1 Preamble

1.1 Core principles

1.1.1 The Guide is a practical treatise on the processes to be followed and standards to be achieved in the effective management of time. It is not based upon any contractual regime, or procurement process and, subject to amendment of existing forms of contract to remove inconsistencies, can be used in any jurisdiction, under any form of contract, with any type of project.

1.1.2 Without effective time management there can be no effective resource management, cost management, nor allocation of liability for slippage, its recovery, or accountability.

1.1.3 In order to achieve effective time management there must be:

- a competent appraisal of the risks which are likely to severely disrupt and delay the progress of the work;
- a design which permits the work sequences that are likely to be severely disrupted and delayed by foreseeable events to be separated into parallel, rather than sequential paths;
- a 'time-model' for the project against which progress, or lack of it, can be measured;
- a practically achievable strategy for dealing with intervening events during the design, procurement and construction processes.

1.1.4 The word 'programme', often used in the past to describe a printed paper copy of a listed process and dates on which the proposed activities might be carried out, is not used in connection with the management of time in complex projects.

1.1.5 The word 'schedule' is used to describe the computerised calculated activity dates and logic; the process is to be referred to as scheduling and the occupation that of the scheduler. It is a process manifest in an editable computer file.

1.1.6 Planning and scheduling are separate disciplines. Project planning is largely an experience-based art, a group process requiring contribution from all affected parties for its success. On the other hand, scheduling is the science of using mathematical calculations and logic to predict when and where work is to be carried out in an efficient and time-effective sequence.

1.1.7 Planning must precede scheduling. They cannot be carried out in parallel, nor can scheduling precede planning.

Guide to Good Practice in the Management of Time in Complex Projects, by The Chartered Institute of Building

1.1.8 Schedule preparation must be a quality-assured process against a standard which will ensure the integrity of the schedule, so that it can function as a time-model.

1.1.9 The schedule (and any revisions and updates) is to be independently audited for integrity and technical competence.

1.1.10 Time management starts on the drawing board with the conceptual design. If the design is not time-effective, no procurement strategy will rescue it.

1.1.11 Time management of complex projects necessarily encompasses the management of design, manufacture, procurement, subcontract and separate contractor work packages, information flow, quality control, safety management and the achievement of multiple key dates, sectional completion dates and multiple projects.

1.1.12 A time-risk appraisal is to be carried out at inception and constantly updated throughout the life of the project.

1.1.13 Time contingencies for the employer's, the design team's and the contractor's risks must be a part of the strategy for effective time control.

1.1.14 The Guide differentiates between the Development Schedule, prepared before a contractor is appointed, and the Working Schedule used in connection with construction.

1.1.15 The Development Schedule cannot be prepared in one process at a single density, or degree of detail at inception. It must be prepared in varying densities consistent with the information available from time to time, and reviewed and revised at regular intervals, as better and more certain information becomes available.

1.1.16 The Working Schedule must follow from the Development Schedule and must also be prepared in varying densities consistent with the information available from time to time. It must also be reviewed and revised at regular intervals as better and more certain information becomes available.

1.1.17 Consultants', specialist contractors' and subcontractors' schedules are to be prepared in the same software as the Development and Working Schedules and integrated into them.

1.1.18 Progress monitoring techniques, which are rooted in comparison of data against a static baseline, have limited value in competent time management in complex projects (in which the work content, resources and sequence necessarily change from time to time).

1.1.19 The work to be carried out in the short term must be scheduled according to the resources to be provided and the productivity quotients for the various work types to be carried out. The absence of a high-density, short-term part of the schedule, or a short-term part calculated other than by reference to resources, is not permitted under this Guide.

1.1.20 Because progress data will be entered only against a fully resourced schedule, the as-built record will provide data standards and productivity feedback for future benchmarking, which will improve predictability and hence reliability of short-term scheduling.

1.1.21 Progress records are to be kept on a database which will provide instantaneous access and retrievability of as-built data for the purpose of checking the reliability of productivity assessments in varying repetitive work cycles.

1.1.22 Quality control and information flow should be managed via the same database as that used for the maintenance of progress records.

1.1.23 The effective management of time necessarily includes the management of the consequences of delaying events.

1.1.24 Intervening events are to be impacted at the time of their initiation, along the lines recommended by the SCL Protocol[1]. The likely consequences of intervening events are to be calculated.

1.1.25 There is no guidance for the approximation of a 'fair and reasonable extension of time', nor of likely delay-related cost claims.

1.1.26 The time management strategy is to be set down in writing in a regularly updated method statement, which is to deal with, amongst other things, the stated strategy and assumptions adopted for:

- project planning
- risk management
- schedule preparation
- schedule review and revision
- progress update
- record keeping
- quality control
- communications

1.2 Mission statement

1.2.1 The primary purpose of this Guide is to set down the standards necessary to facilitate the effective and competent management of time in construction projects.

1.2.2 The Guide defines the standards by which project schedules will be prepared, quality controlled, updated, reviewed and revised in practice.

1.2.3 The Guide describes the standards of performance which should reasonably be required of a project scheduler. It will also form the basis for the education of project schedulers.

1.2.4 Without compromising its primary purpose, the Guide will be developed as a scheduling reference document capable of wide application.

1.3 Genesis of the Guide

1.3.1 The continuous pursuit of excellence in the management of construction is the key to greater effective collaboration, the continued satisfaction of the industry's client requirements and the sustained delivery of successful projects in the 21st century.

1.3.2 With a view to examining the state of the industry in time management, between December 2007 and January 2008 the CIOB conducted a survey of the industry's knowledge and experience of different methods of project control and

[1] The Society of Construction Law, Delay and Disruption Protocol (2002).

time management, record keeping, monitoring and training.[2] The results indicated a wide disparity between the experience of the respondents and good practice in time management.

1.3.3 In the light of the results of that research and with a view to reducing the incidence of delayed projects, the CIOB has initiated this Guide as a part of the initiative in encouraging excellence in the management of construction, increasing awareness of the importance of project planning and scheduling in the industry as a whole and, in particular, with regard to the management of time in complex projects.

1.4 Purpose of the Guide

1.4.1 The growth in training, education and skill levels of the industry in the use of time management techniques has not kept pace with the technology available. There is, however, a trend towards developing more complex projects with contracts which, if not executed efficiently, with good-quality time management and project controls, are increasingly punishing.

1.4.2 It is apparent that, since the 1980s, the construction industry has experienced:

- Design and Build, Guaranteed Maximum Price, and Engineer, Procure and Construct Contracts and other devices, which require the contractor to take more risk than in traditional forms of contracting;
- specially incorporated companies as employer for a particular project which will have limited access to additional funds and are intended to be liquidated once their purpose is fulfilled;
- more technologically complex solutions in shorter timescales and within tighter financial constraints.

1.4.3 The purpose of this Guide is thus to set down the strategy and the standards necessary in order to facilitate the effective and competent management of time in complex projects.

1.4.4 This is not a guide to project risk, value, or other management specialities.

1.4.5 Time-modelling with the use of computers to develop a framework by which the consequences of change and other intervening occurrences can be managed technically and objectively has been available since the early 1960s. However, it is only in the last few years of the 20th century that the necessary computing power and software have become commonly available to facilitate the objective measurements of project deliverables, except in the most unusual circumstances.

1.4.6 Developments in hardware, software and communications' services in the last decade of the 20th century have rendered it virtually impossible in the 21st century to conduct any business efficiently without the use of computers and electronic services.

1.4.7 At the time of writing this Guide, it is apparent that the construction industry uses those resources intensively in design, in manufacture, in procurement, in assembly, in finance and in virtually every field other than the management of time. It is apparent, from the CIOB's research, that time management is generally

[2] See *Managing the Risk of Delayed Completion in the 21st Century*, 2008, Chartered Institute of Building (downloadable from http://www.ciob.org.uk/filegrab/TM_report_full_web.pdf?ref=880 [accessed 14 August 2010]).

pursued intuitively and schedules, if used at all, are used only as a target against which failure to succeed can be reported.

1.4.8 Whilst it is apparent that simple projects can be managed intuitively by experienced construction managers, it is also apparent that the management of complex projects cannot. Attempts to manage time on complex projects by intuition alone will result in failure. In complex projects there are simply too many consequential possibilities for time to be managed by intuition alone. A more scientific approach is required to assess the consequences of express and implied changes and the effect of other intervening events on the multiplicity of activities in a changing time frame.

1.4.9 However, just because the Guide focuses on the requirements of complex projects, this does not mean that what is recommended here cannot be adopted for simple projects if that is what the employer and/or contractor or consultants wish in particular circumstances. On the other hand, it does mean that managing time by intuition alone is simply not good enough for complex projects.

1.5 Applicability of the Guide

1.5.1 Complex projects can be defined both inclusively and exclusively. Much will depend upon the perceptions of those involved as to whether, for the purpose of time management, a particular project is simple or complex. On the other hand, experience and the results of the CIOB's research indicate that the following classifications are likely to prove helpful.

1.5.2 **Simple projects**

1.5.2.1 Simple projects comprise those in which construction has **all** the following characteristics:

- design work is completed before construction starts;
- work comprises a single building (or repetition of identical buildings);
- construction is lower than 5-storey height;
- without below-ground accommodation;
- carried out to a single completion date;
- without phased possessions, or access dates;
- with services not exceeding single-voltage power, lighting, telephone, hot and cold water, and heating;
- with a construction period shorter than 9 months;
- with a single contractor; and
- with fewer than 10 subcontracts.

1.5.3 **Complex projects**

1.5.3.1 Complex projects comprise those in which construction has **any** one or more of the following characteristics:

- design work is to be completed during construction;
- work comprises more than one building;
- construction is higher than 5-storey height;
- contains below-ground accommodation;
- to be completed by multiple key dates and/or sectional completion dates;

- with multiple possessions, or access dates;
- with short possessions;
- work contains services exceeding single-voltage power, lighting, telephone, hot and cold water, and heating;
- construction work is accompanied by work of civil engineering character; or
- the construction period is longer than 12 months;
- construction is to be carried out by multiple contractors; or
- by more than 20 subcontractors.

1.6 Planning and scheduling

1.6.1 Project planning and scheduling, although they are allied disciplines, are not one and the same.

1.6.2 In principle, project planning is a team operation, involving the construction management team, cost control team, design team and project planner in creating the project development strategy. There are fundamental aspects of planning which require a conceptual approach similar to designing. It requires experience, vocabulary, communication and imagination and, at its highest level, provides the formula for the logistic strategy for the project construction.

1.6.3 Project planning involves decisions concerning:

- the overall strategy of how the work process is to be broken down for control;
- how the control is to be managed;
- what methods are to be used for design, procurement and construction;
- the strategy for subcontracting and procurement;
- the interface between the various participants;
- the zones of operation and their interface;
- maximising efficiency of the project strategy with respect to cost and time;
- risk and opportunity management.

1.6.4 On the other hand, scheduling is a mixture of art and science, involving the interpretation of the results of project planning to ascertain, amongst other things, the start and finish dates of activities and their sequence. Scheduling is usually performed by the use of software which facilitates the fast and efficient manipulation of the project planning data for the purposes of time and risk management. In effect, the schedule is the construction manager's time-allocation tool, the employer's risk-management tool and the contract administrator's calculator.

1.6.5 Project scheduling is the art and science of putting the decisions made at the project planning stage into a database:

- to enable the scheduler to allocate contract calendar periods to the various sections of the work in a logical sequence;
- to allocate contingency periods;
- to make decisions as to preferred sequences;

- to calculate float in relation to resources available;
- to present the strategy in a form acceptable to the contractor, employer and the contract administrator as a process-management tool.

1.6.6 In the process of converting the plan into a schedule (within a framework, which will react dynamically to change, so as to facilitate the management of time throughout the life of the project), the scheduler should determine:

- the duration of the activities;
- the party who will perform the activities;
- the resources to be applied to the activities; and
- the method of sequencing of one or more activities in relation to other activities.

1.6.7 It is not good practice to plan the work whilst attempting to schedule it. In the same way that it is possible to start designing a building at the same time as preparing the working drawings and other production information, it is equally possible to perform the project-planning operation whilst scheduling. However, in neither case is such an approach likely to produce, on the one hand, a satisfactory design and consistent production information nor, on the other, a satisfactory project-planning solution and effective schedule.

1.6.8 Accordingly, the Guide recommends that the project-planning function is performed first and the scheduling operation carried out in accordance with the established strategic project plan and planning method statement.

1.6.9 In essence, the prior planning procedure should encompass:

- familiarisation
- outline plan
- strategic plan
- detailed plan and planning method statement

1.6.10 Only when that has been completed should the project-scheduling process commence.

1.6.11 The importance of the project schedule to time management cannot be overemphasised. Without a dynamic time-model which will react dynamically to change, it is not possible, except intuitively, to forecast when work is to be carried out, nor is it possible to assess its criticality, nor the impact on successor activities, nor resources.

1.7 The project scheduler

1.7.1 The job of the project scheduler is to devise and maintain the process plan from overview to micro-level and to manage practical and effective time control from commencement to completion of construction projects.

1.7.2 In order to control the probity of updated schedules, the scheduler must thus be able to advise on and manage the making and retrieval of progress records and, in order to keep the project and construction-management team informed, the project scheduler must be able to prepare as-built schedules of work carried out, progress schedules and progress-related data, for the purpose of progress reporting during the course of the works.

1.7.3 Apart from writing the schedule at inception, the project scheduler will thus be engaged in writing, editing, reviewing, revising and updating the schedule. Reviewing and revising schedules in the light of better information bring the need also to be able to advise on and manage the writing, revision and editing of project-planning method statements.

1.7.4 When change is imposed, the project scheduler must also be able to identify contemporaneously the effect of delaying and disrupting causal events on the planned sequence and to advise the project planner and other members of the project-management team on the likely effect of possible recovery strategies.

1.8 Project control

1.8.1 Project control is the science of identifying, from time to time, what, in the light of current status and information, the completion of a sequence, key date, sectional completion date or completion date is likely to be and then, if that is not what is required, in the light of the information then available, amending the strategy and schedule for the future conduct of the work so as to plan to achieve what is required.

1.8.2 Accordingly, the schedule is to be used for identifying, from time to time, the following intentions:

- periods of activity and sequence of the work and the interface with any other contracts incidental to the work;
- dates and logic by which the information described in the information-release schedule, information-request schedule, or any other request for information, is to be supplied in relation to the activity dependent upon such information;
- dates and logic by which plant, materials or goods are to be supplied, or work to be carried out by the employer, or those engaged or employed by them in relation to the activity dependent upon them;
- any time contingency required by the contractor, any subcontractor and/or supplier in relation to any activity, sequence of activities, or key dates, or the contract requirements for any sectional completion dates and the completion date;
- any time contingency required by the employer, or any directly employed contractor, or consultant, in relation to any activity, sequence of activities, key dates, the contract requirements for any sectional completion dates and the completion date;
- free float and total float that are available to be used by the contractor and/or the employer for managing the re-sequencing of the work or redeployment of resources from time to time;
- the degree of progress actually achieved, on all activities, from time to time;
- the likely and actual effect of any delay to progress on the completion of any sequence, key dates, the contract requirements for any sectional completion dates and completion date, if any, caused by a change, or other intervening event;
- the likely effect of any proposed acceleration, or recovery measures on any such sequence, key dates, the contract requirements for any sectional completion dates and completion date.