. This is 6 years from the date of the breach under a simple contract and 12 years for a contract under seal. However, a client's common-law remedies will be ineffective if the contractor is insolvent.

7.4 Final accounts

In the lead up to a date of practical completion, the quantity surveyor (if usually based on site) could relocate to the contractor's head office to coordinate the certification process and the issue of operating manuals, including the As Built information. During this transition, the project team organise the termination of temporary services, off hire rented equipment, demobilise the site accommodation and reinstate the area disturbed by the presence of the accommodation. At this time, there is also a requirement for the quantity surveyor to consider final accounts and ascertain a final cost of the project.

7.4.1 Main contract final account

The contract will usually specify a period after the date of practical completion when the contractor must submit a final account. Alternatively, it might state that the account must be submitted within a specified number of days after the issue of a making-good certificate, and the quantity surveyor must wait until the appropriate certificate is received. The quantity surveyor must understand the contract provisions regarding timing for the issue of a final account. The issue of anything after a date of practical completion could be understood as compliance with the contract, which in turn activates the assessment procedure for issuing a final payment certificate, where in fact it may be the last progress claim prior to issuing a final account. In other words, only one submission after a date of practical completion may be permitted by the contract, which is the final account.

An intention of issuing a final account is for it to lead to the issue of a final payment certificate which is recognition of the contractor's completion of its obligation to rectify defects. It is also a statement that recognises a client's financial liability under a contract or, rarely, a contractor's liability to a client. Presentation of a final account should be straightforward and ideally comprise:

- The contract sum
- Omission of any client stated contingencies included in the contract sum if not a requirement
- Adjustment of the contract sum due to variations
- Omission of provisional and PC sums included in the contract sum reassessed as variations
- Loss and expense claims
- Agreed permanent deductions
- Price fluctuations if the project was not a fixed price and subject to inflation.

Where a project includes variances that adjust the contract sum and are approved and paid, there is no need to re-present them, as it would cause unnecessary administration. It would, however, be suitable to provide a summary that gives a total sum for the adjustments. A suitable contract clause will describe the presentation which should be cumulative to give a final account figure with deductions of the amounts already paid to produce an amount due. Any cash retention or bank guarantees in lieu should be requested for release in a letter separate to the final account submission. However, the statement should recognise any cash retention owed and include for partial release. Submission of the account must be to the title named in the contract which on a construct-only project may be the client's agent who may instruct the contractor to issue the details to the PQS. Table 7.1 shows a suitable final account summary a contractor could submit that should be accompanied with back up information.

If stated in the contract, the quantity surveyor must record the length of the review period and the date by which a response is required from the client's agent after the account is submitted. This can be noted on the final account as a reminder. During the review period, the PQS or other assessor might contact the quantity surveyor and request additional information which the contractor must endeavour to supply. A request for additional information is not a response; it is a request for supplementary details to assess the final account. A response must be a statement of the account and nothing less. If a contract states the review period leading to a response is 'up to x months' or 'xx days from receipt of the contractor's assessment' and a statement is issued beforehand, it is valid. However, if a contract states the period for response as 'after a minimum period of x months' or 'xx days but not exceeding xx days after this time', it means the contract favours a thorough assessment and a response before the minimum period will mean the statement is invalid. Once the defined period for response stated in the contract lapses, the assessor must issue a statement of final account or it will have breached the client's contract with the contractor. The statement

Table 7.1

FINAL ACCOUNT SUMMARY FORM
PROJECT TITLE

Agreed Contract Sum:			£3,000,000.00
Less Client Contingencies			£ – 50,000.00
			£2,950,000.00
	OMISSION	**ADDITION**	
Provisional Sums adjustment:	£130,000,00	£15,000.00	
Prime Cost Sum adjustment:	£ 5,000.00	–	
Variations summary:	NIL	£65,000.00	
Additional works summary:	NIL	£30,000.00	
Contractors claims summary:	NIL	£15,000.00	
Total:	**£135,000.00**	**£125,000.00**	
Total OMISSIONS			–£ 135,000.00
Total ADDITIONS			£ 125,000.00
Total Final Account			**£2,940,000.00**
LESS Retention (Bank guarantee supplied)			NIL
LESS Architect Certificate Nrs 1 to 15			–£2,827,500.00
Amount due to the contractor			**£ 112,500.00**
Figures exclude Value Added Tax			

is usually similar to the contractor's final account and a cumulative sum stating the PQS or other assessor's final account less payments already made to produce an amount due to or from the contractor. Table 7.2 shows a statement a contractor may receive seeking acceptance of a final account.

Ideally, the contractor's final account should agree with the statement, plus or minus amounts it considers trivial, and the contractor's authorised signatory will sign and return the document for it to become binding. If the contractor disagrees with the statement (and not necessarily the quantity surveyor), the document should not be signed and the contractor should attempt to negotiate the matter with the client to agree an amicable settlement. Alternatively, the contractor may officially reject the statement and, if the PQS or other assessor objects and affirms the statement, resort to dispute resolution. A contractor must consider what it may lose by not agreeing to a statement as it may mean no further payments become due until there is an agreement or any dispute is settled.

Table 7.2

STATEMENT OF FINAL ACCOUNT
PROJECT TITLE

Client: (Name and address) **Contractor: (Name and address)**

Client's Agent: (Name and address)

Date of issue of the Statement:

Pursuant to the terms of the contract and in respect of this statement, I/We certify that the sum of £2,940,000.00 (TWO MILLION NINE HUNDRED AND FORTY THOUSAND POUNDS EXACTLY) is the gross final account and the gross sum of £112,500.00 (ONE HUNDRED AND TWELVE THOUSAND FIVE HUNDRED POUNDS EXACTLY) is the amount due to the contractor. In certifying this statement we understand:

a) The amount due is the final amount to which the contractor is entitled other than any retention amount remaining where applicable or any Value Added Taxation if applicable under the rules of taxation law and relevant to the project. Furthermore, in consideration for payment of the amount due, the contractor hereby releases the client from all monies, accounts, actions, proceedings, demands, costs, claims and expenses that the contractor had or has previously requested or stated.

b) The amount due is a full and final settlement that may be adjusted by liquidated damages and an audit by the client or client's agent.

Furthermore, I/We certify that the works have been carried out in accordance with the contract and construction documents.

Signed:

For and on behalf of: (Name of Contractor)

Witnessed by:

Date:

7.4.2 Issue and effect of the final payment certificate

When the contractor agrees with the statement and signs and returns it, it prompts the issue of a final payment certificate. Ideally, a final payment certificate and the payment the contractor receives should be the amount on the statement. However, a statement may have conditions saying the client can make amendments and could increase or reduce the value of the certificate and pay a different amount. If money is owed to the contractor, an area of disagreement can surround the deduction of liquidated damages. A disagreement may

also occur when any financial incentives paid for early sectional completions are wiped out by liquidated damages because of a delay to the agreed date of practical completion. This can come as a sting in the tail to the contractor if agreeing to the statement only to later discover the amount due will be reduced which may not be shown on the statement. The assessor issuing the statement might have no authority to deduct liquidated damages, even if it is obvious and could avoid advising any deduction. The communicator of any deduction might be the client's agent who alters the value of the final payment certificate or it may be the client who decides to pay a different amount. The right to deduct liquidated damages is dealt with in the same manner as interim payments and the contractor must be informed. A wise contractor who agrees a final account and later discovers liquidated damages are to be deducted would wait to receive payment and then decide whether to challenge the deduction, otherwise there is a possibility nothing will be paid.

Any liquidated damages that the client/client's agent decides to deduct must be to the amount stated in the contract. If they are different or the contract is silent on liquidated damages, any deduction would be considered a penalty. In general, a penalty is a fine or punishment which is unenforceable and used where a client will benefit. If considered a penalty, the contractor may resort to the law courts to recover any amount deducted. If a contract specifically states liquidated damages as nil, a client cannot deduct anything and, if wishing to recover losses because of a delay, the delay must be a breach of contract by the contractor and the client would need to resort to the courts to recover its loss as an award in unliquidated damages.

Where liquidated damages are stated in a contract and deducted from the payment, a contractor may choose to query the calculation which a client might not wish to divulge because of business sensitivity. Stated liquidated damages must be specific, i.e. a rate per day or calendar week, and not vague. If it chooses to query the damages included in the contract, the contractor must go through a court that will expose the calculations to understand their basis. In general, if a court considers the damages are a reasonable representation of an amount of business loss because of a delay, it may decide to leave them intact. If considered excessive due to uncertainty or because they include contingencies, the court may construe them as a penalty, thus making them unenforceable. In the absence of negotiations between the parties on the matter, the contractor's challenge may be a long drawn-out process to see if in fact the liquidated damages are a penalty. Separate to this is the question of the delay itself triggering the damages, because if the contractor's request for an extension of time is rejected in part, it means there is no agreement to the end date and the project's duration is 'time at large'. For liquidated damages to be enforceable, the delay would need rejecting in full, thus cancelling 'time at large'. This links to what is referred in legal terms as the Prevention Principle where a party cannot benefit from its own breach of contract, i.e. one party cannot insist on the performance of the other if it caused the non-performance itself. In other words, if a client acknowledges its part in a delay but not to the full extent claimed by the contractor, the client still carries a degree of

responsibility. If a client agrees to some extension of time as admission, it renders 'time at large' and a third-party neutral may have to intervene to consider what would be a reasonable extension that the parties should attempt to agree on. In the meantime, if the parties are unable to agree, it means there is an inability to apply the liquidated damages.

7.4.3 Supply chain final accounts

The quantity surveyor would be wise to address supply chain final accounts as soon as possible after the date of practical completion. This is important for the contractor because variations and/or claims under the main contract may include submissions from the supply chain that a quantity surveyor requires as part of the main contractor's submission.

Formal agreement to a final account with supply chain members is seldom mandatory unless the contractor writes it into the agreement. If it does not apply, identifying and agreeing final accounts is good practice because it reduces a contractor's exposure to liabilities and provides more certainty with the project final costs. The contractor may have engaged scores of supply chain members for a project and it could prove a huge task to request a formal sign-off procedure without a clause in a contract stating a requirement to agree a final account. Without a suitable clause, supply chain members do not need to agree a final account and one method of determining liabilities is for the quantity surveyor to request supply chain members to issue a final account irrespective of it being an obligation of the agreement. However, some supply chain members' accounting systems might not be as robust as a contractor's and they could decline the request. In this case, the solution is for the quantity surveyor to issue a statement in a Deed of Release. A Deed of Release is usually issued to a subcontractor or consultant who have signed a lump sum contract agreement, and represents a sum due based upon the value of the works in the agreement, plus or minus additional works and variations to calculate a liability. The liability is reduced by an amount already paid to produce the amount due, usually a debt owed by the contractor that, once invoiced and paid, is the final financial liability excluding the retention provision. With subcontractors, the Deed includes half retention release with a note that the balance is due at the end of the defects liability/rectification period, i.e. mirroring the main contract.

When assessing an amount to include on a Deed of Release, a contractor cannot deduct an amount as a penalty because it cannot be enforced. Furthermore, a contractor can only deduct liquidated damages if they are specifically written into the agreement. They are usually capped because subcontractors do not generally accept the full allocation of damages under the main contract as it would not make commercial sense. For damages to apply, a supply chain member's lack of performance must be proven as the sole reason for the contractor delaying the completion date and incurring liquidated damages under the main contract. This may apply when a project is on target to complete

on time but is suddenly hindered by the insolvency of a subcontractor with no programme float available. Here, the contractor would include the liquidated damages as part of its final account with the subcontractor's liquidator in an attempt to claim an amount from the insolvent business's estate.

Forms that constitute a Deed of Release can be worded in a similar way to that issued as a statement from the PQS or other assessor under the main contract as shown in Table 7.2 above. For the Deed to be effective, it needs to be signed off by the supply chain member and also preferably the quantity surveyor.

If a supply chain member disagrees with the sum due on a Deed of Release, the contractor must attempt to negotiate. If the contractor objects to the disagreement, it is up to the supply chain member to adopt the dispute resolution methods that form part of the contract. However, dispute resolution is not a matter for the quantity surveyor to decipher and he/she must advise senior management of the situation.

When reconciling plant hire companies invoices to ascertain a final account, there may be surprises in store if hired plant is considered still under hire when it is clearly not on site. This will need clarifying as either an administrative oversight or to see if, for example, the plant has been transferred to another project which managed to bypass the plant hire register. Theoretically, of course, all hire periods for plant should cease upon completion of a project unless they are retained to carry out rectification works.

Rarely will plant hire or material supplying companies sign off a final account as they usually have an invoicing system driven by their accounts procedures. However, some larger companies may have a unique project account reference system and provide technical representatives to liaise with the contractor's personnel during the construction phase, and will sign off a final account if requested to do so.

7.4.4 Final project costs

Ideally, a project's final cost should be less than the income received by a percentage closely resembling the margin the contractor envisaged it would receive at the time of tender. In order to assess the final margin, the final account under the main contract must be known, together with the final costs.

The assessment of final costs is aided by the cost management system, which shows the value of orders placed as well as amounts paid in comparison with remaining liabilities on the balance of order values. At this stage, it is necessary to review accruals and decide if they are actual costs or residue from approximate order values entered into the system. For example, if there is an order on the system for a supplier to provide a bulk supply of bricks worth £50,000 which includes an allowance for waste of £5,000, and the final cost incurred is £47,000 with no further liability expected, the accrual can be released. In effect, this will reduce the final project costs for the brick supply by £3,000. This process should be repeated for any order that has approximate values. However, care is required

when releasing accruals and they must apply to orders issued with approximate values and not fixed amounts because a supply chain member may seek the balance of an order supply it has fulfilled at any time and the quantity surveyor must recognise such liabilities.

The quantity surveyor must be satisfied that a project's costs include accruals for unpaid amounts for minor work agreements or single purchases for which invoices may arrive months later and which then would become a debt to the contractor. Therefore, it would be wise to spend time reviewing site instruction books and purchase order copy forms to become aware of the possibility of late invoicing. If the cost management system has an accruals facility, the value of outstanding sums as purchase orders or variations to material suppliers should be on the system and included in the cost. If this is not possible, the quantity surveyor would be wise to view financial statements from material suppliers and plant hire companies, a procedure not often followed. Statements are not favoured by quantity surveyors because they include a summary of every invoice issued to a contractor's business over a stated period and may not provide project reference. Statements usually include cumulative amounts owed by the contractor and deduct payment amounts from the bottom line to show company liability and not project liability. A project's liability is, of course, what the quantity surveyor is interested in when ascertaining a project's final expenditure. It would therefore be wise to contact any supplier who has an award undergoing a final account to identify those invoices for the project and assess if anything is owed.

The process of ascertaining final costs for a contract is reviewed regularly after the date of practical completion because the contractor still has responsibilities under the contract. This continues through the defects liability/rectification period until the receipt of a making good certificate. The intention is to review a contractor's costs incurred during this period which can amount to considerable sums, and part of cost management is to ensure the expense is controlled. Normally, the preliminaries budget includes a sum to cover costs within this period and is the recognition of the liability instead of an accurate assessment of costs because the expense is an unknown factor when preparing a tender and setting the budgets.

A different scenario exists with national house builders that rely on income from the sale of properties and may complete a project with a proportion of houses unsold and need to maintain and promote unsold housing stock. Here, the quantity surveyor will carry out a regular cost to complete in order to forecast final costs until the remaining stock is purchased and income received. A cost to complete is a forecast of expenditure required to see the works through to completion in addition to the costs already incurred, which produces a projected final account. This period can be considerable if there are unsold liabilities whilst income is pending. A cost to complete process may also be implemented by a contractor during the defects liability/rectification period because of the rectification work involved and whether it includes variations.

7.5 Project closure

7.5.1 Feedback

A contractor should consider a project a success once it achieves practical completion. To verify this, the contractor should seek confirmation and opinions about its contribution to a completed scheme by requesting feedback from the client and client's team. Naturally, a project team and contractor's business will have worked hard to achieve the desirable outcome and would welcome a pat on the back for a job well done. However, the contractor may be in its infancy in business or recently gained the trust of a new client. It may also have completed a type of building it has never done before or executed a design and build project for the first time. Here, a contractor should welcome comments and any constructive criticism for it to learn from so it can bolster improvements for future projects. Feedback to a contractor is essential, even if the contractor considers itself an expert with construction of certain types of projects. For example, a contractor's normal business may be building schools, and it has completed a unique school project that tested innovation. Here, the contractor may wish to learn if the innovation it provided met the standards expected, which a client can provide with feedback.

With feedback, clients might adopt their own key performance indicators as a record of a contractor's performance, which they either divulge to the contractor or preserve for their own use. However, a contractor could record feedback by using a questionnaire that it can issue to the client to complete and returng to the contractor. The type of questions to include should focus on customer service that a client can score as a rating, e.g. 0–5 with 5 being the most favourable, and styled so that it would take no more than 15 minutes to complete. It may include sections that warrant a written response in lieu of a rating, although this should be limited to preserve the estimated time to complete. Questions should focus on the overall satisfaction achieved for the service provided, commencing from invitation to tender through to the end of the defects liability/rectification period. The fact there may be an unresolved dispute post-construction should not prohibit the contractor from issuing the questionnaire as it is feedback on the overall performance that is sought which a client will usually understand.

If the contractor wishes to issue a questionnaire to members of a client's team, the client should be given an opportunity to accept or reject the request, and the contractor should only issue the forms upon the client's acceptance. These questionnaires should focus on collaboration and may be phrased to suit the appropriate discipline rather than being a generic form.

In addition to the client and client's team feedback, the quantity surveyor should provide final project costs to the contractor's estimator who will be tendering for new projects. Information provided should include market labour rates, material costs and subcontractor prices all of which provide indicators of actual expense. The estimator will also be interested in the

effectiveness of the site management and constraints of the building process on the completed project, such as site access, as these have an impact on estimating the cost of future works.

7.5.2 Archiving and retrieval

Once a project is complete, paper documents and files will need archiving and storing in locations from which they can be easily retrieved, e.g. if required for legal reasons. The Companies Act 2006, Section 388(4) states a requirement that a private company should preserve their accounts records for a period of three years, or six years for a public company, from the date they were made. Furthermore, the contractor will need to consider its closing position on a project and the limitation period of liabilities under legislation, i.e. 6 and 12 years for simple and sealed contracts respectively. Notwithstanding this, the contractor will need to consider where to store the information as well as how long it will be kept in store, and if the information will be transferred at a known time. A contractor may have an in-house arrangement for archiving documents described in the company's policies and procedures manual. Understandably, a standard reference system will be required for the system in order for it to be to be practical. A room either within the contractor's premises or independent storage facility is a method of preserving hard copy information. A project completion record will aid management and needs to be uniform with other existing archived material. A typical completion record will include:

- **Approvals** A summary of authority approvals, including planning and Building Regulations
- **Compliance certificates** A schedule and copy of services, testing and compliance certificates issued as part of the handover process
- **Handover certificates** Client agent's certificates of practical completion and making good defects
- **Survey** As installed strata plan survey
- **Financial certificates** As issued by the client/client's agent
- **Final accounts** Main contract issue including statement and Deed of Release with each supply chain member
- **Progress claims** Interim applications for payment under the main contract
- **Supply chain payments** Supply chain members' files including tenders, negotiations, payments and correspondence
- **Consultant correspondence** To and from the contractor, including reports
- **Client/architect's instructions** Listed chronologically
- **Client/architect's correspondence** To and from the contractor
- **Minutes of meetings** Relevant to meetings with the client and any of the client's team
- **General correspondence** Letters, public notices, etc, issued for any reason, to and from the contractor
- **Site instructions** Issued to the contractor's supply chain

- **Health and Safety** The construction phase and CDM plan, including registers
- **Other site administration** A schedule of registers, including plant and the site diary
- **Project reports** Internal progress and cost reporting and reports to the client
- **Retention accounts** Final cost management report produced by the cost management system
- **Pre-construction file** The handover file and details issued by the estimator at commencement
- **Project performance summary** A schedule including the contract construction programme and updates during the construction phase, delay register and trade attendance summary by month if not included in the health and safety file. The summary can also include the client-completed feedback questionnaire about the contractor's performance
- **Master building manual** The contractor's copy of the operating and maintenance manual and As Built information and one copy of each manual issued for private parts, including copies of collateral warranties
- **Project contact list** This includes the client's team, the contractor's supply chain and project team members' contact information. The list should include a primary contact detail for the client and post-construction contacts, i.e. tenants or owners if made available to the contractor
- **Contract and construction documents** Specifications, drawings, etc, including photographs taken during the construction phase, and after if they are to be used for commercial promotion
- **Outstanding issues** A list of any features that are unresolved, including disputes and planning conditions yet to be discharged applicable at the time of creating the archive content.

Collection and archiving of this information could be a mini project in itself, and the paper option of storage will take up a considerable amount of space on a contractor's premises. With the use of alternative storage methods and information technology, specialist companies offer paper and paperless options to store documents as well as an archiving and retrieval service to free up office space. Services include:

- **Document warehouse** Hard copies are kept in store in a warehouse and charged as an ongoing fee. The contractor has unrestricted access and usually involves an authorisation process to protect the contractor's confidentially. Even though the warehouses may be described as waterproof and fireproof, a contractor would be wise to keep electronic back-up information at head office in the event of irreversible damage at the warehouse.
- **Document reduction** Traditional folders and files can be replaced with vacuum packing, a waterproof method of reducing the bulk factor of contents by as much as 50%. Here, documents are sealed in plastic wrapping in accessible pouches with the air removed. Pouches can be coloured for identification and have security coding embossed in seals.

- **Bulk document and large format scanning** Standard documents up to A3 in size can be scanned at a rate of thousands per day as .pdf, .tiff or .jpeg files using sophisticated scanners. The information is supplied by the scanning company on compact discs available in various colours for identification, or can be uploaded to a host web site. Format scanning is also available where documents are larger than A3. Some service providers offer an on-site scanning service that involves creating a temporary network which can be set up at the contractor's offices. Once documents are scanned, the provider might offer to shred the documents as an additional service.
- **Electronic storage** Contractors often retain business activity on a computer server for general viewing. This is usually restricted to members of the contractor's business and located on a common shared drive with a designated letter other than A:/, C:/ or D:/, which are the common hardware drive references. Here, documents are stored and maintained through the construction phase and, when the project is complete, the information is transferred to a completed project file elsewhere on the shared drive. Any information relevant to a project which is stored by project team members on their own C:/ drives at workstations or laptops must also be saved and transferred to the shared drive.
- **Electronic web viewing** An electronic vault can be created with information stored by cloud computing. Here, information such as spreadsheets, word processed documents and emails is uploaded and stored to a host cloud either created by the scanning company or arranged by the contractor that can be retrieved on-line for downloading at any time using authorised access. Electronic systems are environmentally friendly and have advantages over hard copies because they release physical space for the contractor to carry out its ongoing business activities.

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