CIOB

Managing the Risk of Delayed Completion in the 21st Century

Acknowledgements

The CIOB is grateful to all respondents who gave their time and effort in completing the survey. We would also like to thank all those who participated on the Time Management working committee. They are:

Trevor Drury

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Keith Pickavance

David Tyerman

Rachael Peters passed away shortly after this research was completed. Rachael was responsible for many of the CIOB's recent surveys and pieces of research and without her hard work and dedication this research would not have been possible. She will be missed, but not forgotten, by all those fortunate enough to have known her.

Table of Contents

Table of Figures

Introduction

Between December 2007 and January 2008, The Chartered Institute of Building (CIOB) conducted a survey of the construction industry's knowledge and experience of different methods of project control, and time management, record keeping, monitoring and training. Respondents were also invited to report on how their current projects, and projects that they have been involved with which have completed during the past three years, are dealt with in terms of extensions of time and compensation for delay-related costs.

Standard form construction contracts neither promote nor encourage efficient time management. However, there is a trend towards developing contracts that are increasingly punitive if not executed efficiently using good quality time management and project controls.

Current industry trends indicate that there is also:

- Increasing demand for efficient and technologically complex solutions in shorter timescales and within tighter financial constraints;
- High demand for an accurate completion date, as required by many commercial and public benefit projects;
- A growing trend for employers to require the contractor to take more of the risk that is traditionally taken by the employer;
- A growth in the use of Design and Build (D&B), Guaranteed Maximum Price (GMP) and Engineer Procure and Construct Contracts (EPC); and
- Potentially devastating consequences of the failure to manage time in construction projects.

Purpose of the Research

The main purpose of this research is to:

- Further awareness in the industry of time-management issues;
- Identify the current level of understanding of the importance of project engineers and project schedulers in the management of time;
- Gauge members' opinions on the state of standards of education and training; and
- Determine the use of available technology.

The research also helped to identify the:

- Degree of incidence of unresolved delay in different types of building and building contracts;
- Degree of understanding in the industry of project control techniques by different disciplines; and
- Need and support for training and accreditation of planners and project schedulers.

The findings will be used to prepare the foundation for a scheme of education and training for the 21st century.

The research fell generally into four main parts:

- The nature of the respondents and the sort of work they do.
- Respondents' experience of delay in projects completed over the last three years.
- Current methods of time-risk management and their effectiveness.
- Training and accreditation of planning engineers and project schedulers.

Executive summary

1 The respondents were primarily concerned with managing construction projects, either as contractors or as consultants engaged in the construction industry.

2 Simple, repetitive, low-rise projects have a high chance of success using traditional management processes, and would not benefit substantially from any change.

3 The more complex the project, the less likely it is that it will be completed either on time or shortly after the completion date, using traditional management methods.

4 Low-rise hospital, clinic and health-related buildings, prisons and security buildings, stadia and sports-related buildings and railway stations are the types of projects that currently are most likely to be substantially delayed in their completion.

5 High rise building projects and complex engineering projects also have a low chance of being finished on or before the completion date, and the majority reported upon were likely to be substantially delayed in their completion.

6 In more than a third of building projects and four-fifths of engineering projects, it was perceived that the contractor was predominantly held to be to blame for any delay to completion.

7 In around two-thirds of building projects, and half of engineering projects, the respondents perceived that the delay-related costs were predominantly at the risk of the contractor.

8 Nearly a fifth of all projects are currently being constructed under specially prepared contracts either drafted by the employer or under its direction. While this may be taken to indicate a degree of dissatisfaction with standard forms of contract, it is apparent from the results that the current bespoke contracts fare no better in securing project success than standard contract forms.

9 More than half of respondents answering the planning and scheduling part of the survey had experience of just a master schedule alone being used to manage the sequence and timing of the works, without any short-term planning.

10 In the experience of more than half of respondents to the planning and scheduling part of the survey, a bar chart was used for the long term planning of the works. Less than a sixth were familiar with a fully-linked critical-path network being used to manage the timing and sequence of the works. It is thus apparent that the majority of respondents were unable to identify, promptly, the likely effect any slippage or imposed changes would have on the completion date. Thus managers are currently unable to manage the effects of delay to progress, other than intuitively.

11 Only 3% of respondents to the planning and scheduling part of the survey perceived that the intended construction process was formulated following discussions between the interested parties and the planning engineer or scheduler, coupled with a formal written method statement. The remainder thought that the planned sequence was determined in a less precise or manageable way that would tend to reduce the construction management team's commitment to carrying out the work, in accordance with the project schedule. The low proportion of respondents who had experience of the design team and others outside the contract manager's office being consulted in the drafting of the planned sequence, may be indicative of the anecdotal preference of some contractors for 'working things out for themselves' as the project goes along, irrespective of what is shown on the project schedule.

12 Only a tenth of respondents to the planning and scheduling part of the survey were familiar with the use of project management software suitable for comprehensive time-management being used to control construction schedules. A similar proportion found no project management software being used at all; the schedule being drawn on a spreadsheet. More than half the respondents identified Microsoft's MSProject as the software used to plan construction project schedules. This is a relatively high proportion in relation to other research in this subject carried out by the Planning Engineers Organisation, which may indicate that that organisation's members tended to use the more sophisticated types of software.

13 Only a third of respondents to the planning and scheduling part of the survey reported that in their experience the duration of planned activities was calculated, in whole or in part, as a product of the resources to be applied and their anticipated productivity for the quantity of work planned. Less than a fifth priced the activities in the planned project schedule.

14 Of those who were familiar with logic-linked schedules in any form at all, one-third reported that the logic was left to the scheduler to decide. A further third were not familiar with the logic being shown on the schedule that was disclosed to the remainder of the project team, which in effect, restricts access to that logic.

15 One-fifth of respondents to the planning and scheduling part of the survey were aware of date constraints. Nearly half were aware of float constraints being used to manipulate the apparent criticality of activities on the construction project schedule, and to render the appearance of criticality where the logic alone did not.

16 In a fifth of the cases reported upon, the quality assurance of the project schedule was either left to the scheduler's discretion to check the master schedule, or there was no checking process at all. Only a tenth of respondents had experience of the master schedule being checked for quality by an independent third party review, or against an ISO 9001 certified process.

17 Three-quarters of respondents to the planning and scheduling part of the survey were familiar with working with short-term, look-ahead schedules. However, less than a quarter of those schedules were integrated into the master schedule for identifying the effect of the short-term schedule on the totality of the works.

18 Less than a sixth of respondents to the planning and scheduling part of the survey were familiar with identifying the cost of the activity on the short-term schedule in order to be able to identify those activities that were suffering a loss of productivity and disruption costs.

19 Only one-twentieth of respondents to the planning and scheduling part of the questionnaire had experience of short-term look-ahead schedules being quality assured against an ISO 9001 certified process.

20 More than 90% of respondents had occasion to write, read or consider records of progress achieved. This illustrates that the majority of respondents were concerned with the progress of the works (or lack of it) at some stage of a project.

21 Less than a tenth of those familiar with the keeping of records had experience of them being kept by automated or manual input into a relational database that would produce virtually instantaneous reports of trends and effects of progress and productivity.

22 More than half of respondents to the records part of the survey had experience of records being kept only on paper. This renders such records virtually useless for promptly detecting trends, managing the effects of lack of progress, and identifying the factual data relative to loss-causing events.

23 When it came to relating the records of the resources used to the planned activity, only half the respondents to the records part of the survey reported that the task and the area on the schedule to which the labour had been applied were identified. Around one fifth were familiar with the records being related to a task or area description contained in a different document, while slightly fewer kept records describing tasks and areas that could not be related to the schedule at all.

24 A quarter of the respondents to the records part of the survey reported that labour records failed to note details of the date or day of the week on which the data was recorded. More than a third reported that the name of the labour resource was not noted. To put this into context, less than a fifth experienced a failure to keep basic details of plant and equipment resources. Without adequate labour records it is impossible to know when a resource was used.

25 More than one-third of respondents to the records part of the survey identified a failure to keep the necessary progress records that would aid the detection of trends in labour resources and productivity, or to relate the labour used to the activity timed on the master or short-term schedule. Approximately half had experienced a failure in keeping the necessary plant and equipment records. Without such information it is impossible to detect the symptoms of disruption and the resultant lost productivity, or to predict with any certainty the effects of progress made in relation to progress planned.

26 Less than a sixth of the respondents to the planning and scheduling part of the survey had experience of changed or additional work being identified on a schedule. Less than 3% were familiar with such work being identified in a way that would aid the prediction of the consequences on the future conduct of the work. Only a half were familiar with details being kept of the labour resources needed for the additional work, just over a third were aware of records being kept of the plant and equipment resources involved, while just over one quarter report that details were kept of the additional materials used. Less than half the respondents reported that the date on which changed or additional work was carried out was identified.

27 More than a fifth of all respondents were not aware of any records at all being kept of compensation or delay-related events. This may go some way to explain why such a low proportion of contractors suffering delayed projects are compensated for delay-related losses, or excused payment of liquidated damages by an extension of time.

28 Design work formed a part of the schedule of work in two-thirds of cases reported upon. Design progress was related to the value or quantity of work products executed by less than a sixth of respondents, the majority preferring to estimate the state of work in relation to definable work stages.

29 Those responding to the relevant part of the survey reported that little science is applied to measuring the progress of activities on site. For the majority of respondents, it was very much a matter of subjective judgment at the time. However, provided that the duration of the planned activity is relatively short, there is no great harm in this. The difficulties in this approach

arise for activities of longer duration, where substantial error is likely to be considerably greater than for short duration activities.

30 Just under half of respondents had experienced project progress as a whole not being reported, either in meetings or in correspondence. In only a small minority of projects was progress reported against a reporting period.

31 In around half of projects, respondents reported that progress was likely to be monitored against a schedule that was not regularly updated. This practice will inevitably adversely affect the reliability of estimates of progress achieved, the gauging of the effect of that progress on completion and the consequential effectiveness of reports on progress, if any.

32 Over a third of respondents to the planning and scheduling part of the survey did not have experience of schedules being updated and rescheduled against progress. Instead, activities were monitored against diary dates, without a calculation of the effect of the progress achieved on successive activities, or on completion.

33 Less than a fifth of respondents to the planning and scheduling part of the questionnaire were familiar with the logic of the schedule being corrected to reflect the work sequence actually being followed. This is notwithstanding the fact that without such a procedure the resultant progress calculations are unlikely to accurately reflect a predictable, planned sequence. In the case where progress is permitted to override logic, it could actually predict an impossible future sequence of work.

34 More than half of the respondents said that in their experience a delay to progress was not identified until the schedule was updated, reinforcing the importance of this in project control. Only a fifth of respondents said they would voluntarily declare that a delay to progress had occurred, even if the contract required it.

35 When asked why delay to progress was not reported promptly, just under a half of respondents said it was because they might be able to 'catch up' the lost time, while a tenth admitted that it was because they thought they might be able to blame someone else for it. A third failed to notify the delay because they didn't want to upset the client.

36 In about half the cases, delay was notified to the contract administrator. However, in less than a fifth of cases where there was delay to progress was that delay formally notified to the contractor's board management or to the site management. In only a fifth of all cases was the notice of delay accompanied by an updated schedule illustrating the effect of the delay on the future progress of the works.

37 In the experience of respondents, in a third of cases the contract manager was not one of the parties likely to identify the nature of an event causing delay to progress. In only about a quarter of cases was this likely to be identified by the contractor's commercial director or the project manager. In nearly half the cases it was thought that the quantity surveyor was the party most likely to identify the occurrence of such an event.

38 More than half the respondents did not distinguish between the required skills of a planning engineer and those of a project scheduler. However, those that did distinguish between the two thought that planning engineer's education and training was primarily conducted by universities. Five-sixths of those answering this part of the survey thought that the primary source of education and training was job-related experience. In relation to standards, about half thought that the education and training currently received was currently below an acceptable standard, regardless of its source and nearly two-thirds were unaware of any accreditation that a planning engineer could achieve.

39 More than half thought that the predominant need was for more education and training of planning engineers at university degree level, and just over a third thought it should be at post-graduate level. Just under a third thought that in the future more education and training should be at pre-degree level, while a fifth thought that education and training should be made available at all three levels.

40 Where no distinction was made between the needs of a planning engineer and those of a project scheduler, just under a third of respondents thought that the education and training was via a university education and about four-fifths thought it was primarily through experience on the job. As to standards of education and training, just under a half thought that whatever the source, current education and training were below an acceptable standard. However, just over a third thought it was acceptable, and a further fifth thought it was good. More than two-thirds were unaware of any accreditation that a project scheduler could achieve.

41 Nearly 90% of respondents thought that there was a need for improved training and education of project schedulers. A third thought that, in the future, training and education should be at university degree level, just under a third thought this should be at pre-degree level while nearly a third thought it should be at post graduate level. About a tenth of respondents thought that education and training of project schedulers should in future be made available at all three levels.

1. Who participated in the survey?

Types of business in which the respondents are concerned

Principal occupation of respondents

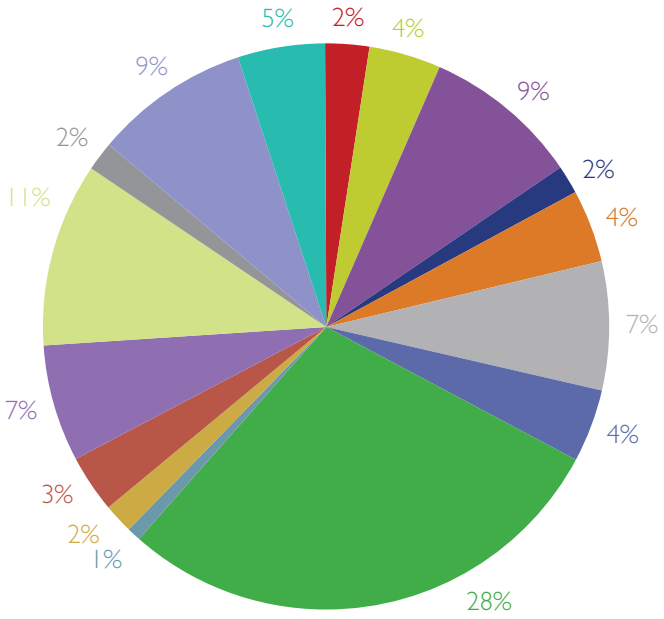

Chart 1 – Principal occupation of the respondents

- Arbitrator, adjudicator or mediator
- Architecture
- Building surveying
- Civil engineering
- Claims consultancy
- Commercial management
- Company administration
- Construction management
- Facilities management
- Financial management
- Health and safety
- Planning engineering
- Programming and scheduling
- Quality assurance
- Quantity surveying
- Other

Principal business of respondents

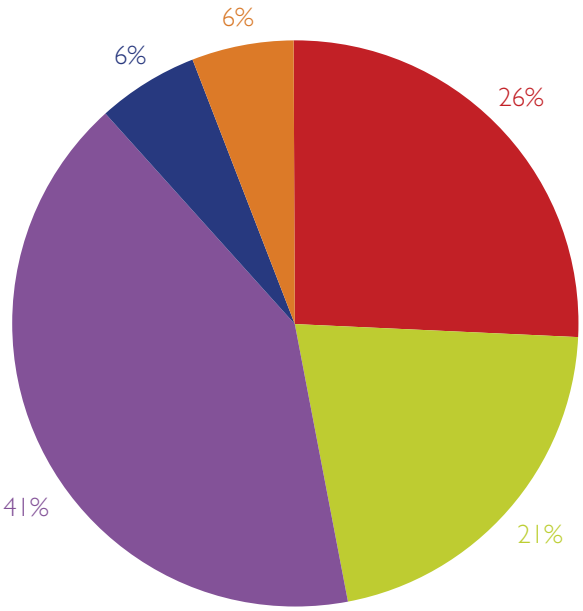

Chart 2 – Respondents' principal business areas

- Professional services
- Project management
- General contracting
- Specialist trade contractor
- Other

Chart 1 indicates that the primary occupation within the construction industry of just over one-third of the respondents was given as construction or commercial management. Just under a quarter identified their primary occupation as being planning engineers or project schedulers. The survey results may thus reasonably be viewed as the views of a sample of the construction industry as a whole, rather than any particular sector within it.

Chart 2 indicates that the respondents were divided 50-50 between those in building contracting in one form or another, and those in professional services in one form or another. 21% of respondents were involved in project management.

** The values in some of the following charts will total more than 100% as respondents were able to select multiple answers.*

2. Project performance over the last three years

Success of low-rise building projects

The performance recorded by all respondents shows that in their experience over the past three years, over 70% of all low-rise construction projects were completed on or before the contract completion date. For the purposes of this research, a low-rise project was defined as one which was one to six stories high. Only 25% of such projects were completed within three months of the completion date, while only 4% were completed more than three months late. These findings are illustrated in Chart 3.

These results included the replies of four respondents who recorded an exceptional standard of performance from a portfolio of over 600 projects (predominantly housing and petrol filling stations involving relatively small and repetitive projects), of which 92% were completed on or before the completion date and 8% within the following three months. Analysis of the performance of the remaining respondents revealed that 61% of low-rise projects were completed on or before the completion date.

Overall performance of over 2000 low-rise projects

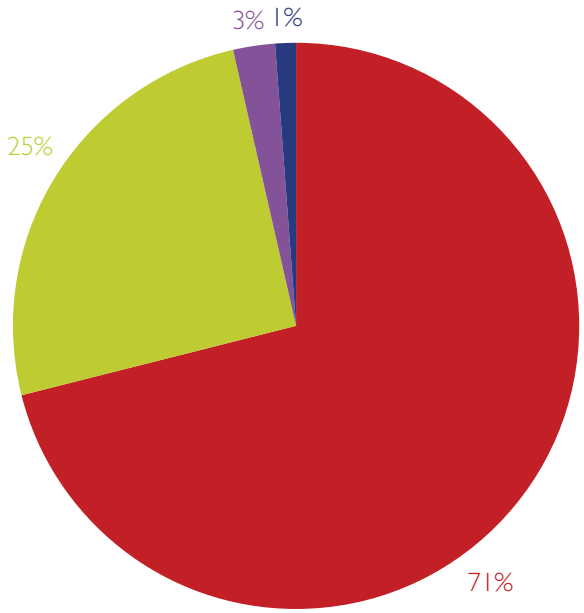

Chart 3 – Low-rise building projects

- On or before completion date
- 1 - 3 months late
- 4 - 6 months late
- More than 6 months late

Principal business of respondents

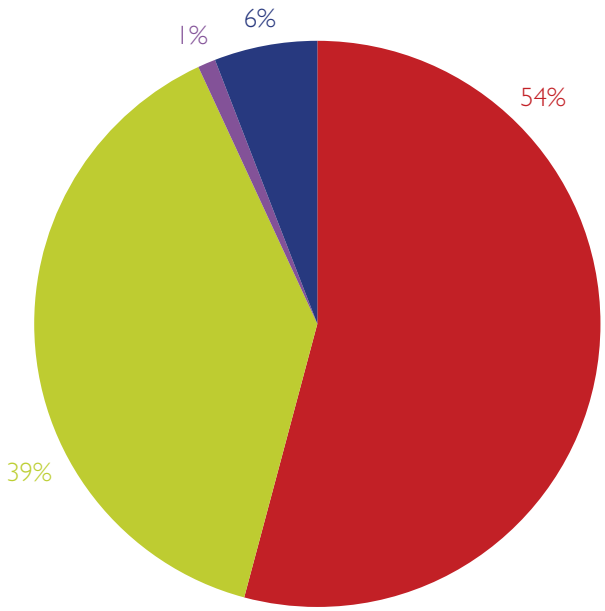

Chart 4 – Low-rise hospitals, clinics and health-related building projects

- On or before completion date
- 1 - 3 months late
- 4 - 6 months late
- More than 6 months late

Analysis of the reviewed building types shows that low-rise offices, commercial, industrial, housing, schools and educational buildings, science, pharmaceutical and airport buildings, all followed a similar pattern of more than 60% being completed on or before the completion date. Exceptionally good performance was also recorded as having been achieved in shops and shopping malls, in which, out of 246 projects, 93% were completed on or before the contract completion date, and only 2% were completed between three and six months late.

The poorer performers included low-rise hospital, clinic and health-related buildings, in which just over half were completed on or before the completion date with more than a third being up to three months late.

Sports and stadia related

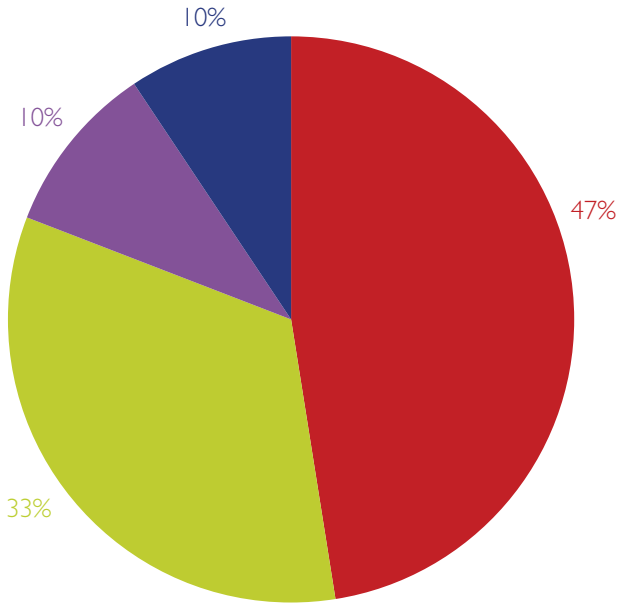

Chart 5 – Low-rise stadia and sports-related building projects

- On or before completion date
- 0 -3 months late
- 3 -6 months late
- More than 6 months late

Prisons and security buildings

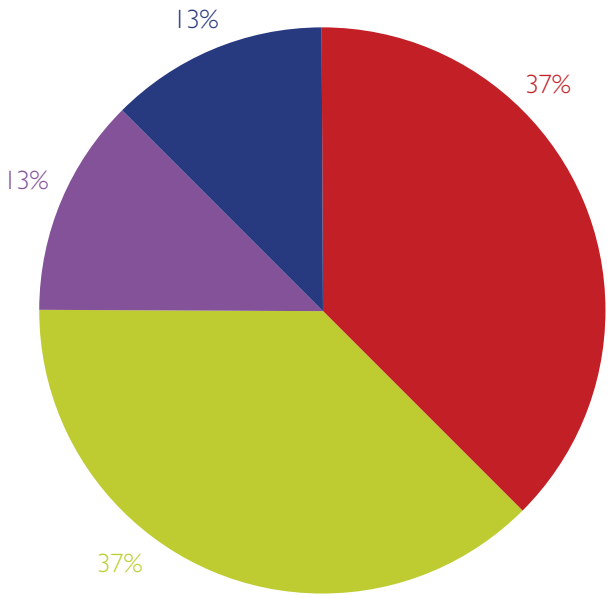

Chart 6 – Low-rise prison and security-related building projects

- On or before completion date
- 0 -3 months late
- 3 -6 months late
- More than 6 months late

Chart 6 indicates that amongst the worst performers were prisons and security buildings, stadia and sports-related buildings. Less than half of the security and sports buildings were completed on time, and 13% were more than six months late in being completed.

Success of high-rise building projects

Railway stations

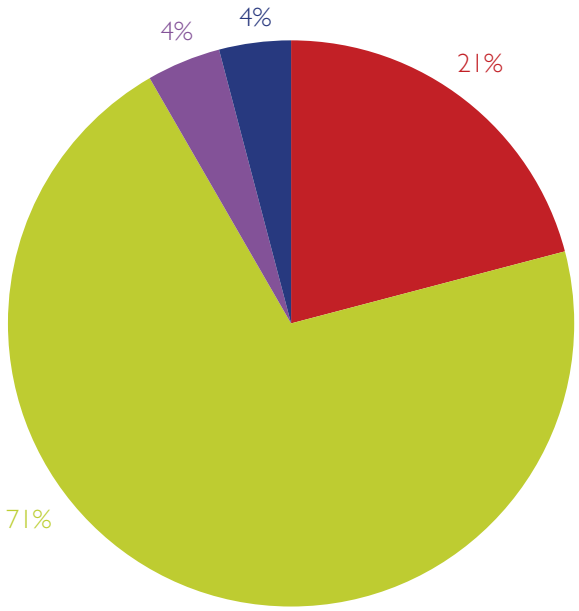

Chart 7 – Low-rise railway station building projects

- On or before completion date
- 0 -3 months late
- 3 -6 months late
- More than 6 months late

Performance of high-rise buildings

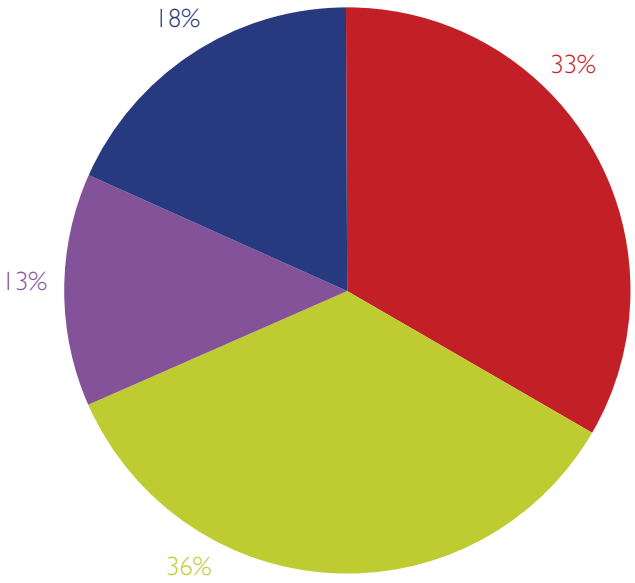

Chart 8 – High-rise building projects as a whole

- Completed on time or early
- 0 -3 months late
- 3 -6 months late
- More than 6 months late

Where high rise buildings were concerned, the performance of the smaller sample of 60 projects included within the survey was not good in general. Only a third were completed on or before the completion date, 13% were completed between three and six months late while 18% were completed more than six months after their completion date. High-rise building projects necessarily have more complex services, security, vertical circulation systems and construction logistics than low-rise buildings. This thus requires a high standard of pre-planning and project control if success is to be achieved.

Success of engineering projects

When taken in the round, engineering projects tended to fare less well than the building projects in general. Out of the 122 engineering projects reported on, 58% were completed on or before the completion date but 18% were more than six months late in completion.

Again, the best performers in this category were those projects that tended to be simpler and/or repetitive, including those for roads, and water storage and treatment plants.

Amongst this group the average performance was 77% being completed on or before the completion date with a further 18% being completed within the following three months. Only 5% of projects within this group were more than three months late in completion.

Performance of engineering projects

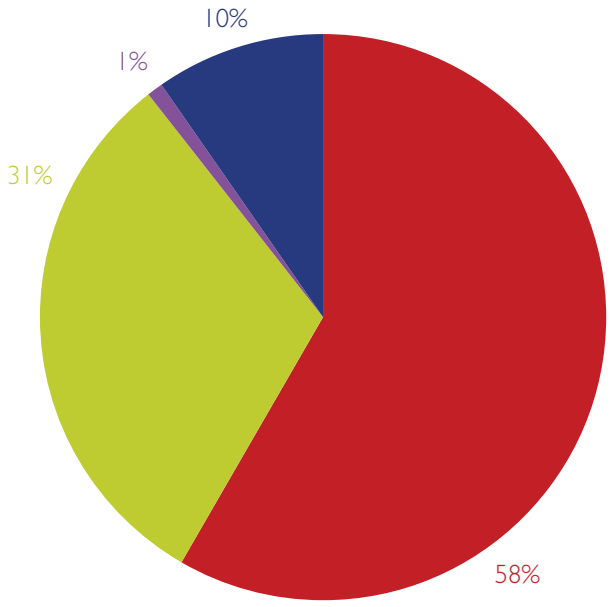

Chart 9 – Engineering projects as a whole

- Completed on or before completion date
- Completed within 3 months of the completion date
- Completed 3 - 6 months late
- Completed more than 6 months late

Performance of oil and gas projects

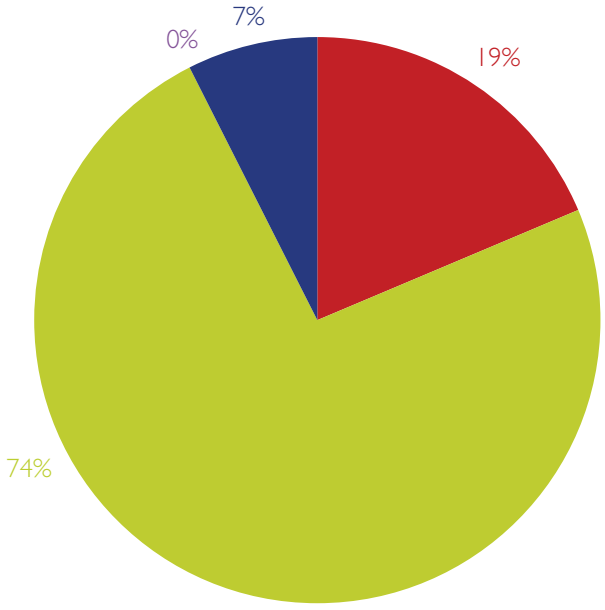

Chart 10 – Oil and gas projects

- Completed on or before completion date
- Completed within 3 months of the completion date
- Completed 3 - 6 months late
- Completed more than 6 months late

Chart 10 illustrates that the worst performers in this category included oil and gas projects in which only 19% were completed on or before the completion date, and 74% were up to three months late in completion.

Performance of power generation projects

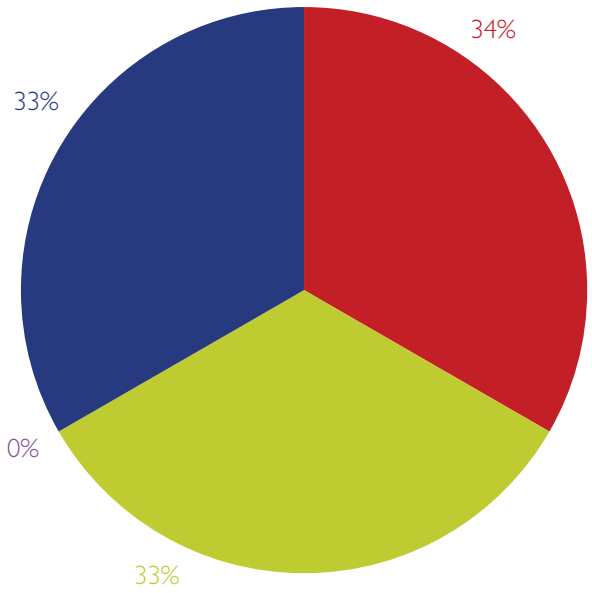

Chart 11 – Power-generation projects

- Completed on or before completion date
- Completed within 3 months of the completion date
- Completed 3 - 6 months late
- Completed more than 6 months late

Projects in the field of power generation also performed poorly with only a third of such projects completing on or before the completion date. A third were completed up to three months late, and a further third were completed more than six months late.

The worst performer of all in this category was airports; although only a small sample of two airport projects were included in the survey, both were completed more than six months late.

Liability for delay to completion of building projects

Percentage of building projects in which it is perceived that the contractor was entitled to an extention of time for completion

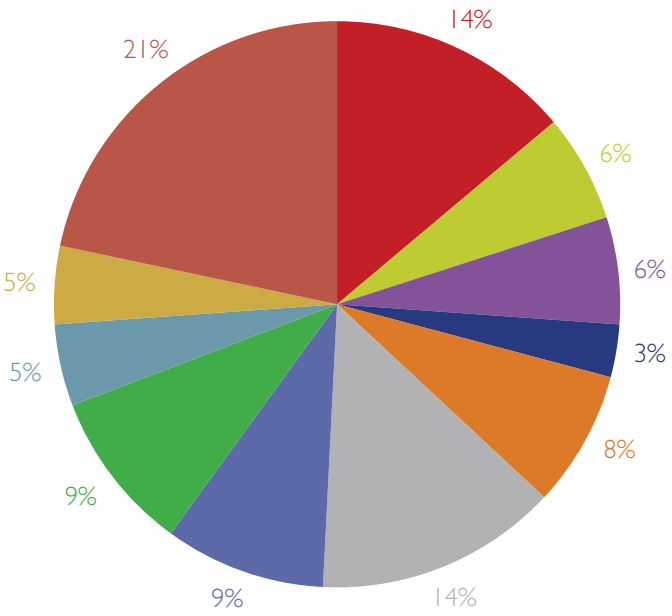

Chart 12 – Extension of time (EOT) for delayed building projects

- No EOT
- EOT of 10% of delay
- EOT of 20% of delay
- EOT of 30% of delay
- EOT of 40% of delay
- EOT of 50% of delay
- EOT of 60% of delay
- EOT of 70% of delay
- EOT of 80% of delay
- EOT of 90% of delay
- EOT for all of delay

Respondents were asked to consider a delayed project they had worked on or knew of, and to indicate, on a scale of 0-10, their perceived responsibility for delayed completion by reference to the extension of time that had been awarded.

Chart 12 indicates that with regard to low-rise building projects, the respondents' experience was that in 22% of cases the cause of delayed completion was entirely the employer's liability with the contractor being contractually entitled to relief from liquidated damages. In 14% of cases, the respondents perceived that the delay to completion to be entirely the contractor's responsibility. Delay to completion was the equal responsibility of both parties in 14% of low-rise building projects and in 37% of all low-rise the contractor was predominantly to blame for the delay to completion.

On the other hand, in regard to high rise building projects, in only 13% of cases was the cause of delayed completion perceived to be entirely the employer's liability with the contractor being contractually entitled to relief from liquidated damages. In 7% of cases, the respondents perceived that the delay to completion to be entirely the contractor's responsibility. Delay to completion was the equal responsibility of both parties in 19% of high-rise building projects and in 41% of all high-rise projects the contractor was perceived to be predominantly to blame for the delay to completion.

Liability for time-related costs for building projects

So far as concerns of compensation for the loss and expense resulting from delayed projects, it was the respondents' experience that in 29% of low-rise projects, but only 15% of high rise projects, the cause of the delayed completion was either not within the employer's control (bad weather, strikes, force majeure, etc.) or was entirely within the contractor's control and was hence, not subject to compensation under the contract.

Percentage of building projects in which it is perceived that the contractor was compensated for its prolongation costs

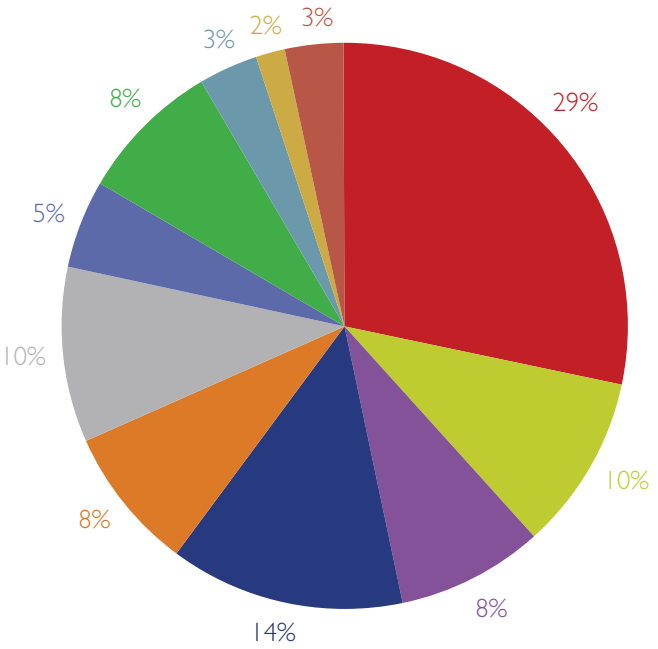

Chart 13 – Compensation for delay-related costs in building projects

- No compensation
- Compensation of 10% of delay
- Compensation of 20% of delay
- Compensation of 30% of delay
- Compensation of 40% of delay
- Compensation of 50% of delay
- Compensation of 60% of delay
- Compensation of 70% of delay
- Compensation of 80% of delay
- Compensation of 90% of delay
- Compensation for all of delay

Chart 13 indicates that in only 3% of all delayed low-rise projects was the delay perceived to have been caused by matters entirely within the control of the employer or its design team, thus entitling the contractor to be fully compensated.

In 10% of cases it was thought that the liability for the costs of the delayed completion was borne equally between the contractor and the employer. Of the remaining 66%, the respondents perceived the costs of delayed completion to be predominantly at the risk of the contractor.

However, in regard to high rise projects, in 38% of cases the delay was perceived to have been caused by matters entirely within the control of the employer or its design team, thus entitling the contractor to be fully compensated.

In 4% it was thought that the liability for the costs of the delayed completion was borne equally between the contractor and the employer. Of the remaining 60% of high rise building projects, the respondents perceived the costs of delayed completion to be predominantly at the risk of the contractor.

Liability for delay to completion of engineering projects

Percentage of engineering projects in which it is perceived that the contactor was entitled to an extension of time for completion

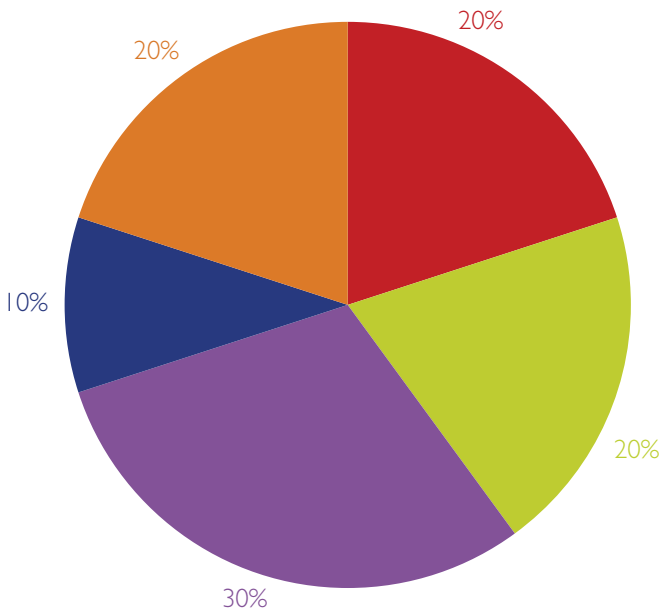

Chart 14 – Extension of time for delayed engineering projects

- No EOT
- EOT of 20% of delay
- EOT of 30% of delay
- EOT of 40% of delay
- EOT for all of delay

Perhaps because of the lower number of reported projects, the response was less graduated in engineering projects than for building projects. In 20% of all engineering projects, the delay to completion was perceived to be entirely the liability of the employer, while in 20% it was perceived to be entirely that of the contractor. In 80% of the projects the responsibility for delayed completion was perceived to be primarily that of the contractor.

Liability for time-related costs of engineering projects

Percentage of engineering projects in which it is perceived that the contractor was compensated for its prolongation costs

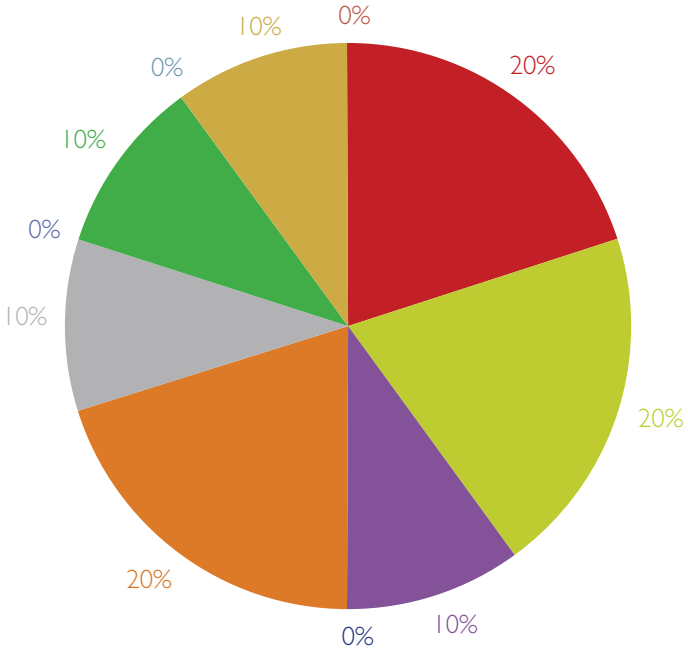

Chart 15 – Compensation for delay-related costs in engineering projects

- No compensation
- Compensation of 10% of delay
- Compensation of 20% of delay
- Compensation of 30% of delay
- Compensation of 40% of delay
- Compensation of 50% of delay
- Compensation of 60% of delay
- Compensation of 70% of delay
- Compensation of 80% of delay
- Compensation of 90% of delay
- Compensation for all of delay

Chart 15 illustrates that where compensation for delay-related costs is concerned, in only 10% of projects was the compensable delay perceived to have been entirely caused by the employer or its design team, thus entitling the contractor to be fully compensated. In 20% of cases, the costs of the delay were perceived to be entirely the contractor's liability. In 20% of engineering projects the cost of delay was thought to have been borne equally between the employer and the contractor, and in 50% of all projects, the costs were thought to be predominantly the liability of the contractor.

3. How respondents are managing a current project

Respondents were asked to consider a current project with which they are involved, and to indicate how time on the project was being managed. This section of the survey was answered by 68 of the 73 respondents.

Procurement Methods

Method of procurement

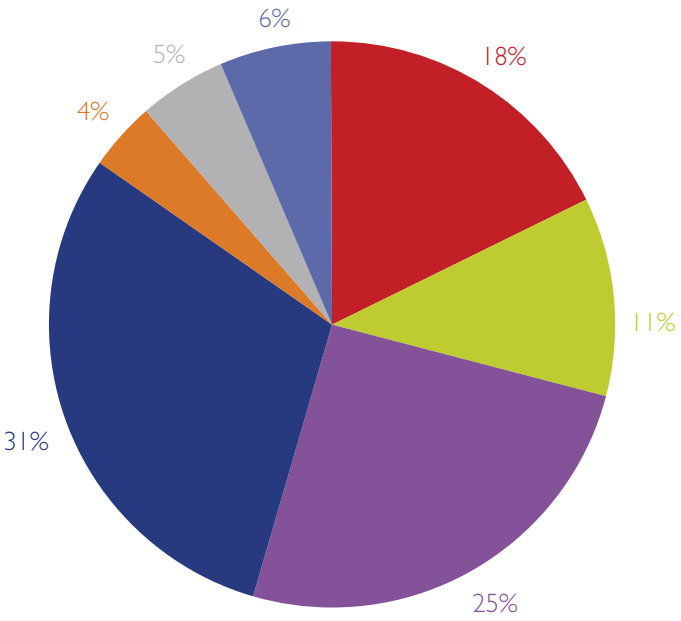

Chart 16 – Method of contract procurement

- Bespoke contract
- Partnering
- Lump sum
- Design and build
- Target cost
- Re-measure
- Construction management

In light of the prolific standard forms of contract published by the various bodies concerned with the building and engineering industries, the analysis of responses shows that a surprisingly large proportion, 18%, of all projects are currently being constructed under a bespoke contract specially prepared by the employer. 25% are being constructed under what used to be known as a traditional form of contracting; the standard lump-sum contract. Partnering contracts account for only 11% of projects underway while 31% are being constructed using standard design and build contracts.

Time management methods

The way time is currently managed on site

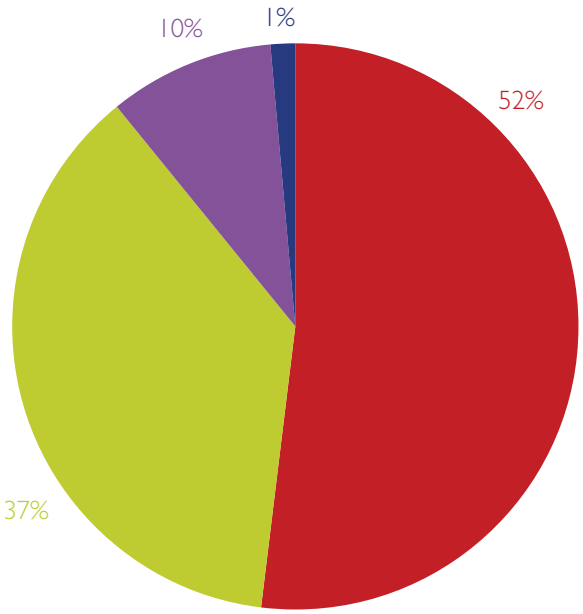

Chart 17 – Method of time management

- Professional services
- Project management
- General contracting
- Specialist trade contractor
- Other

Chart 17 indicates that in the experience of just over 50% of respondents answering this question a master time-management

Principal tools for time management

The principal method of time management

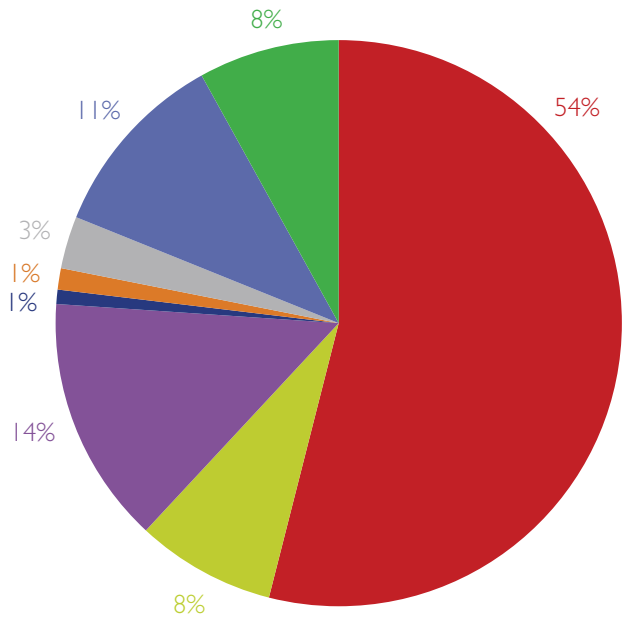

Chart 18 – Type of tool used for time management

- A bar-chart
- Partially linked network
- Fully linked network
- Time chainage diagram
- Line of balance diagram
- Flow chart
- Minutes of meetings
- Correspondence

Chart 18 shows that only 14% of respondents answering this question had experience of a fully-linked critical path network being used to manage the sequence and timing of the work. (By comparison, similar research carried out in Australia found that in over 1000 construction schedules examined, less than 10% had adequate logic.)

54% of respondents were familiar with the use of a simple bar chart as a time-management tool. However, bar-charts can only show the dates upon which activities were initially planned to start or finish, and do not identify the sequence of tasks or their priority. 8% of respondents were familiar with a partially linked network being used for time-management tasks, to show some of the priorities and sequence of tasks, but without the benefit of a dynamic network. 4% were familiar with either a flow chart or a time-chainage diagram being used to predict the sequence. 20% were familiar with using other methods of communicating their intended progress, without reference to a schedule of any sort.

Therefore, it can be deduced from this that 86% of all respondents answering this part of the survey did not have the facilities to, and were thus unable to, identify promptly the likely effect upon the completion date of slippage or imposed changes in the works. Thus these respondents are unable to manage the effects of delay to progress, other than intuitively.

4. The Master Schedule

Planning the sequence of the works

How the planned sequence of work is established

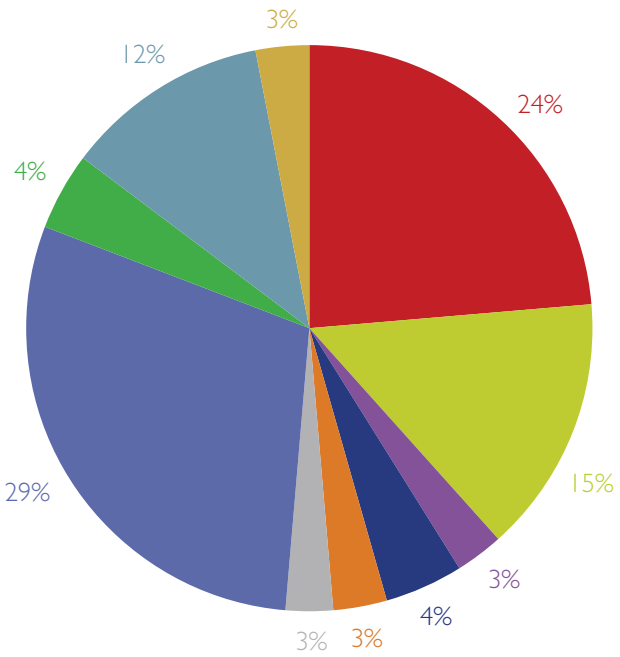

Chart 19 – establishment of the planned sequence of work

- By writing out a method statement only
- By discussion in meetings only
- By a discussion and written statement, with the programmer
- By a discussion and written method statement
- By a discussion with the programmer
- By the programmer by reference to other jobs coupled with a method statement
- By the programmer alone
- By the programmer with reference to other jobs
- By reference to other jobs only

Chart 19 indicates that only 3% of respondents answering this question had experience where the intended process was formulated by discussions between the interested parties and the project scheduler, coupled with the creation of a formal written method statement. In the experience of the remaining respondents the planned sequence is determined in a less precise or manageable way, which tends to reduce the construction management team's commitment to carrying out the work in accordance with the schedule.

In the experience of 29% of all respondents answering this question, the planned sequence of work was left entirely to the project scheduler to determine, in isolation from everyone else. This may account for the anecdotal evidence that the feeling amongst many project planners and schedulers is that they are not a part of the management process, and their work product is only used to decorate walls, at best.

16% of respondents reported that other jobs were used as a baseline for the planned sequence of work, while 12% reported that other jobs were used entirely in determining the planned sequence of work without reference to any specific details of that particular contract. In all probability, the resultant project schedule would thus be less likely to reflect the needs of the contract and would thus reduce its effectiveness in time-management.

24% of those answering this part of the questionnaire said that in their experience the sequence was planned as a result of a written method statement alone.

Participation in producing a method statement

Of those responding to this question, just under half had experience of the site manager and the contract manager being involved in the drafting of a method statement.

In the experience of 44% the project manager was also involved, participating equally. Only 16% of respondents had experience of the project scheduler being involved. These results are shown in Chart 20.

Parties usually involved in drafting method statements to arrive at planned sequence

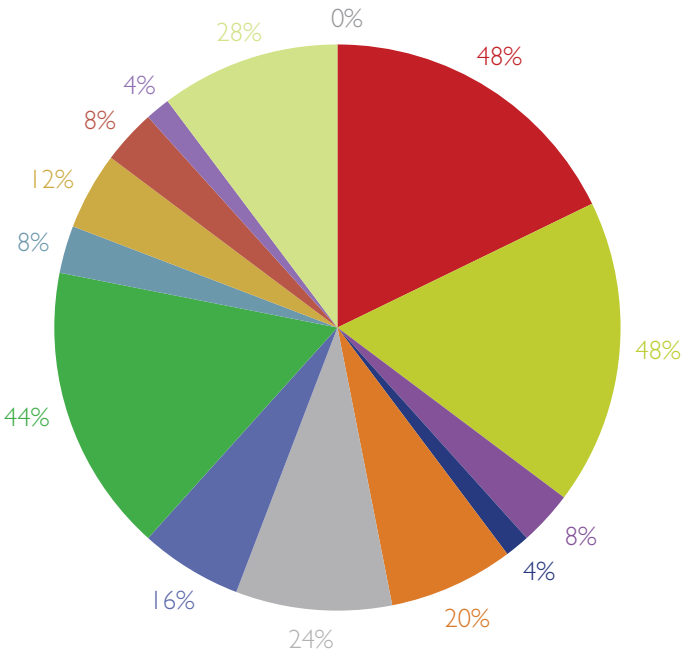

Chart 20 – Parties usually involved in drafting a planning method statement

- Contract manager
- Site manager
- Foreman
- Tradesman
- Sub-contractors
- Quantity surveyor
- Programmer
- Project manager
- Architect
- Structural engineer
- Mechanical engineer
- Client
- Relevant specialist/subcontractor/supplier
- Electrical engineer

In the experience of those responding, relevant subcontractors and specialist contractors and suppliers were likely to be consulted in the production of a method statement in 28% and 20% of occasions respectively.

The research indicates that in around 10% of projects some of the designers (the architect, structural engineer and the mechanical engineer) were likely to be consulted about the drafting of a method statement. However, in the experience of all respondents the electrical engineer was not consulted. However, 24% of those responding felt the quantity surveyor was likely to be consulted.

Parties usually involved in meetings to arrive at planned sequence

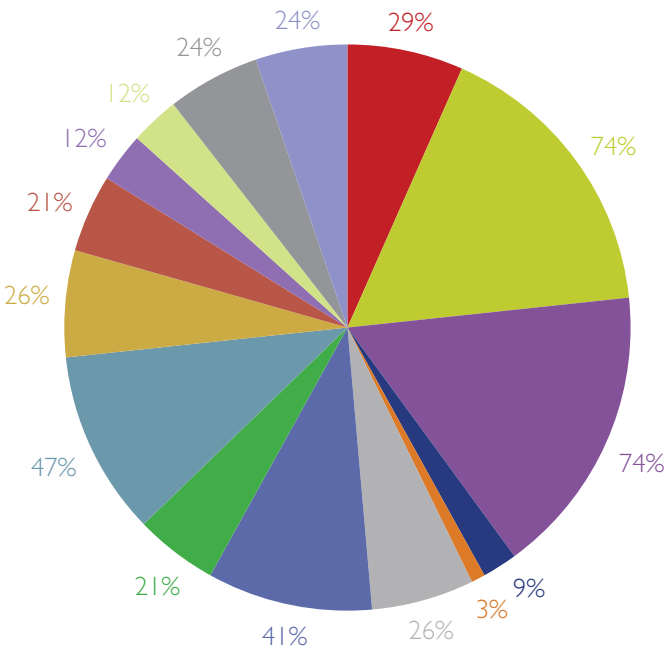

Chart 21 – Parties usually involved in project planning meetings

- Commercial director
- Contract manager
- Site manager
- Foreman
- Tradesman
- Sub-contractors
- Quantity surveyor
- Programmer
- Project manager
- Architect
- Structural engineer
- Mechanical engineer
- Electrical engineer
- Client
- Relevant specialist subcontractor supplier

Chart 21 shows the parties who are typically involved in meetings for determining a planned work sequence.

Overall, respondents indicated that in their experience more parties were involved in the meetings to determine a planned work sequence than were involved in drafting the method statement. The percentage of respondents answering this question who had experience of the site manager and contract manager being involved in such meetings was double the number who indicated that such managers were involved in formulating the method statement. Similarly, those reporting that the project manager was involved rose to 47%. While only 8% of respondents said the architect was involved in creating the method statement, this figure also rose, to 26%, who said the architect was involved in the meetings. Similarly, while no respondent reported the electrical engineer being consulted in drafting the method statement 12% were familiar with the electrical engineer being involved in meetings. While only 16% of respondents indicated that in their experience the project scheduler was involved in drafting the method statement, this figure also rose, to 21%, who said the project scheduler was prepared to consult in meetings.

The low number of the respondents to this question who reported experience of anyone other than the contractor's high-level management team being consulted in the drafting of the method statement and in taking part in meetings to determine the planned sequence is a matter for concern. It is self-evident that the designers and other designing specialist contractors are likely to have a far greater understanding of the engineering logic of the needs of the project than those more usually consulted.

It is also odd that a surprisingly low number of respondents to this part of the survey had experience of the project scheduler or the tradesmen, subcontractors and specialist contractors being consulted on such a vital issue. This may reflect the anecdotal preference of some contractors for 'working things out for themselves' as the project goes along irrespective of what is shown on the construction schedule.

Participants using project schedules

Of all the respondents to this part of the survey, 89% indicated that they do use project schedules, but 11% said they had no occasion to read, write or consider using a construction schedule. If this is representative of the industry as a whole, it shows that a facility to create construction schedules is likely to be necessary to a large number of people of varying disciplines.

Surprisingly, of those that indicated that they had no need to use construction schedules, four respondents indicated that their primary occupation was construction management, three were engaged in architecture and building surveying, while one was in commercial management.

Software used to prepare the construction schedule

Software identified

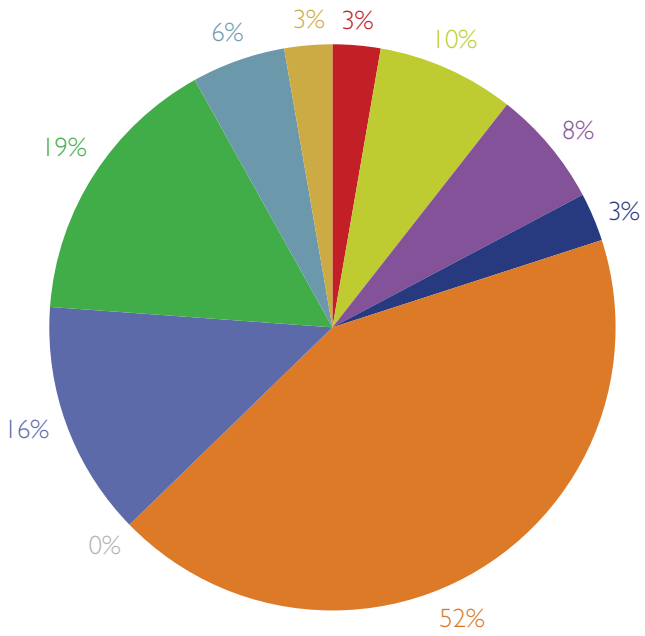

Chart 22 – Software used to prepare the construction schedule

- Primavera P3e
- Primavera P3
- Primavera SureTrak
- Pertmaster
- MSProject
- CA Superproject
- Project Commander
- PowerProject
- Teamplan
- CS Project Professional

While it might be thought that the question of which software is used to prepare the construction schedule would show respondents use a single type of software, 22% of respondents actually said they had experience of two or more types of software being used. Thus, the results of this question may not be as clear cut as they might have been.

From Chart 22, it can be seen that the most popular planning software identified by those responding to the survey was Microsoft's MSProject, with 52% of the respondents indicating that they been involved in projects where that schedule was used. Each of the more sophisticated planning tools, such as Pertmaster, Primavera P3, P3e and Primavera SureTrak, were used by less than 10% of respondents each. 19% of respondents identified PowerProject as being used, while 16% used Project Commander. A surprisingly large proportion of the respondents, 10% reported that these schedules are produced by drawing on spreadsheets, rather than by project planning software.

Development of the schedule content

The method of establishing the planned activity durations

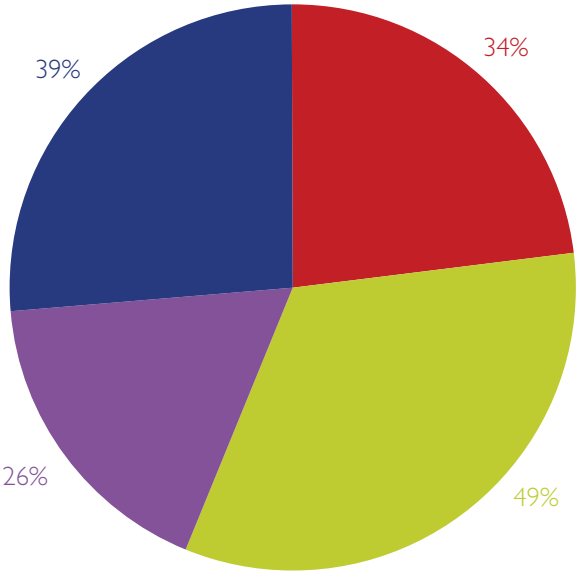

Chart 23 – Identifying the planned activity durations in construction schedules

- Calculated by reference to resources and productivity in whole or in part
- Estimated by judgment of the time reasonably necessary
- Estimated by the time reasonably necessary plus a contingency
- Estimated by reference to historical records of similar projects

34% of respondents answering this question had experience of a combination of two or more methods being used to identify the duration of a planned activity. As illustrated by Chart 23 34% of the respondents had experience of the activity durations being calculated, in whole or in part, as a product of the resources to be applied, and their anticipated productivity for the quantity of work planned. In the experience of 49% the duration was estimated by experience, while 26% added an activity duration contingency. 39% of respondents reported that historical data was used as the basis of their estimates.

The application of costs to planned activities

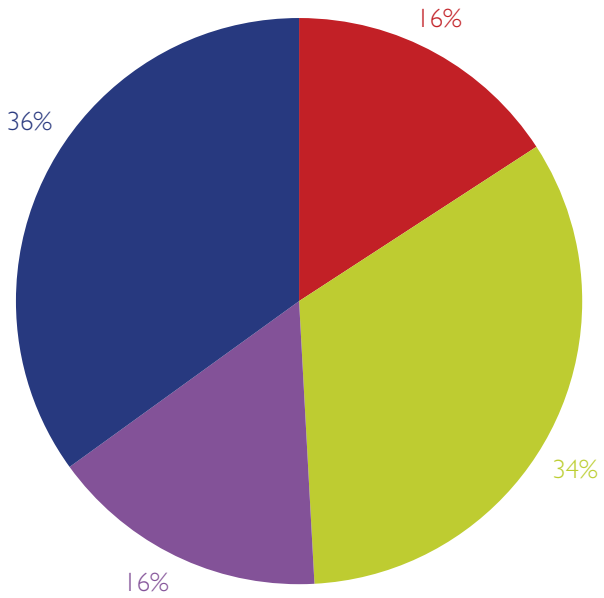

Chart 24 – The application of costs to planned activities

- The costs are allocated to the activities in whole or in part in the schedule plus a contingency
- By reference to a separate document cross referenced to the schedule
- By reference to another document not related to the schedule
- Values of activities is not generally identified

Chart 24 illustrates that 36% of all respondents answering this question had no experience of the activities in the schedule being priced. In the experience of 34% of respondents, the activities were priced in a separate document, cross referenced to the schedule, while 16% indicated that the activities were priced in a separate document that was not related to the schedule. Only 16% of respondents indicated that in their experience, the activities were priced in the construction schedule itself.

From Chart 25 it can be seen that when asked how they identified the logic in the construction schedule itself, 8% of respondents answering this question said that they had not experienced any construction logic being shown on the schedule. However, this response must be read in conjunction with answers to the question on the principal tool used for time management (Chart 18), which indicated that only 22% of respondents were familiar with a schedule being used that had any logic in it at all. It can thus be concluded that of those who had experience of logic-linked schedules, one-third were also aware of instances where access to that logic was not given to others.

In so far as logic was required, in the experience of 32% of respondents, this was left to the project scheduler writing the construction schedule, while 28% indicated that the logic of previous projects of a similar type were used as a baseline. 24% of respondents reported that in their experience a variety of methods were used for developing the schedule's construction logic, rather than a single method alone.

The application of logic to the planned activities

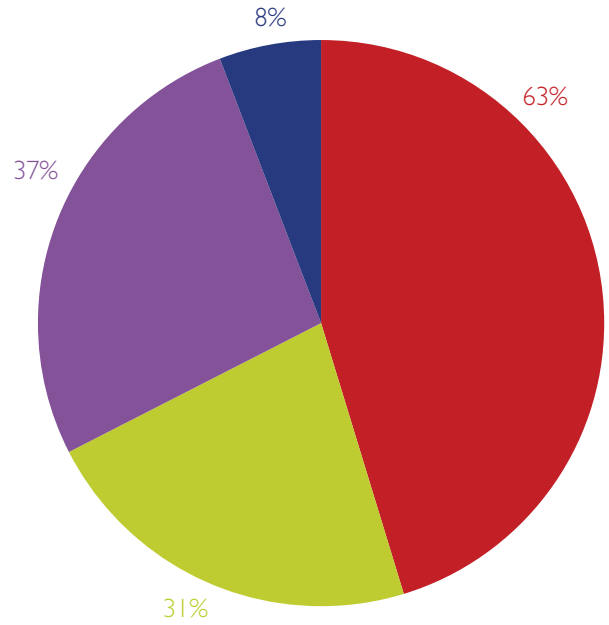

Chart 25 – The application of logic to planned activities

- By meetings with the construction manager and other interested parties
- By reference to previous projects of a similar type
- By the planning engineer of project scheduler writing the programme
- Logic is not indicated on the schedule

Date constraints are used to override the logic of a schedule (if any) and to force an activity to start by, on or after a specified date. Chart 26 indicates that no respondents answering this question knew of date constraints being forbidden as a matter of company policy. 11% had found them used in a combination of two or more ways; 21% found that date constraints were used to control criticality. To render the appearance of criticality where the logic alone did not, 68% said that they had experienced date constraints being used to constrain the performance to dates given in the contract documents. The effect of using date constraints to constrain the performance dates would be to hold those milestones to the stated dates on the schedule, irrespective of whether the activity durations, coupled with the logic of the schedule (if any) would predict that the dates could be met.

In the experience of 18% of respondents it was left entirely to the project scheduler as to whether and, if so, how date constraints were used.

The use of date constraints

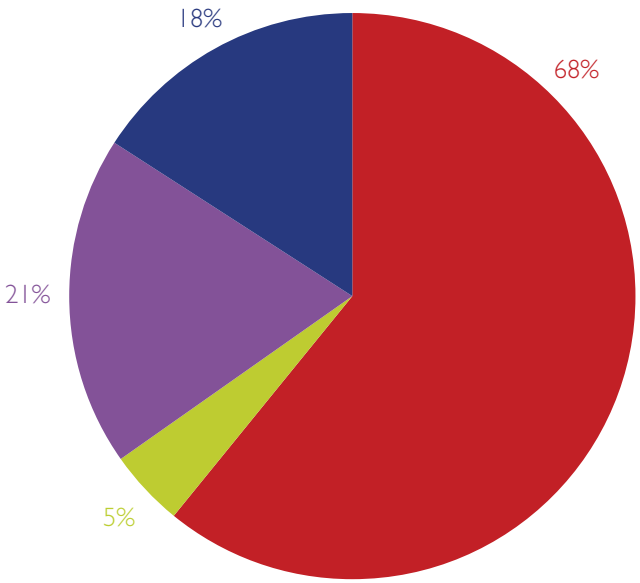

Chart 26 – The use of date constraints in the construction schedule

- By reference to the contract documents
- Where the logic cannot be determined
- To control critically
- As the project scheduler writing the schedule chooses

Float constraints are used to override the logic of a schedule (if any) and to force the removal of free or total float from a path where the logic of the schedule would dictate otherwise. Whilst Chart 26 shows that none of the respondents knew of any company policy forbidding the use of date constraints, Chart 27 identifies that 8% were aware of the use of float constraints being forbidden. 34% said that in their experience it was left to the project scheduler to determine how float constraints were used. 40% of respondents said that in their experience these constraints were used to control criticality; in other words to change what would otherwise logically be a non-critical path into what would be illustrated as a critical path. Only 18% were familiar with float constraints being used to identify dependent predecessors, such as identifying the supply of information as having zero free float in relation to the activity for which the information was required. 8% of respondents answering this question admitted that they did not understand the question of how float constraints were used.

The use of float constraints

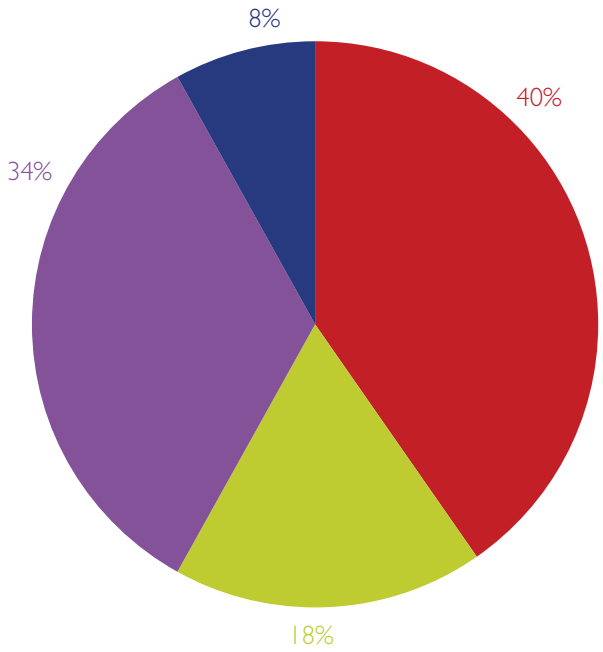

Chart 27 – The use of float constraints

- To identify critically
- To identify dependent predecessors
- As the scheduler writing the project schedule chooses
- The company does not permit the use of float constraints

Quality control of the construction schedule

Quality control of construction schedules

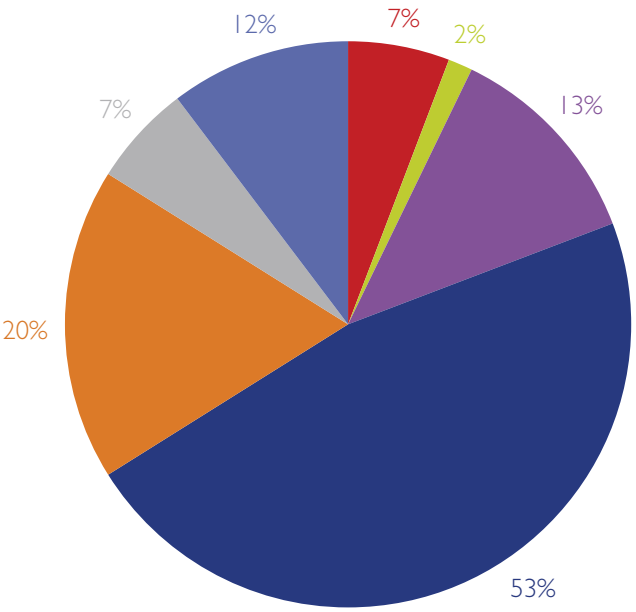

Chart 28 – The quality control of construction schedules

- By review against an ISO9001 certified process
- By independent, third-party review
- By internal review by someone not associated with the project
- By internal review by someone associated with the project
- By submittal process under the contract
- However the scheduler writing the project schedule chooses
- None

When asked how the quality of the construction schedule was maintained, it can be seen from the responses that 13% of the respondents were aware of a combination of two or more methods of quality assurance being used. 19% of respondents said that in their experience it was either left to the author to check the schedule, or there was no checking process at all. 53% had experience of the construction schedule being checked in an internal review by someone associated with the project, while 13% stated it was checked internally by someone not associated with the project.

In the experience of 20% of respondents to this question, the construction schedule was expected to be checked as a result of the submittal process under the contract. Thus, unless the architect, engineer or project manager to whom it was submitted was able to check it effectively, it was introduced without any quality assurance at all.

Only 2% of respondents had experience of the project schedule being checked for quality by an independent third party and only 7% had experience of their project schedules being reviewed against an ISO 9001 certified process.

5. Short-term schedules

Participants working with short-term schedules

11% of those answering the survey did not respond to this question. However, three-quarters of all the respondents who did answer this question, declared that they did work with short-term schedules, that is, schedules for a brief part of the contract period instead of the totality.

Production of short-term schedules

Of those respondents who were familiar with the use of short-term schedules, 82% were experienced in working in the same software as the master schedule for the works. In the experience of 9%, no software at all was being used to create short-term schedules; instead these were created informally, or were hand-written. 7% were familiar with the use of a different type of software being used from that in which the master schedule had been created.

Development of the short-term schedule content

How durations are determined in short-term schedules

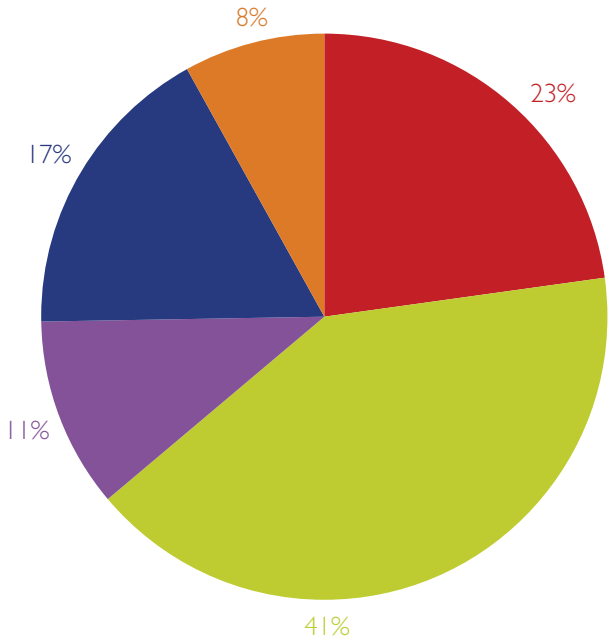

Chart 29 – Identifying the planned activity durations in short-term schedules

- Calculated by reference to resources and productivity in whole or in part
- Estimated by judgement of the time reasonably necessary
- Estimated by the time reasonably necessary plus a contingency
- By reference to the master construction scheduler
- By reference to historical records of similar projects

As for the creation of master schedules, around 30% of respondents who were familiar with the use of short-term schedules were used to a combination of two or more methods being used to identify activity duration. However, while 34% of respondents were familiar with calculating in whole or in part, the activity durations in master planning as a product of the resources to be applied and their anticipated productivity for the quantity of work planned, surprisingly this percentage fell to 23% for short-term planning. One would have expected the opposite as it is significantly easier to estimate durations by reference to resources in short-term planning because of the availability of detailed short-term information. The percentages for those familiar with estimating the duration by experience remained virtually the same between master and short-term planning, while that for those who added an activity duration contingency fell by half. Only 8% of respondents answering this part of the survey were familiar with historical data being used as the basis of estimates at this stage, compared to 39% who were aware of such data being used at the master planning stage.

How the cost of activities is identified in short-term schedules

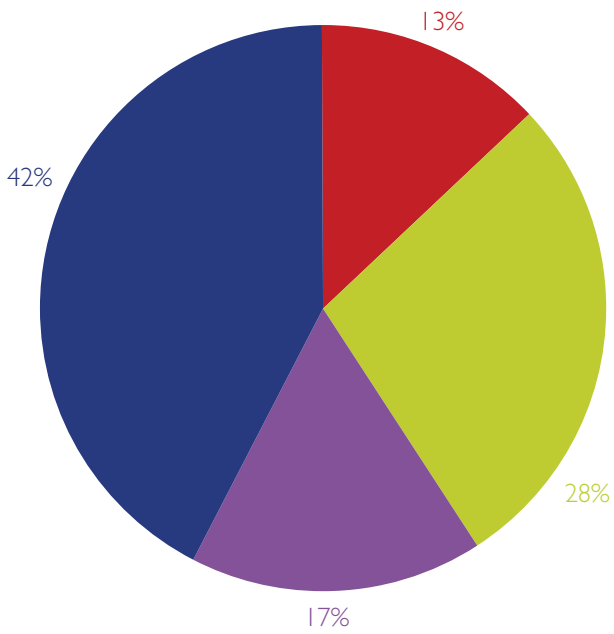

Chart 30 – The identification of activity cost in short-term schedules

- The costs allocated to the activities in whole or in part in the schedule
- By reference to a separate document cross referenced to the schedule
- By reference to another document not related to the schedule
- Value is not indicated on short term schedules

Of those responding to the question of how the value of activities in a short-term schedule was identified, Chart 30 shows that only 13% were familiar with the cost of the activity being identified on the short-term schedule. 42% had experience of details of the costs of the activities being kept on a separate schedule and 17% had experience of the costs of activities not being identified at all. This tends to illustrate that a contractor is likely to have sufficient contemporary management information available in only a very small minority of cases, for identifying which activities are suffering a loss of productivity and disruption costs.

How the logic of short-term schedules is established

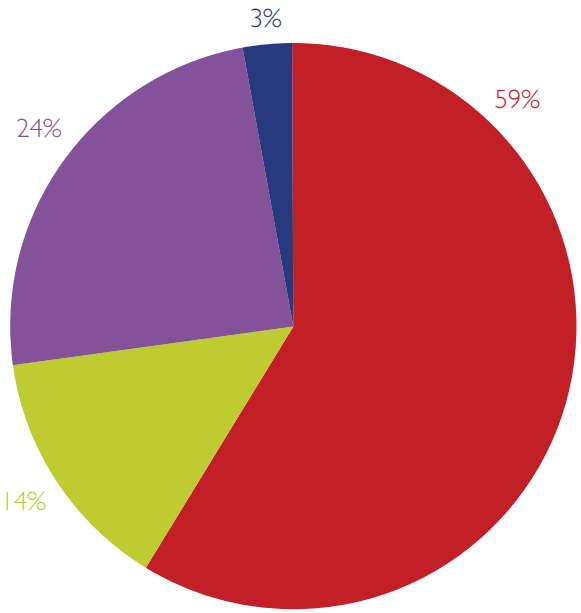

Chart 31 – The identification of construction logic in short-term schedules

- By meetings with the construction manager and other interested parties
- By reference to previous projects of a similar type
- By the planning engineer or project scheduler writing the programme
- Logic is not indicated on short-term schedules

Only 78% of respondents answering this part of the survey responded to the question of how the logic of the short-term schedule was developed. Chart 30 shows that of those who did respond, 3% said that they were not familiar with any logic being identified on short-term schedules. 14% of respondents said that historical data from other projects was used in developing this logic, while in the experience of 24% it was left to the project scheduler to work out. However, the most popular method of calculating this logic, as experienced by 59% of those answering the question, was by meetings with the construction manager and other interested parties.

How the short-term schedule is related to the master schedule

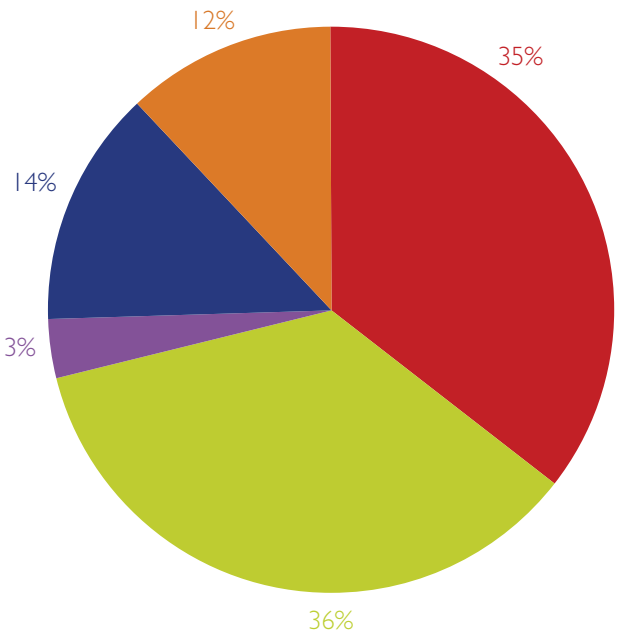

Chart 32 – The integration of short-term schedules into master schedules

- It is incorporated in it as a sub set of the baseline schedule
- It is created in the same software as a subproject but not integrated
- It is created in separate software but using related activity IDs
- As the scheduler writing the schedule chooses
- It is not related to the baseline schedule

The question regarding the manner in which the short term schedule related to the construction master schedule, if at all, was answered by 75% of the respondents. Chart 32 illustrates that, of the remainder who did answer this question, only 35% had experience of the integration of the short-term schedule as a subset of the master schedule, which is essential if its effect is to be calculated upon the schedule as a whole. 36% had experience of the short-term schedule being created in the same software as the master schedule, but not integrated with it, while 12% of those responding were unfamiliar with the two being related at all.

This tends to demonstrate that in the majority of cases reported upon, contractors are unaware of the effect their short-term schedules are likely to have on the remainder of the project. They are thus unlikely to know whether these schedules will affect the critical path of the project, and hence the completion date.

Quality control of short-term schedules

The question asking how short-term schedules were quality-assured was answered by 79% of the respondents dealing with this part of the questionnaire. Of those that did answer it, 2% did not appear to understand the question; 16% had no experience of any quality control at all, and 3% had experience of it being left to the project scheduler writing the schedule to deal with. Only 5% were familiar with an ISO 9001 quality review process being used. A further 7% had experience of an internal review being undertaken by someone not associated with the project, while 56% were familiar with an internal review by those associated with the project being adopted. In the experience of 11%, the contract submittal process was relied upon for quality control.

This tends to demonstrate that in about a quarter of all short-term schedules reported upon, there is either no quality control at all or no effective control. Inn only a very small minority is there a structured formal review process.

How the quality of short-term programmes is quality controlled

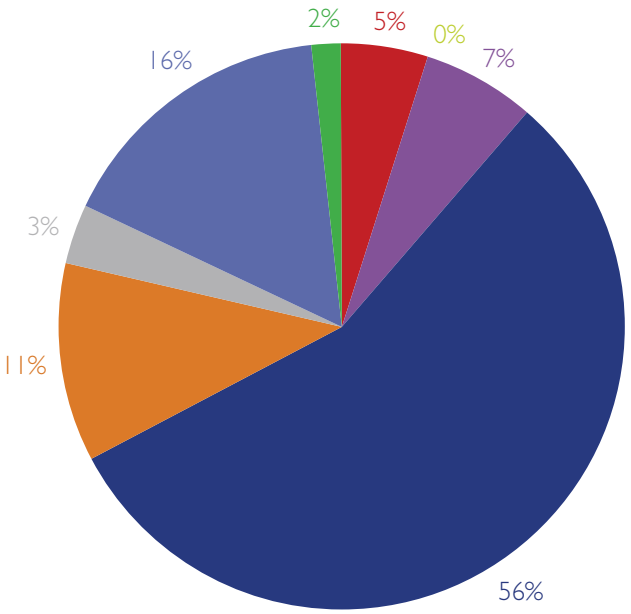

Chart 33 – The quality assurance of short-term schedules

- By review against an ISO9001 certified process
- By independent third party review
- By internal review by someone not associated with the project
- By internal review by someone associated with the project
- By submittal process under the contract
- However the programmer writing the programme chooses
- None
- Don't understand the question

6. Progress records

Recording the progress of the works

93% of all respondents answering this part of the survey said they had occasion to write, read or consider records of progress achieved. This tends to illustrate that the vast majority of respondents were concerned with the progress of the works (or lack of it) at some stage of a project.

How progress records are kept

Only 7% of those familiar with record keeping had experience of them being kept by automated or manual input into a relational database, which would produce virtually instantaneous reports of trends and effects of progress and productivity. 40% had experience of the records being kept on a spreadsheet, either by direct entry or by transcription from paper records. Such records would require some analysis in order to be able to detect trends and the effects of progress achieved. However, in the experience of an alarming 53% of the respondents to this question, records were kept only on paper, rendering them virtually useless for promptly detecting trends, managing the effects of lack of progress and identifying the factual data relative to loss-causing events.

How progress records are kept

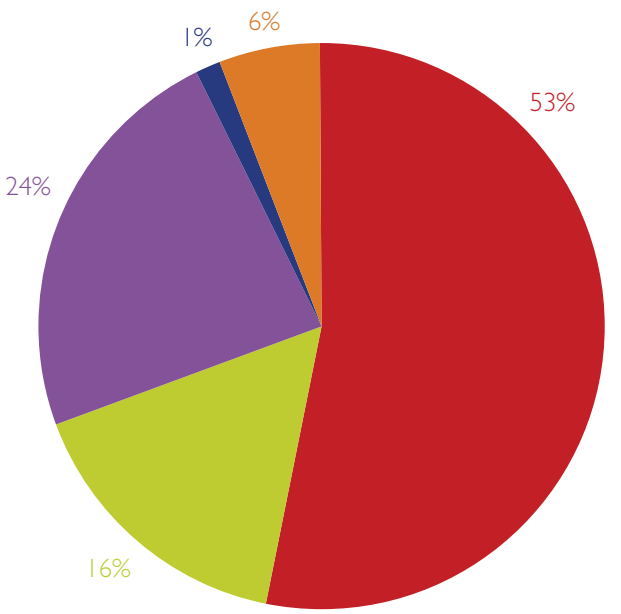

Chart 34 – Types of progress records kept

- On paper only
- On paper but immediately transcribed into a database
- By direct entry on an Excel spreadsheet
- By direct entry onto an access or other relational database
- By automated electronic transfer to a database

Types of labour record data kept

In this part of the survey, respondents were invited to indicate their experience of which of various data types were maintained in progress records. The percentages expressed are thus those of the respondents dealing with this part of the questionnaire in relation to each data-type.

Only 79% of respondents to this question reported that the relevant date for labour records was recorded while 74% found that the day of the week to be recorded. 61% found that the name of the labour resource was recorded, although 85% found that the relative trade was recorded. Less than half of those responding reported that the rank of the resource was reported.

Labour records - basic data

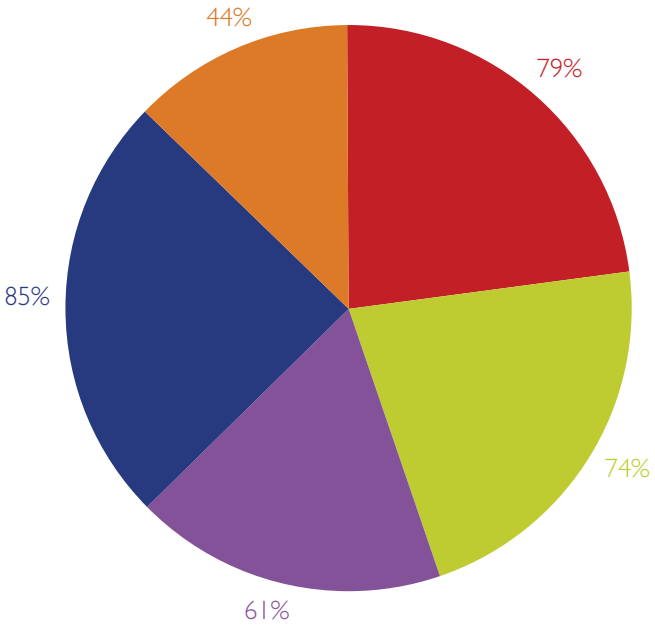

Chart 35 – Labour resource records - basic data

- Date
- Day of week
- Name
- Trade
- Rank

Labour records - work data

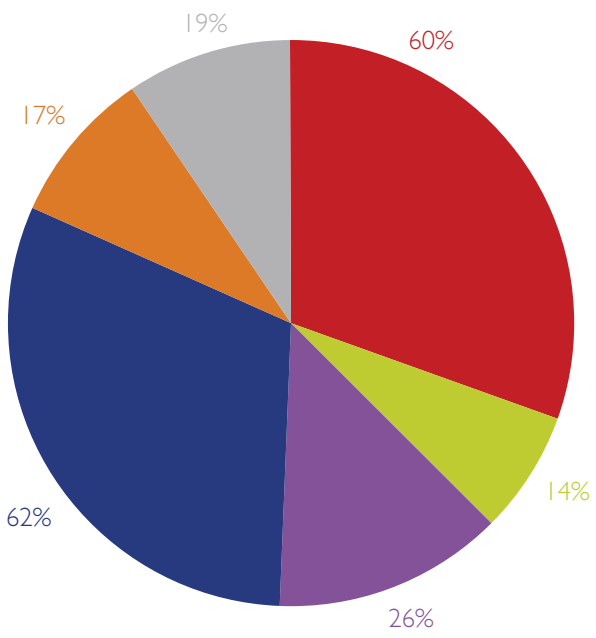

Chart 36 – Labour resource records - work data

- Task identified by reference to description on schedule
- Task identified by reference to description on other document
- Task identified by reference to ad hoc description
- Area worked on by reference to description on schedule
- Area worked on by reference to description on other document
- Area worked on by reference to ad hoc description

When it came to relating the resource used to the work done and in which location, it was the experience of only 60% of respondents to this part of the survey that the task description was identified. 62% of respondents reported that the area description was recorded in the same way as that on the construction schedule to which the labour had been applied. In the experience of 14% of the respondents the labour resource records were related to a task description held in a different document, while 17% said that a work area description was contained in a different document. In the experience of 26% of respondents the details of the area being worked on were identified in the record, while 19% reported a work area description having no relationship with anything.

It is apparent from the response to this question that approximately one-third of respondents have experience of a failure to keep the necessary progress records that could enable them to detect trends in labour resources, or to relate the labour used to the activity timed on either the master or short-term schedule. Without such information it is impossible to detect the symptoms of disruption and the resultant lost productivity, or to predict with any certainty the effects of progress made in relation to progress planned.

Types of plant and equipment records kept

Plant and equipment - basic data

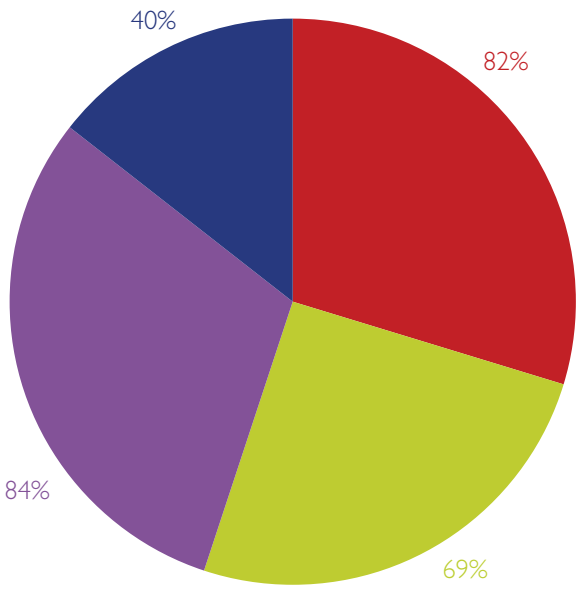

Chart 37 – Plant and equipment resources - basic data

- Date
- Day of week
- Name
- Title

The response to the question of what plant/equipment/machinery records are usually kept was more reassuring than the response to that related to labour resources. As Chart 37 illustrates, around 82% of respondents reported that details of the date were kept in plant and machinery records, while 69% reported that details of the day of the week to which the record related were recorded. 84% reported that details of the name of the type of plant were kept, with 40% reporting that details of the trade to which it related were kept.

Plant and equipment - work data

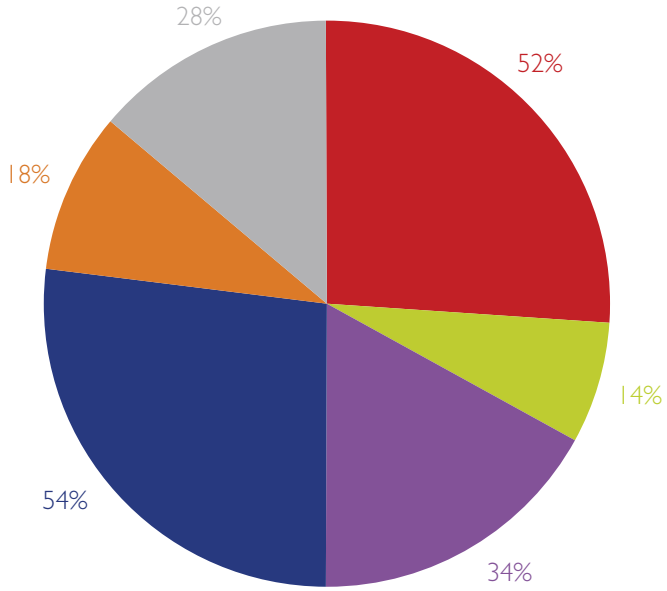

Chart 38 – Plant and equipment resources - work data

- Task identified by reference to description on schedule
- Task identified by reference to description on other document
- Task identified by reference to ad hoc description
- Area work on by reference to description on schedule
- Area worked on by reference to description on other document
- Area worked on by reference to ad hoc description

Chart 38 illustrates that in the experience of those responding, only about half of the plant and equipment records were related to the work and area descriptions on the master schedule. In 14% of cases, the plant and equipment was related to a task description while in 18% of cases it was related to an area description on another document. In 34% of responses, the plant and equipment resources were related to a task description. However, 28% of respondents to this question had experience of a work description with no relationship to anything.

It is apparent from the response to this question that approximately half of the respondents to this question have experienced a failure to keep either the necessary progress records, which would aid the detection of trends in plant and equipment resources, or a record of the relationship between the labour used and the activity timed on the master or short-term schedule. Without such information, it is impossible to detect the symptoms of disruption and the resultant lost productivity, or to predict with any certainty the effects of progress made in relation to progress planned.

Types of delay and compensation event records kept

Types of delay or compensation related data

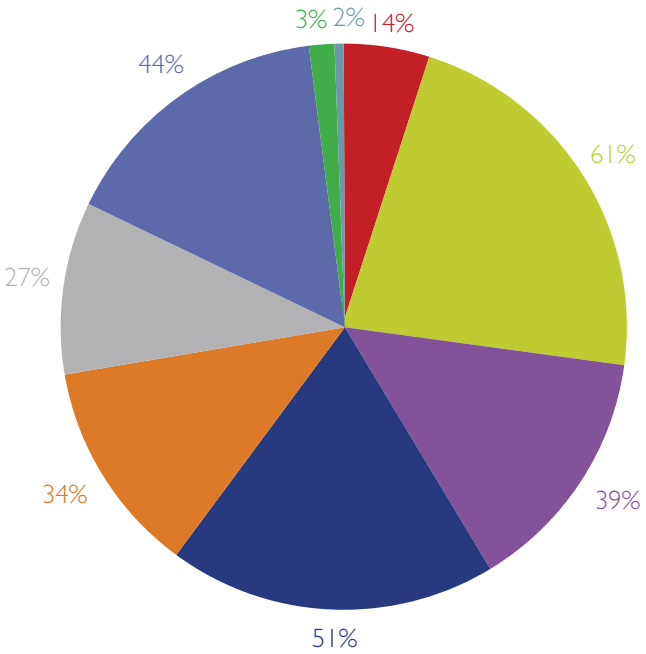

Chart 39 – Event related data

- An allocated Activity ID
- AI/CVI or other contract document instructing the work
- Task description
- Labour allocation
- Plant allocation
- Materials allocation
- Date of work carried out
- Predecessor logic
- Successor logic

Chart 39 shows that only 14% of respondents answering this question had experience of additional work being identified by relation to an activity ID on the schedule of work. However, only 3% or less related that additional work logically to the planned schedule in order to be able to promptly gauge its likely effect on completion. 61% of respondents experienced details of the source of the change, and 39% a description of the tasks being kept. In the experience of 51% of respondents, the labour resource was identified, while34% found that the plant and equipment resource allocated to it was identified. However, less than a third of respondents were familiar with materials allocation records being kept when the work was carried out.

22% of all respondents replying to this question were not aware of any records at all being kept of compensation or delay-related events. This explains why such a low proportion of contractors suffering delayed projects tend to be compensated for delay-related losses or excused payment of liquidated damages by an extension of time.

7. Identifying the effect of progress achieved

Schedule monitoring and updating

13% of respondents answering this part of the survey said that they were not familiar with the use of monitored or updated schedules in any way. However, 87% said that they did have occasion to read, write or consider monitored or updated schedules. In two-thirds of these cases the schedule included design activities.

Monitoring the progress of design activities

Completion of design was a scheduled essential pre-requisite of the start or end of a related work activity in two-thirds of the cases reported upon. The question relating to how progress in design was assessed was not answered by 29% of respondents but of those that did respond, 29% said that they had experience of more than one method being used to assess, from time to time, the degree of completeness of design work.

Methods adopted to assess the degree of progress of design attained

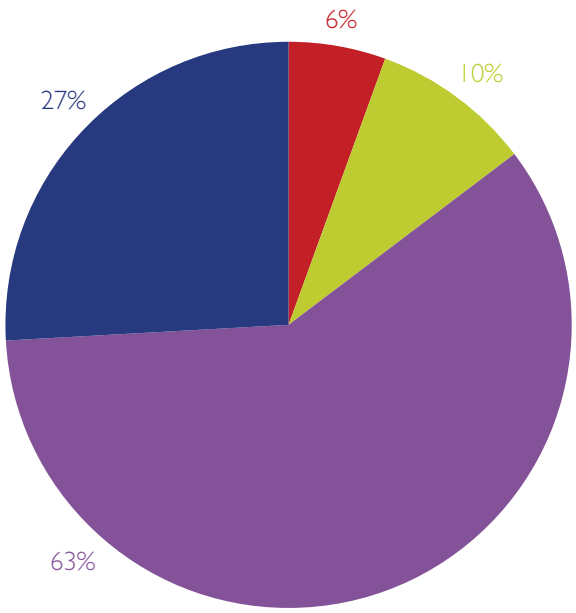

Chart 40 – Assessment of the progress of design activities

- By the earned value certified
- By the number of drawings produced against those planned
- Estimated % complete of identifiable stages of design
- Estimated % complete of totality

Chart 40 Illustrates that only 6% had experience in the use of earned value as a measure of progress in the design stage. 63% reported that the degree of progress made was estimated by reference to identifiable stages of design, and 27% by estimating progress against the estimated totality of design work to be done. The progress of design work was not something that was measured quantitatively in the experience of the majority of respondents.

Monitoring the progress of work activities

16% of those responding to the question relating to how the progress of work activities was assessed experienced the use of more than one method to assess the degree of completeness of activities.

Methods adopted to assess the degree of progress of activities on site

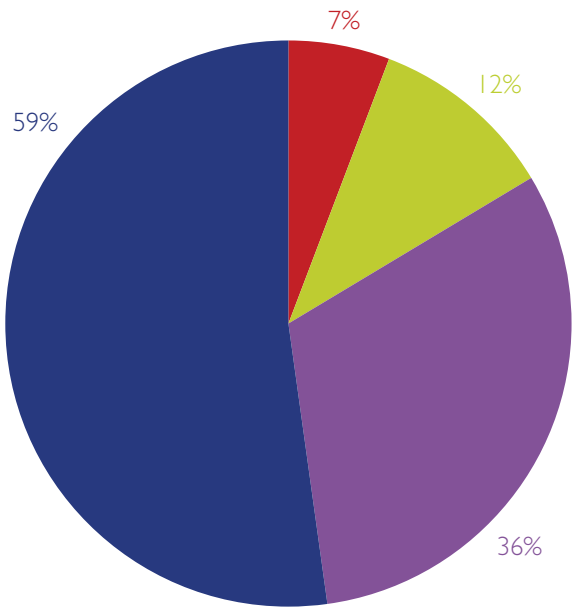

Chart 41 – Assessment of the progress of work activities

- By reference to the earned value certified
- By reference to the resources and materials used against those planned
- By estimated time needed to complete
- By estimated % complete of totality

Chart 41 illustrates that, as with design progress, only a very small minority, in this case 7%, were familiar with the use of earned value as a measure of progress in the activities on site; while 12% were familiar with the use of the relationship of resources used against those planned. Of the remainder, 36% had experience of the amount of progress made being gauged by reference to an estimate of the time needed to complete an activity, and 59% were familiar with progress being estimated by reference to the amount of work done in relation to the total amount to be done in the activity.

It is apparent from this that in the experience of those responding, little science is applied in the measure of progress of activities on site, and for the majority of respondents, it is very much a matter of subjective judgment at the time. Provided that the planned activity duration is relatively short, however, there is no great harm in this. The difficulties arise for long duration activities where the likelihood of substantial error is liable to be considerably greater than for short-duration activities.

Monitoring the progress of the project

Progress of the project as a whole

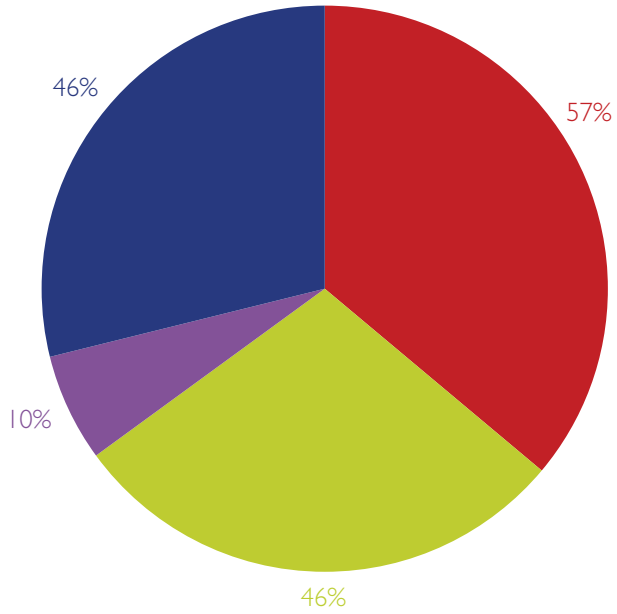

Chart 42 – Assessment of the progress of the project as a whole

- The work on site is assessed and reported upon in meetings or correspondence
- Estimated % complete against the first construction schedule for progress
- Estimated % complete against previous degree of progress
- Calculated % complete against updated/revised schedule for progress

Chart 42 illustrates that in relation to the progress of the work as a whole; more than 40% of those responding to this part of the survey had no experience of progress being reported either in meetings or in correspondence. Of the 57% who did have experience of the reporting of the progress of the project as a whole, 46% of those indicated that progress was either reported against the first schedule or the last revised schedule. Only 10% were familiar with progress being reported in the period since the last report.

This tends to suggest that in more than half the projects reported upon, the parties did not have a common understanding of the state of progress from time to time, and in only a small minority of projects was progress reported against a reporting period.

Schedule monitoring and updating

Schedule updating

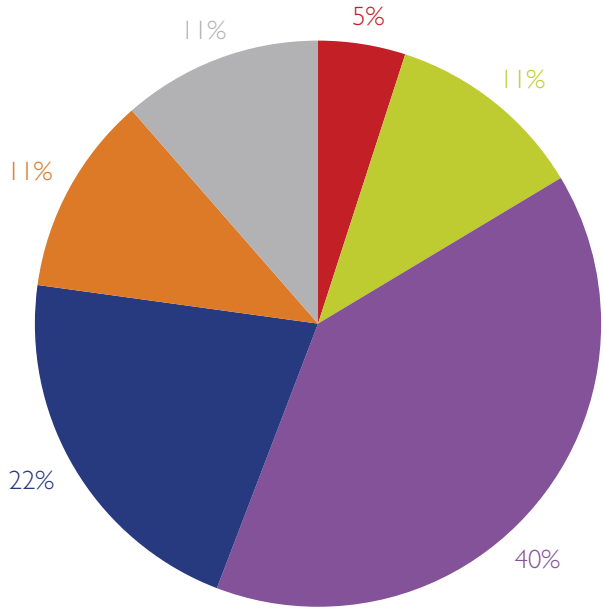

Chart 43 – Monitoring and updating construction schedules

- No the schedule is not updated
- Regularly at weekly intervals
- Regularly at monthly intervals
- When the contract management team chooses
- When requested by contract administrator
- When requested by the client

16% of respondents answering this question had experience of a combination of two or more methods of monitoring and updating being applied to a single project. 5% of those that did respond to this question said that in their experience, the schedule was not updated. 11% had experience of the schedule being updated at fortnightly intervals, and 40% at monthly intervals. It was the experience of 11% of respondents that the schedule was updated only if, and when, the contractor was requested to do so, either by the client or contract administrator, and 22% believed the schedule was updated when the contract management team decided the contractor should do so.

It would thus appear that in the experience of around 50% of respondents, progress is likely to be monitored against a schedule that is not regularly updated. This will adversely affect the reliability of estimates of progress achieved, the gauging of the effect of that progress on completion and the consequential effectiveness of reports on progress, if any.

Progress monitoring or schedule updating

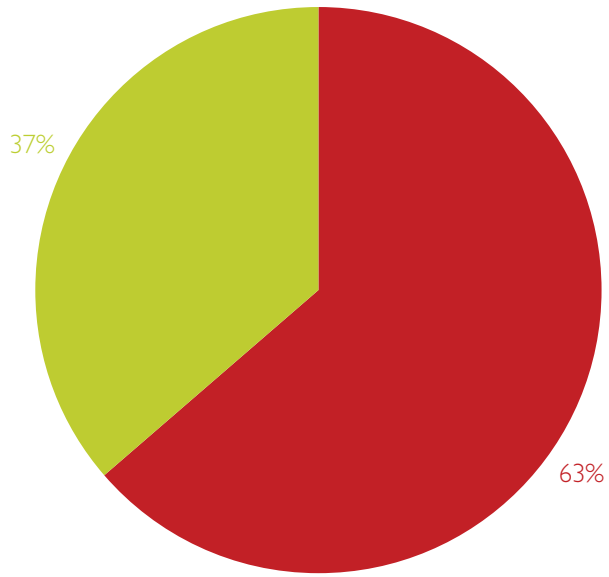

Chart 44 – Monitored or updated schedules

- Activities are progressed up to a straight, date related status line with work actually done to the left and work to be done to the right of the line and the schedule resequenced
- The degree of the progress is attributed to activities without changing the order and sequence of the schedule

When asked if the schedule was updated from a straight date line, or the activities monitored for progress without changing their timing, 8% said that in their experience, both occurred. Chart 44 indicates that 63% of respondents experienced the updating of the schedule as a straight, date-related status line with the work actually done to the left of the line and the work to be done to the right of it and the schedule re-sequenced. This would show the effect upon the timing of the remaining planned activities of the progress estimated to have been achieved to date. However, over a third of respondents answering this question had not experienced that process, being more familiar with the progress of activities being monitored against calendar dates without a calculation of the effect on successive activities, or on completion.

How out of sequence working is dealt with

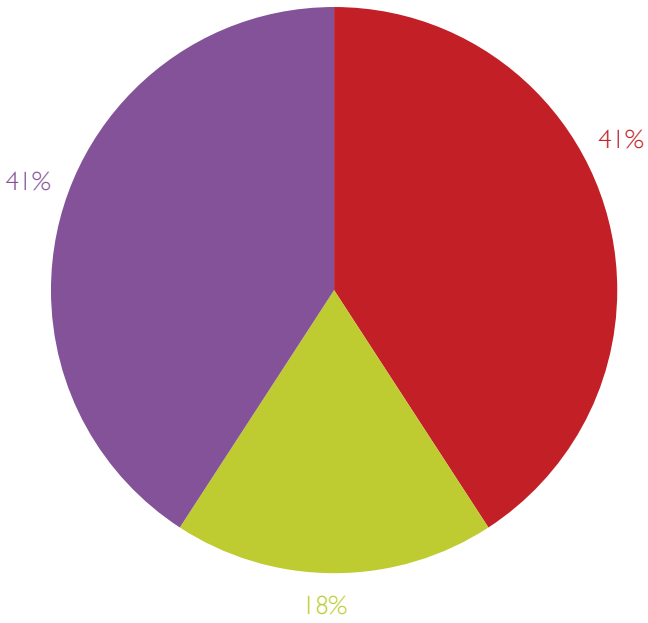

Chart 45 – Dealing with consequences of out of sequence work

- Progress achieved taking priority of logic
- Planned logic taken in precedence to progress achieved
- Logic corrected to conform to progress achieved

The question of how out of sequence work was dealt with when the schedule was updated from a status line was answered by three-quarters of respondents 8% admitted that they did not know the answer, or did not understand the question. Chart 45 illustrates that of those who answered the question, only 18% had experience of the logic of the schedule being corrected to reflect the sequence actually being followed. 41% of the respondents said that in their experience progress estimated to have been achieved was permitted to take priority over planned logic, or vice versa. The importance of this is in the calculation of the effect of progress achieved on the remaining part of the work. Unless the logic is corrected to follow the sequence actually followed, the resultant calculations are unlikely to accurately reflect a predictable planned sequence. In the case where progress is permitted to override logic, these calculations may actually predict an impossible future sequence of work.

8. Administration of delay

Notices

On what occasion is an identified delay to progress notified

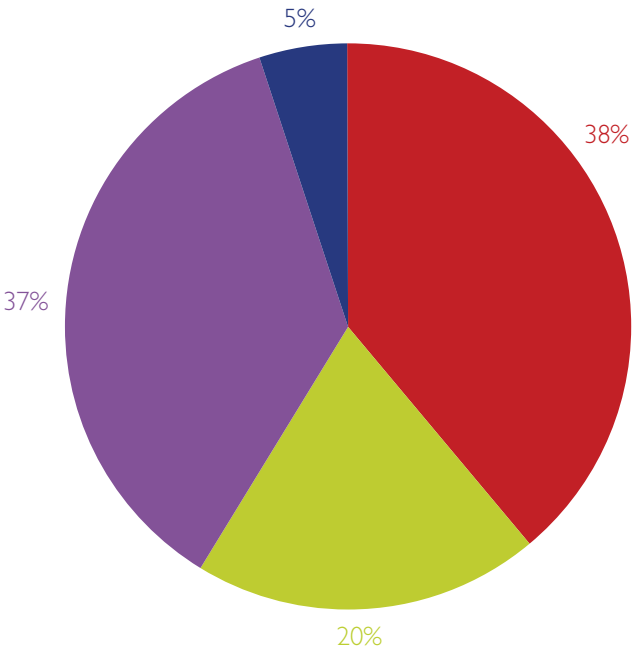

Chart 46 – When delay to progress is notified

- If it is likely to delay completion but not otherwise
- If the contract requires it
- Irrespective of whether the contract requires it
- Occasionally irrespective of predicted consequence

Chart 46 indicates that 38% of respondents answering this part of the survey declared that in their experience a delay to progress was only notified if it was perceived to be likely to delay completion. 5% said that in their experience, a delay to progress would be declared irrespective of the predictive consequences.

When taken in the context of the way progress is estimated and its consequences predicted, only 20% of respondents said they were familiar with a delay to progress being declared even if the contract required it.

The occasion on which delay is ultimately acknowledged

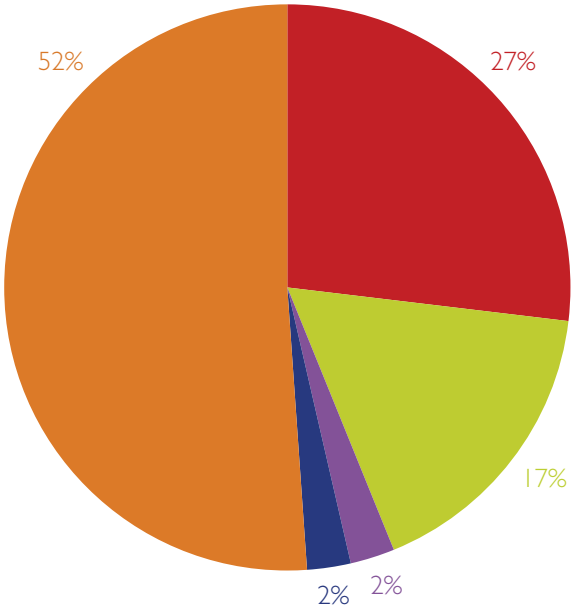

Chart 47 – When delay to progress is identified

- The client complains
- The contract administrator complains
- Liquidated damages are deducted
- Sub contractors complain
- The schedule is updated and reissued

Chart 47 shows that around 50% of respondents answering this question admitted that they were generally unaware of delay to progress until some time after it had occurred. In 52% of cases this was on the updating of the schedule, reinforcing its importance in project control. Alarmingly, in 2% of cases reported, it was not until liquidated damages were deducted for delayed completion that the respondent became aware of a delay to progress. In the remainder of cases, 27% said that they were not aware of delay to progress until the client complained, and 17% were not aware until the contract administrator complained.

Reasons for failing promptly to notify delay to progress

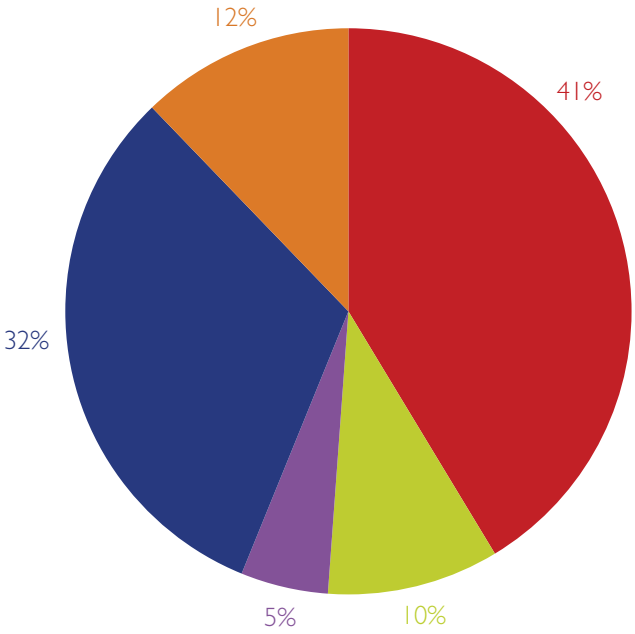

Chart 48 – Reasons for not promptly notifying delay to progress

- We might get over it
- We might be able to blame someone else for it
- We don't want to upset the contract administrator
- We don't want to upset the client
- It is not a contract obligation

Chart 48 shows that 21% of those responding gave a combination of two or more reasons to explain why delay to progress was not reported promptly. 41% said it was not notified because they might be able to 'catch up' on lost time, while 10% admitted that it was because they thought they might be able to blame another party for it. In 12% of cases, it was not notified because the contract didn't call for it. 32% of those responding failed to notify the delay because they didn't want to upset the client and 5% because they didn't want to upset the contract administrator.

Nearly a third of all respondents answering this question gave a combination of two or more parties to whom delay is usually notified.

The parties to whom delay to progress is usually notified

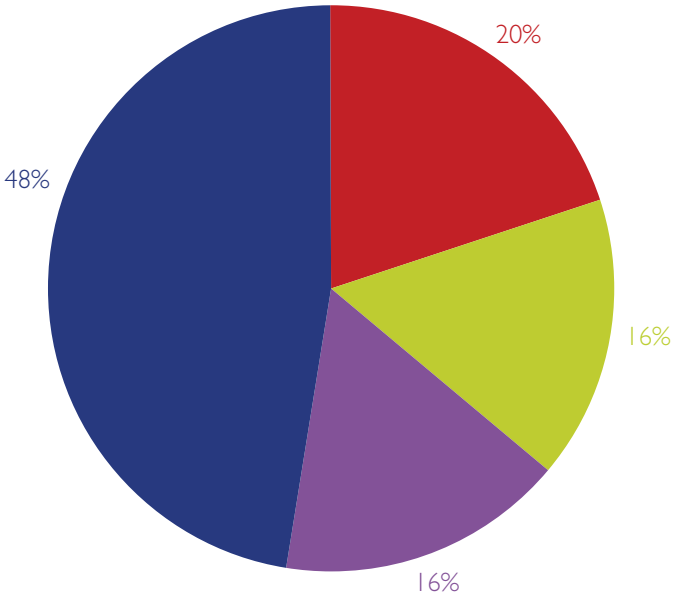

Chart 49 – The parties to whom notice of delay to progress is given

- Contractors site management
- Contractors board management
- Client
- Contract administrator

Chart 49 shows that for nearly 50% of respondents, notification was to the contract administrator. 16% of respondents said delay was notified to the client or to the contractor's board management, but only 20% of respondents had experience of delay to progress being formally notified to the site management team. A third of all respondents answering this question were familiar with notice of delay being given in a combination of two or more forms.

The form of notice of delay provided

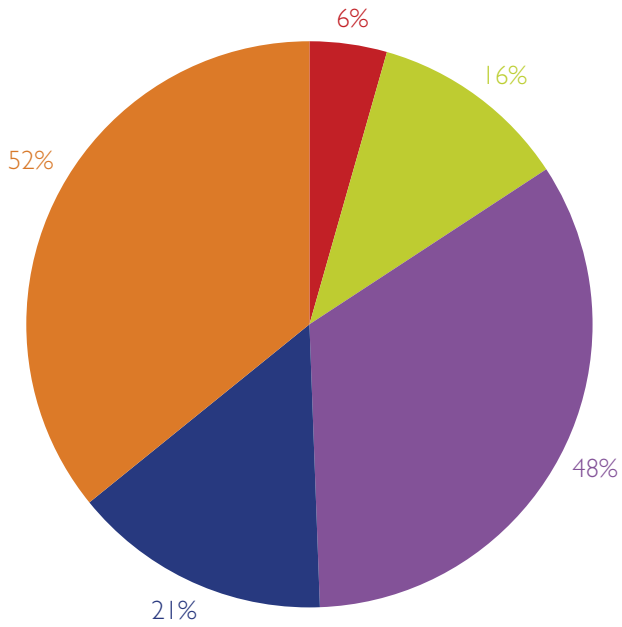

Chart 50 – The form of notice provided

- A standard format document
- Electronic communication
- A standard letter
- An updated impacted programme
- Advice given in a meeting

Chart 50 shows that in the experience of nearly 50% of respondents notice was given in a standard letter, while just over 50% of respondents thought it was given in a meeting. 16% of respondents reported that delay was notified electronically, and 6% by a standard form document other than a letter. Only 21% of respondents reported that the notice was accompanied by an updated schedule illustrating the effect of the delay to progress on the works.

Identification of delaying events

What usually identifies events ranking for an extension of time or compensation

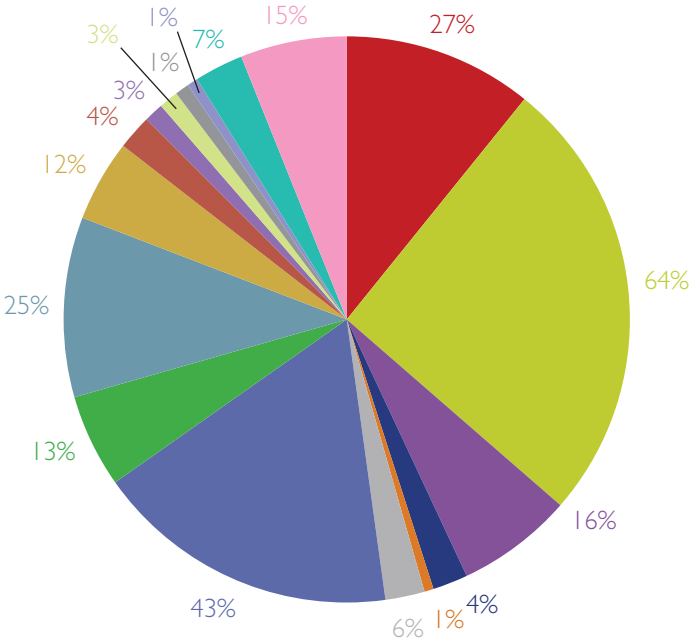

Chart 51 – Identification of causative events

- Commercial director
- Contract manager
- Site manager
- Foreman
- Tradesman
- Sub-contractors
- Quantity surveyor
- Programmer
- Project manager
- Architect
- Structural engineer
- Mechanical engineer
- Electrical engineer
- In-house legal department
- Independent expert
- Claims consultant
- Client

Two-thirds of respondents answering this question gave a combination of two or more likely sources for identifying the occurrence of events likely to give rise to either compensation or an extension in time. Surprisingly, it was the experience of those responding that in a third of those cases, the contract manager was not one of the parties likely to make that identification, and in only about a quarter of cases was it likely to be the contractor's commercial director or the project manger. It was the experience of only 16% that the contractor's site manager would identify an excusable or compensable event. 43% of respondents thought it was the quantity surveyor who was most likely to identify the occurrence of such an event.

9. Education, training and accreditation

Planning engineers

55% of respondents did not distinguish between the skills required by a planning engineer and those by a project scheduler, and felt they were unable to answer the question relating to how planning engineers were educated and trained. Of those that made the distinction between the two, 39% thought that the training of planning engineers was through a combination of two or more routes. 55% thought that they were trained through a university degree course and 85% by experience on the job. 36% thought that the training was a combination of university education and training on the job. 6% thought they were trained by software suppliers.

The training of planning engineers

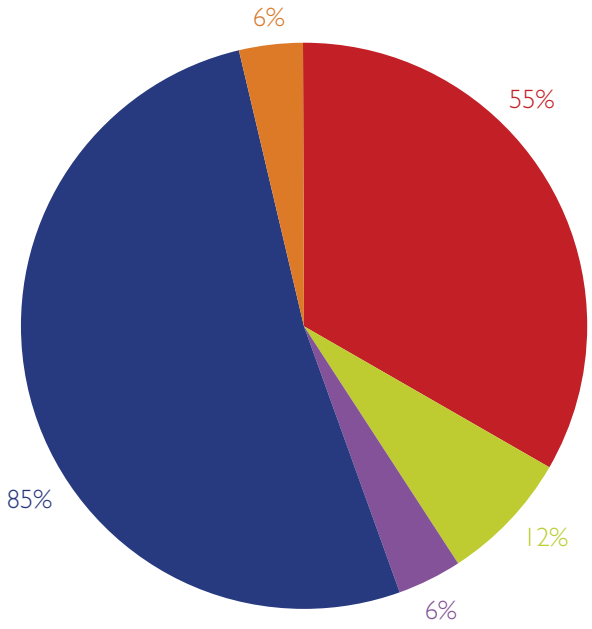

Chart 52 – Availability of education and training of planning engineers

- By university or other full time education
- By NVQD course or other part time education
- By home study
- By experience on the job
- By software suppliers

The standard of training of planning engineers

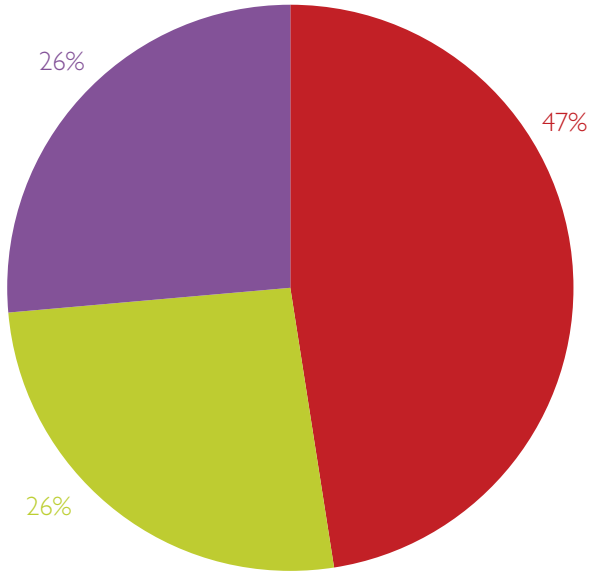

Chart 53 – The standard of education and training of planning engineers

- Below an acceptable standard
- Acceptable
- Good

Chart 53 illustrates that 47% of respondents answering this question thought that the standard of education and training of planning engineers was below an acceptable standard. However, 26% thought it was acceptable, and a further 26% thought it was good.

What qualifications can a planning engineer achieve

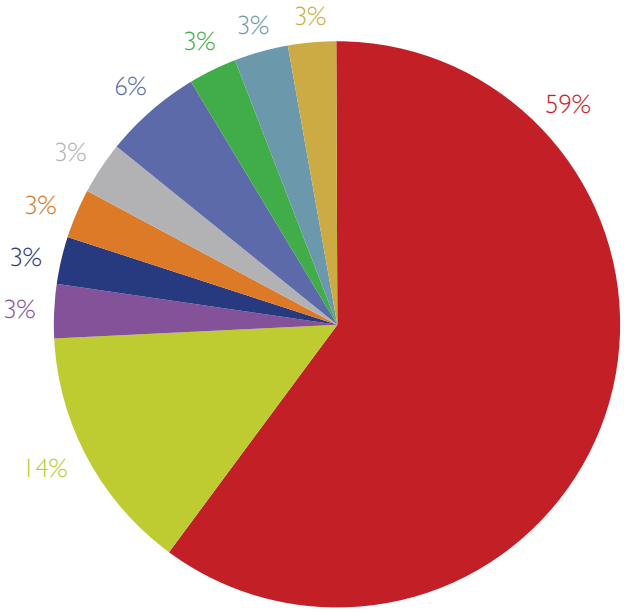

Chart 54 – Accreditation that might be achieved by a planning engineer

- Didn't know there were any
- CIOB
- ICE
- NVQ
- PMP
- RICS
- AACE-PSP
- PG-Dip
- PEO
- SUQ

Chart 54 illustrates that of those that made a distinction between the skills of a planning engineer and a project scheduler, 59% admitted that they were not aware of any accreditation that a planning engineer could achieve, and 14% thought that The CIOB already provided a planning engineering qualification.

Is there a need for training and accreditation of planning engineers

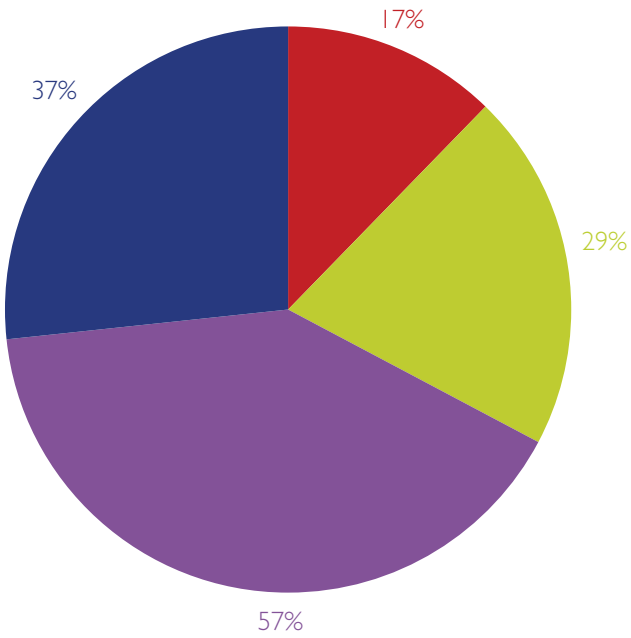

Chart 55 – The need for education and training of planning engineers

- No it is satisfactory at the moment
- Yes at pre degree level
- Yes at degree level
- Yes at post graduate level

Chart 55 illustrates that of those that made the distinction between the skills of a planning engineer and a project scheduler, only 17% thought that the existing facilities (whatever they were) for the training and accreditation of planning engineers were satisfactory. 57% thought that the predominant need was for education and training at university degree level, while 37% felt training was needed at post-graduate level. 29% thought that education and training should be at pre-degree level, and 20% thought that education and training should be available at all three levels.

Project schedulers

How project schedulers are perceived to be trained

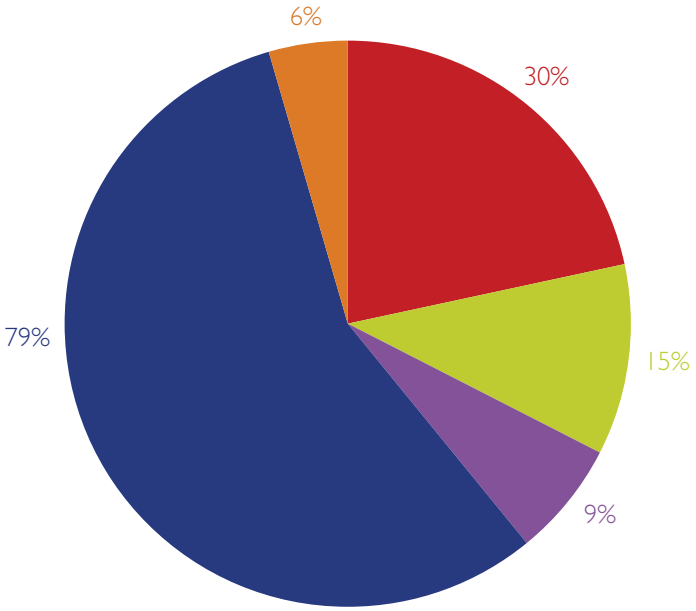

Chart 56 – Education and training of project schedulers

- By university or other full time education
- By NVQD course or other part time education
- By home study
- By experience on the job
- By software suppliers

The question of how project schedulers were perceived to be educated and trained was answered by 88% of respondents, which included those who did not distinguish between the skills needed by a planning engineer and those by a project scheduler. Chart 56 illustrates that 79% of those responding thought that the education and training of project schedulers came from experience on the job, 30% thought they were trained via a university degree and 15% by an NVQD course or other part-time education. A small proportion thought that education and training came via software suppliers or home study. 31% of respondents thought that education and training came from a combination of two or more sources.

The standard of training of project schedulers

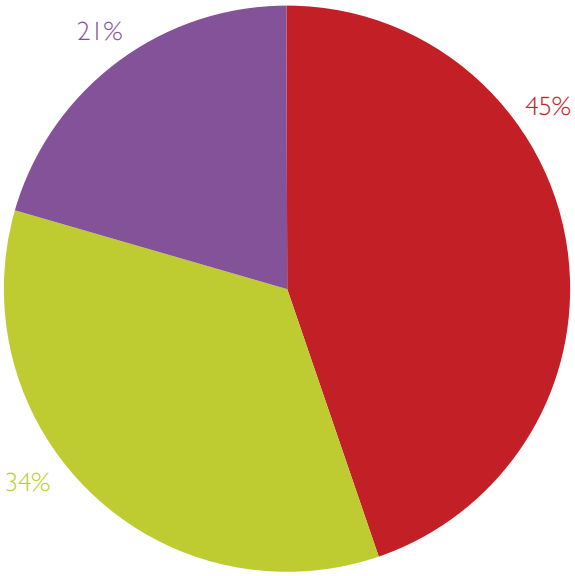

Chart 57 – Standard of education and training of project schedulers

- Below an acceptable standard
- Acceptable
- Good

Chart 57 illustrates that 45% of respondents answering this question thought that the education and training of project schedulers was below an acceptable standard. 34% thought it was acceptable, and a further 21% thought it was good.

What qualifications can a project scheduler achieve

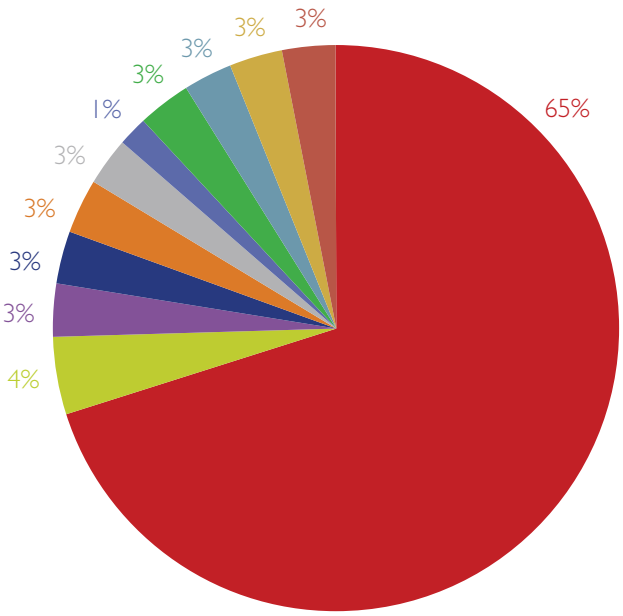

Chart 58 – Accreditation of project schedulers

- Didn't know there were any
- CIOB
- ICE
- NVQ
- PMP
- RICS
- SUQ
- AACE-PSP
- APM
- Degree
- PG-Dip

Chart 58 Illustrates that 65% of respondents answering this question admitted that they did not know of any qualifications that could be obtained by a project scheduler. A small minority thought that accreditation was provided by a variety of institutions and training bodies.

Is there a need for training and accreditation of project schedulers

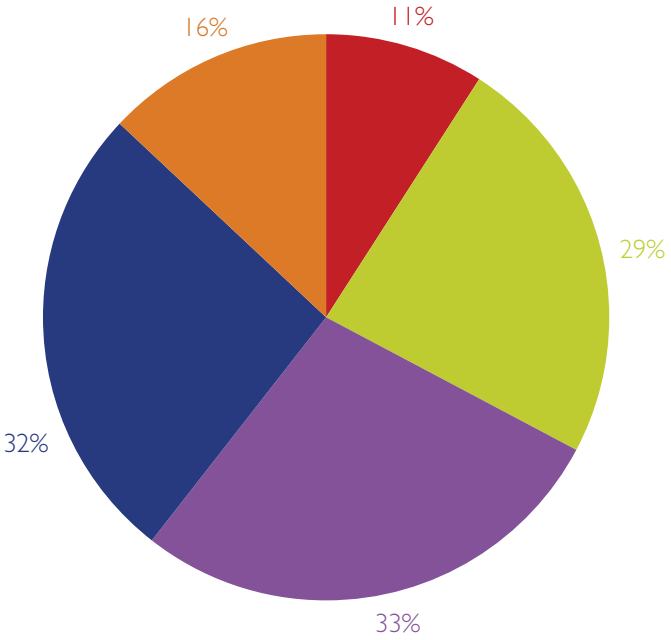

Chart 59 – The need for education and training of project schedulers

- No it is satisfactory at the moment
- Yes at pre degree level
- Yes at degree level
- Yes at post graduate diploma level
- Don't know

From Chart 59 it can be seen that only 11% of respondents thought that the training and education of project schedulers was satisfactory at the moment. 33% thought that training and education should be at university degree level, 29% at pre-degree level and 32% at post graduate level. 11% of respondents thought that education and training of project schedulers should be made available at all three levels.

Support for a formal training and accreditation scheme for planning engineers and/or project schedulers

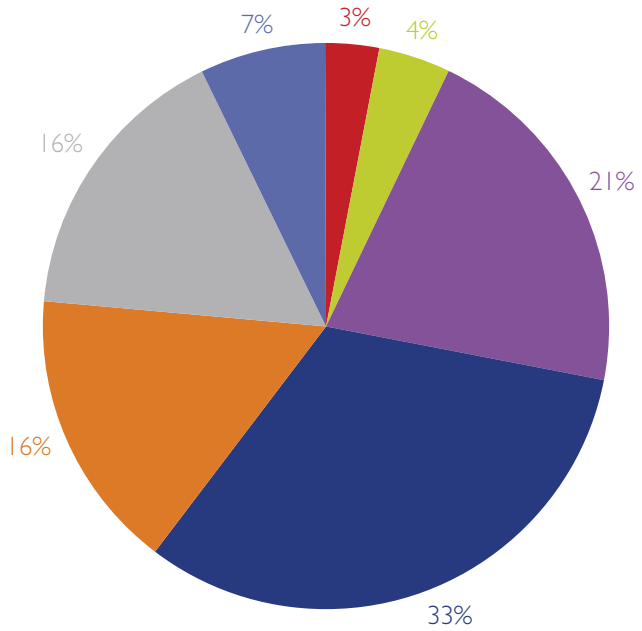

Chart 60 – Support from the industry

- By financial sponsorship of courses
- By presenting prizes for graduation
- By making it a desired employment requirement
- By sending employees on appropriate courses
- By attending appropriate courses
- By teaching on appropriate courses
- By providing a help desk

20% of those responding said they would support a scheme of education and training for project planners and schedulers in more than one category. From Chart 60, it can be seen that 33% would send employees on appropriate courses and 16% of respondents said they themselves would attend appropriate courses. 16% volunteered to teach courses, 7% volunteered a help desk and a further 7% volunteered financial support either by sponsorship or graduation prizes.

Conclusions

Although research into the incidence of delayed projects and the type of software used has also been conducted by others, as far as we can ascertain, this research into the methods by which time is managed by the construction industry (conducted by The CIOB between December 2007 and January 2008) is the first of its kind. The essence of the research was to understand industry performance in managing time on construction projects, and in particular the techniques used and the competence of those engaged in the process. The thesis of the research was that despite the development of sophisticated critical-path network software tools, little had changed in the practice of time-management since the development of the bar chart nearly 100 years ago. This was expounded by members of the project team on the basis of their own experiences of project failure through delays, time-based claims and disputes.

If the thesis was to be demonstrated, it was essential to understand why the management of time was dysfunctional, resulting in delayed completion of so many projects. It was felt that this could, at least in part, be due to the failure of management to give due regard to the importance of project scheduling and record keeping, coupled with the absence of standards, formal education and training in the management of time, planning and scheduling in all sectors of the industry.

The CIOB is grateful to all who gave their time and effort in completing the survey. The survey required respondents to answer in-depth questions and to submit commercially sensitive information. We approached 400 companies, and received 73 responses received, of which 35 were anonymous. While we were unable to identify all the responses it is reasonable to assume that only one response was received from each company. Thus the results of this survey concerning the incidence of delay in construction projects are based on data provided by 73 companies on over 2000 projects. Of the 73 respondents, 11 said that they did not have occasion to read, write or consider construction schedules, this section of the questionnaire was thus answered by 68 respondents.

As demonstrated by the Construction Manager of the Year Awards, some projects are managed very well indeed. However, it has to be recognised that the experience of the respondents to this questionnaire is that the quality of time management on construction projects is generally poor. Over half of the respondents were used to only a master schedule being used, with no short-term planning taking place. Their experience was that these master schedulers would normally be bar charts with no linked sequencing.

Thus, in general, managers would be unable to measure the impact of either slippage, or imposed changes to the works. Hence, they would be unable to manage the effects of the delay on project completion, except intuitively.

The experience of the respondents was that there was little collaborative discussion with project participants, including subcontractors and suppliers, in developing project plans. Additionally, project plans, are not generally coupled with well thought out, written method statements.

The conclusion that has to be drawn from these results is that there are grounds for concern for effective management of time using network-based programming on construction projects. In the experience of the respondents, resource, cost and value allocation to schedules was a minority exercise. Whereas schedules should be regularly updated to manage progress and minimise delays, in reality, too often schedules were used solely as a political tool to protect companies and management from accusations of blame for delays..

The respondents reported that recording of progress against plans was generally not systematic. Thus, quantifying progress became, for the majority of respondents, a matter of subjective judgement. Many respondents had experience of progress not being reported in meetings or correspondence. In many instances, progress is measured against schedules that are not regularly updated, with no understanding being gained of the effect delays on activities, and the impact on the overall project.

In many cases respondents found that delays were not being recognised until schedules had been updated, so demonstrating the importance of schedule updating to project control. However there appears to be a reluctance to face the consequences of delay. Only a fifth of respondents said they would voluntarily declare a delay to progress, even if the contract required it. Nearly half of respondents did not report a delay because they might be able to 'catch up' the lost time; a third did not report it because they did not want to upset the client; while a tenth admitted they failed to report delay because they felt they might be able to blame it on someone else. On the one hand the result is a failure of project control; on the other an issue of relationships, transparency and even deceit.

The failure of management to effectively control time is best shown through the performance of the industry. The survey shows that simple, repetitive, low-rise projects have a high chance of success within traditional management processes.

However, the more complex the project; the less likely it is to be completed on time. Without more sophisticated project control, complex buildings (both low-rise and high-rise), and engineering projects are likely to be substantially delayed in their completion. The majority of delay-related costs are perceived to be predominately at the risk of the contractor, and in many cases the contractor was perceived to be predominately to blame.

It was felt that the education of planning engineers should be mainly at university degree and post-graduate levels, while that of project schedulers should be at pre-degree (higher technician) and degree level though much is through work experience only. However, we have to conclude that the education and training needed to prepare all those involved in the management of time on construction projects is unsatisfactory.

All those involved as professionals and managers in construction at some time need to use construction schedules. Current levels of understanding and skill are not adequate for a modern, progressive industry that seeks to deliver contracts on time to the satisfaction of the client.

The survey makes the case for systematic project planning and control, using available technologies, in order to minimise delays and risk to clients, contractors and other parties. Project planning and control is fundamental to effective management and to the avoidance of delay and disputes. Competent planning engineers and project schedulers are vital to the success of this process.

Recommendations of The CIOB

Recommendations for further research

The report identifies security-related projects, such as prisons, and health-related projects, such as hospitals and clinics, as being particularly susceptible to delay. The CIOB should thus consider writing to the Home Office and the Department of Health to request comprehensive information on delays to contract completion dates for Home Office and Department of Health projects as the first step to establishing the issues in their projects, if any, and making further recommendations.

Recommendations for publications

It is important to establish best practice in the management of time on construction projects. It is therefore recommended that following consultation with other interested institutions, The CIOB should consider publishing a Code of Best Practice for the Time Management of Construction Projects.

Recommendations for education and training

There are four areas for consideration regarding education and training:

1. Training for professional and senior managers responsible for projects is required. This could take the form of masterclasses and workshops to promote best practice to enable these managers to make informed strategic and business decisions about the management of time and delay avoidance.
2. Training and accreditation for practitioner planning engineers and project schedulers is needed in order to raise the standards of planning and scheduling on construction projects.
3. The industry should work with education providers to improve education and training to new entrants through NVQs (higher technician) and university schedules.
4. A CIOB working group should be established to address the issues of education, training and accreditation and to make recommendations to The CIOB as to the appropriate way forward for the development of these schedules.

Englemere
Kings Ride
Ascot
Berkshire
UK
SL5 7TB

Tel: +44 (0) 1344 630700
Email: reception@ciob.org.uk
www.ciob.org

Registered charity 280795