



CONSTRUCTION

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CONSTRUCTION

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BIM DIGITAL PLAN OF WORK 2013

Key processes:

- Performance monitoring and control
- Health, safety and welfare systems
- Quality management and control

Key objective:

- ‘Are we constructing what has been designed?’

Key deliverables:

- Performance management plan

Key resources:

- Client team
- Project manager
- Design team
- CDM coordinator
- Constructor team

Stage process and outcomes

During this stage, the construction of the facilities as defined by the design and contract documentation are completed. This process involves the greatest number of people and organisations, and the greatest expenditure. The project manager's role during this stage focuses on monitoring the progress of the works, reporting to the client, protecting the client in regard to timescale, cost and quality, and ensuring full compliance with statutory, legal and contractual requirements.

Outcomes:

- progress reports
- contract management and administration
- management of change
- dispute avoidance/resolution (if necessary)
- update Health and Safety Plan and File
- record of construction works
- facilities completed in accordance with design and contract documentation
- as-built drawings
- operating and maintenance manuals
- occupiers handbook

Project team duties and responsibilities

Client

Traditionally, the client has had a relatively nominal direct involvement in the construction works; however, as more and more client project teams are being constituted with extensive construction background, the role of the project manager in managing the client's expectations is also expanding. There is now a greater emphasis on the client having more involvement during the construction stage with their primary interests being:

- Ensuring that the build quality is acceptable, taking advice from the project manager where appropriate
- Progress of the works is to schedule and in a logical fashion
- Understanding potential effects of client changes to the construction stage progress
- Managing internal stakeholders in terms of decision making to help with the progress on the site
- Ensuring security, environmental friendly and safe working practices are adopted
- Satisfying themselves that the contractors performance is in accordance with the contract
- Making sure the obligation to pay all monies certified for payments to consultants and the contractor(s) is being carried out

Project Manager

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

- Ensuring contract documents are prepared and issued to the contractor
- Ensuring the contracts are signed
- Arranging the handover of the site from the client to the contractor
- Reviewing the contractor's working schedule and method statements
- Ensuring the contractor's resources are adequate and suitable
- Ensuring procedures are in place and being followed
- Ensuring site meetings are held and documented
- Monitoring construction cash flow
- Reviewing progress with the contractor
- Monitoring performance of the contractor
- Ensuring that the construction phase health and safety file is being maintained
- Ensuring design information required by contractor is supplied by consultants
- Establishing control systems for environmental sustainability, time, cost and quality
- Ensuring site inspections are taking place
- Confirm insurance cover on the works
- Managing project cost plan
- Ensuring that the client meets contractual obligations (i.e. payments)
- Reporting to client
- Managing introduction of changes
- Ensuring statutory approvals are being obtained
- Ensuring all relevant legal documents are in place (such as collateral warranties and performance bonds among others)
- Review construction risks
- Establish mechanisms for dealing with any claims
- Monitor for potential problems and resolve before they develop

Design Team

The design consultants are responsible for the following:

- Providing production information (i.e. details of building components)
- Commenting and approving working drawings being provided by specialist contractors
- Responding to site queries raised by the contractor
- Inspecting the works to check compliance with the drawings and specification
- Inspecting the works to check an acceptable quality standard has been achieved

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

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

Quantity Surveyor

The quantity surveyor has a duty to:

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

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

Contractor

The contractor has several statutory and contractual responsibilities that must be enacted in order to allow the construction of the project to proceed. Depending on the precise form of contract, these responsibilities will vary but will generally include the following:

- Executing the contract agreement between the employer and contractor
- Submitting the requisite health and safety documentation
- Actioning compliance with the requirements of the CDM Regulations of 2007
- Implementing the site waste management plan as required under the Site Waste Management Plans Regulations of 2008
- Producing documentary evidence of all insurance policies as required by the contract
- Enacting all parent company guarantees, bonds, warranties, indemnities and third party rights as required by the contract
- Actioning any statutory notices and consents such as planning requirements, hoarding licences, scaffold licence
- Actioning any third party notices, licences and consents such as tower crane over- sailing agreements
- Gaining any necessary consents from the employer such as subletting any part of the works
- Providing the working schedule with all relevant method statements and activity schedules
- Mobilising all necessary labour, subcontractors, materials, equipment and plant in order to commence the construction works in accordance with the contract

Construction Manager

A client may decide on a construction management route, directly employing a construction manager as a consultant acting as an agent with expertise in the procurement and supervision of construction and not a principal.

In this arrangement, the construction manager's role is the following:

- to determine how the construction works should best be split into packages
- to produce detailed working schedules
- to determine when packages need to be procured
- to manage the procurement process
- to manage the overall site facilities (such as access, storage, welfare, etc.)
- supervise and coordinate the works package contractor's execution of the works

Management Contractor

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

Subcontractors and Suppliers

Subcontractors have specialist expertise, usually trade related (i.e. mechanical or electrical installations, lift installation, joinery and demolition), for the supply and installation of an element of the total works. Subcontractors may be either nominated or named by the consultants or selected and appointed directly by the main contractor, known as domestic subcontractors. If nominated, the client carries some risk in respect of the subcontractor's performance.

Suppliers provide certain materials, components or equipment for others to install. Labour-only subcontractors provide only labour to carry out the installation of materials, components or equipment provided by the main contractor (i.e. carpenters, bricklayers and plasterers).

Due to their specialist knowledge, subcontractors have an increasing design responsibility for the technical design related to their installations (may include fixing details, fabrication details, coordination with other installations). There is a general obligation on all the project team to ensure the site is safe, although legally this falls to the principal contractor under the CDM Regulations.

Other parties

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

- building control officer
- highways authority
- environmental health officer
- fire officer
- Health and safety executive
- planning officers

- archaeologists
- trade unions
- Landlords representatives
- Funders representatives
- police

Performance monitoring

Throughout the last few decades, a number of industries, primarily manufacturing, have introduced innovative methods and techniques to shift traditional paradigms in order to improve their performance. This has led to the creation of philosophies such as concurrent engineering /construction, lean/agile production/construction and many others such as JIT (just in time), TQM (total quality management), etc. The main driver behind those philosophies is to optimise an organisation's performance both internally and externally within its respective marketplace. Inevitably, this has led to the 'rethinking' of performance management systems through effective performance measurement.

The construction industry's core business is undertaking projects in generating new buildings or refurbishing existing ones for a variety of clients. Therefore, it is not a surprise to find that traditionally performance measurement in construction is approached in two ways:

- (a) in relation to the product as a facility
- (b) in relation to the creation of the product

In particular, the latter of the two has been the prime performance assessment in terms of success or failure) of construction projects. Although the 'three traditional measures of time, cost and quality' provide an indication as to the success or failure of a project, they do not, in isolation, provide a balanced view of the project's performance. Furthermore, their implementation in construction projects is usually apparent at the end of the project, and therefore they are often classified as 'lagging' rather than 'leading' indicators of performance. Therefore, the traditional measures of the performance of construction projects are not enough to assess their 'true' performance.

Key performance indicators (KPIs) were devised to generate information on the range of performance being achieved on all construction activity and they generally, in a typical project, these will comprise of:

1. client satisfaction – product
2. client satisfaction – service
3. defects
4. predictability – cost
5. predictability – time
6. profitability
7. productivity

- 8. safety
- 9. construction cost
- 10. construction time

These KPIs are intended for use as benchmarking indicators for the whole industry whereby an organisation can benchmark itself against the national performance of the industry and identify areas for improvement, that is, where they perform badly.

However, these measures are specific to projects and offer very little indication as to the performance of the organisations themselves from a business point of view apart perhaps from the 'customer perspective'.

Health, safety and welfare systems

In accordance with the construction phase health and safety plan which would have been prepared prior to commencement on site by the contractor at construction stage, it is the responsibility of the principal contractor to ensure adequate health and safety and welfare systems have been implemented. There are a number of initiatives for example Considerate Constructors Scheme (<http://www.ccscheme.org.uk>) which provides information guidance and monitoring and benchmark service to contractors with a view to improve H&S and welfare systems across the industry. Often in order to encourage clients to support these initiatives links are established with environmental performances (i.e. BREEAM credits).

Environmental statements

Environmental concerns will increasingly affect our projects. This is especially the case with the pressure to develop brown field sites and reuse old sites. The cost of addressing contaminants or other environmental issues can add significant costs and increase the duration of project. Planning authorities are also more likely to instruct environment studies and restraints as part of the planning process, all of which must be incorporated into the project during the construction stage. It is the project manager that has overall responsibility to ensure compliance with these aims, objectives and constraints. The project manager will need to:

- Understand and act on the environmental impact assessment
- Ensure proper environmental advice is available.
- Ensure that the contractor is complying with the environmental statement
- Seek and ensure action by the contractor of any remedial actions should they be necessary to comply with environmental considerations.

Contractor's environmental management systems

The contractor must establish his own environmental management systems (EMS), but it is for the project manager to ensure that it is being managed properly and is progressing sufficiently to achieve all EMS objectives. Therefore the project manager should:

- Receive details of the contractor's EMS and the environmental plan (EP) specific to the project.
- Ensure that the contractor has set up all necessary procedures and structure to manage the EMS and implement the objectives of the EP.

- Check that the contractor's environment management plan matches the aims and objectives of the environmental statement.
- Agree with the contractor any further aims, specific targets or initiatives that will maximise sustainability of the project and minimise the detrimental impact of the construction process.
- Proactively monitor the progress of the contractor to maintain his proposals and objectives.

Compliance with Site Waste Management Plan Regulations 2008

In April 2008, site waste management plans (SWMPs) became a legal requirement for all construction and demolition projects in England, for projects valued over £300,000.

A SWMP provides a framework for managing the disposal of waste throughout the life of a construction project.

In essence, it should contain the following information:

- ownership of the document
- information about who will be removing the waste
- the types of waste to be removed
- details of the site(s) where the waste is being taken
- a post-completion statement confirming that the SWMP was monitored and updated on a regular basis
- an explanation of any deviation from the plan

Generally, the SWMP will be instigated by the client at the pre-construction stage, where the designers will also have to provide the required information. At the construction stage the document becomes the responsibility of the principal contractor.

Monitoring of the works

Once the project is underway on the site, regular monitoring of progress is to be carried out by the project manager. There is a fine line as to how involved the project manager should become with the everyday issues facing the contractor, and thus the relationship, as mentioned previously, will determine the appropriate approach. It is the project manager's responsibility to arrange from the outset progress meetings at regular intervals. During these meetings, the contractor will present a report as to progress on the site with any relevant design issues which will require resolving.

If necessary, separate design meetings should also be set up. The reporting process to the project manager must not be restricted to the contractor but also to all designers and consultants. It is at these forums that the project manager must manage and ensure all parties are working together and achieving individual target dates for producing information and maintaining progress against the schedule.

Notwithstanding formal progress meetings, the project manager should also visit site regularly and spend limited time at the site discussing progress with site staff and chasing up the appropriate individuals for information and progress.

Reporting

A fundamental aspect of the project management role is the regular reporting of the current status of the project to the client. The project manager needs to ensure an adequate reporting structure and calendar is in place with the consultants and contractors.

Frequency and dates of project meetings need to be coordinated with the reporting structure. Reporting is required for a number of reasons:

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

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

The project manager needs to receive individual reports from the consultants and contractor and summarise them for the report to the client. The detailed reports should be appended as a record. Typical contents of a project manager's project report would contain the following:

- an executive summary
- legal agreements
- design status
- planning/Building Regulation status
- procurement status
- construction status
- statutory consents and approvals
- master development schedule and progress
- project financial report
- variation register update
- major decisions and approvals required
- Trends shown visually are an excellent mode of conveying information to clients and senior management.

Public liaison and profile

The client would probably have set out their overall public relations and liaison strategy during the pre-construction stages of the project. A good local public relation, particularly during the construction stage, will help to improve the public's perception of the construction industry in general. Such activities or actions should include the following:

- ensuring that there is no local nuisance or negative impact arising from the project

- maintaining good housekeeping both on-site and in the immediate off-site area
- erecting informative scheme boards and public viewing platforms
- ensuring that the contractor takes part in a local or national Considerate Contractor's Scheme
- taking awareness initiatives with local schools
- attending local public meetings to raise the profile of the project
- organising site visits for local schools, residents and business people
- partaking in local environmental schemes or issues
- being involved with fundraising for local charities or causes

Quality management systems

Quality in construction can be thought of as the satisfaction of a whole range of performance criteria owned by an interacting collection of stakeholders and mediated by a range of mechanisms running from regulation to market forces. Client satisfaction is the ultimate measure of construction quality, but that this will only be achieved if construction companies adopt a strong external orientation in order to address the full range of quality dimensions that impact on the client. Then there is a good prospect that the client will get satisfied users, satisfied statutory authorities, etc., as well as meeting their own direct ends.

In order to achieve and implement quality management systems, either an organisation- based approach or a project-based approach can be undertaken. Typically, the quality management requirements will be developed at the strategy stage and will form part of the Project Execution Plan.

Commissioning and production of operation and maintenance manuals

Commissioning

The main commissioning and putting to work issues are covered in Stages 6 and 7.

This section covers the construction stage.

The project manager should receive the contractor's commissioning schedule within the early stages of construction in order to satisfy himself that it is properly coordinated with the building works schedule. (As an example, the balancing of the heating and air conditioning system can only take place when the building envelope and internal spaces have been secured.) A problem may occur in that in many instances the building services contractor is a subcontractor to the main contractor and that the subcontract may not be in place at this early stage of construction. In this case, the main contractor will need to identify the logic and sequence of the commissioning.

Operation and maintenance manuals

The CDM Regulations now cover the operation and maintenance manuals, and it is the CDM coordinator's role to ensure that they are delivered as part of the health and safety file. These manuals should also include details of the complete building with input from all of the design team. The project manager has to monitor the progress that the CDM coordinator is making on assembling these files and, if needs be, ensure that all necessary actions are taken to expedite their completion with active cooperation from the contractor. It is a legal responsibility of

the contractor to cooperate with the CDM coordinator and to comply with any reasonable request from the CDM coordinator in order to enable completion of the health and safety file including the operating and maintenance manuals.

BIM strategy

Once operations have commenced on site, the project BIM should ideally be at full detailed coordinated construction status. This will include any input in terms of design geometry and data from supply chain, that is, subcontractors with the design responsibility and product suppliers.

This is a major change from traditional 2D construction information environments, where design development work and construction operations can have substantial overlap in programming terms.

In using BIM to its full potential, the construction BIM geometry and model should be complete or virtually so before operations start on site. This means changing the emphasis on design input to the contract mobilisation period and pre-construction activities to enable effective supply chain involvement.

In this way, construction operations can commence with the delivery team having in their possession most if not all of the information they need to deliver the project successfully. This information will have been clash checked, coordinated and validated for compliance with statutory regulations and the client's requirements, giving more certainty and predictability to the project outcomes.

During the course of construction, the BIM is updated with changes resulting from the site operations, and any other inputs such as client changes and design changes. The site team will use 'field BIM', with site managers accessing the BIM via handheld tablets and while walking round the project they can update the BIM with progress, snagging and any other information available. In this way, the BIM is kept up to date, so that at completion of the construction stage, the BIM is an accurate and complete representation of the constructed project.