"Delay to completion of the works by the date for completion":

> An adverse effect on completion the date by which, from time to time, C intends to complete the works, or any contractually defined section of the works.

"Delay to progress of the works":

> An adverse effect on the date by which, from time to time, C intends to start and/or to finish any identifiable activity, sequence, or resource.

Disruption

1–034 Dictionaries will provide the meaning of "disruption" as a prevention, or hindrance, to something intended, expected, or proceeding, an interruption in continuity, dislocation, discontinuity, or disorder. As with the word delay, disruption is also a comparative term and has no intrinsic meaning. In order to give it effect, it must therefore be related to something else. In construction and engineering contracts, for a given work content, disruption is the difference between an intention and reality as to productivity, or achievement, where the reality is in derogation from the intent. Disruption is not delay. Although disruption may cause delay and it may be caused by delay, delay is not a precondition of disruption and, indeed, disruption may be caused when the progress of the works previously delayed is recovered, or accelerated. Disruption is the term used to signify the condition precedent to a reduction in productivity, which results in an increase of cost for a given quantity of work.

Illustration

Facts: Dynalectric (D) sent notices as the work proceeded and sought to negotiate a resolution to its equitable adjustment claim on a performing arts centre in Kentucky. Whittenberg (W) never rejected any of the notices and even attempted to negotiate a settlement to the claim, although it offered to pay less than the $682,480 sought by D. D refused that offer and submitted the equitable adjustment claim for $682,480 to court. D argued that it was entitled to recover additional costs, which it incurred because of the cardinal change it had suffered as subcontractor and argued that a cardinal change had occurred when the project work areas became seriously congested with numerous sub-contractors and W failed adequately to manage the conflicting schedules and ensuing delay and disruption. *Held:* that a cardinal change only occurs if an alteration in the work effectively requires the subcontractor to perform duties materially different from those foreseeable in the subcontract. The existence of a cardinal change would mean that the prime contractor breached the subcontract. The fact that the site became crowded with contractors was insufficient to prove a cardinal change. The court rejected the cardinal change claim, because the electrical installation was still in essence the same work as that which had been originally bargained for when the subcontract was awarded. The court therefore granted summary judgment in favour of the prime contractor: *Dynalectric Co v Whittenberg Construction Co.*[52]

52 US Dist LEXIS 110136 (WD Ky 2010).

CHAPTER 2

The risk of development

Introduction

> *"No construction project is free of risk. Risk can be managed, minimised, shared, transferred or accepted. It cannot be ignored."*[1]

2–001 Construction is a risky business. Research carried out in 2002 by the then Department of Trade and Industry[2] showed that 58% of all construction projects were late in completion and 50% were over budget. In 2005, it was reported that time

1 Sir M Latham, *Constructing the Team* (London: HMSO, 1994), Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the Construction Industry, at para.3.7.
2 Department of Trade and Industry, Construction Industry KPIs – Industry Progress Report, 2002.

predictability had worsened over the previous 12 months, with the proportion of government agency projects delivered on time, or better falling from 49% to 44%[3]. In 2007, it was conservatively estimated that, since the first wave of PFI schemes began in 1994, £100m had been lost to overruns on 40 major PFI hospital projects alone[4]. Research, carried out under the Constructing Excellence initiative[5], revealed that fewer than half of respondents (48%) believed that the projects they work on had been completed on time, or to budget. These statistics are discomforting.

2–002 Recent research carried out by the Chartered Institute of Building[6] has shown that the more complex the project, the less likely it is to be completed on time.

[Please refer to Figure 2.1]

2–003 The respondents to the CIOB questionnaire reported that, in their experience of over 2,000 projects, low-rise offices, commercial, industrial, and educational buildings, housing, shops and shopping malls, have a reasonable chance of being completed on, or before, the completion date, without recourse to modern, scientific methods and using only a traditional intuitive approach to time management.

2–004 On the other hand, it was also the respondents' experience that hospital, clinic and health-related buildings, prisons and security, stadia, sports-related, railway and high-rise projects have a poor chance of being completed on time and that a high proportion of complex projects was likely to be completed more than six months late, when managed without the benefit of scientific methods of project control.

2–005 High-rise building projects necessarily have more complex services, security, vertical circulation systems and construction logistics, requiring a high standard of pre-planning and project control if success is to be achieved. The CIOB report found that performance of these projects was not good; only one-third were completed on, or before, the completion date and 18% completed more than six months late. The report also found that, when taken in the round, engineering projects tended to fare less well than building projects. A little over half of those engineering projects reported upon were completed on, or before, the completion date and 18% were more than six months late in completion.

2–006 As a result of the CIOB research, it has become apparent that time management in the construction industry in the United Kingdom has now reached a comparable level of advance to that which quantity surveying had reached in respect of cost management at the turn of the twentieth century, just over 100 years ago[7]. There are currently no accepted standards to work to; no formal educational schedule for those who set out to do it; no formal training for those doing it; and no accreditation, or qualifications, to demonstrate competence.

2–007 At the root of the industry's difficulties is the fact that project planning and scheduling are currently carried out by those whose primary profession (if any) is another discipline: they may have come from an industry trade, be construction managers, project

3 Constructing Excellence, "Report on Key Performance Indicators" (2005) *Building magazine*, 7 June.

4 Confederation of British Industry Building on Success; the Way Forward for PFI (June 2007). See also Ch.3 – "Project Procurement" at paras 3–056 to 3–072.

5 Constructing Excellence, *Never Waste a Good Crisis* (2009), at p.9.

6 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008).

7 K Pickavance, *Time for Change: Time Management in Construction projects, Practical Aspects of the CIOB Reforms*, Herbert Smith Construction Conference, London, 29 September 2009. See also K Pickavance, *Managing the Risk of Delayed Completion in the 21st Century: The CIOB Research* (Society of Construction Law, 2009).

managers, architects, engineers (of one form or another), quantity surveyors, or just an employee with an understanding of how the software works, but without professional education, or training at all in the management of time.

2–008 The experience of those involved with delayed construction projects is that the quality of performance of project planners and schedulers is patchy. Notwithstanding the absence of formal education training and qualifications, some to whom the task of time management is allocated are extremely talented and experienced. On the other hand, some are not. However, without a standard against which to work and some form of accreditation, it is apparent that the industry is at a loss to follow the recommendations of the *SCL Protocol*[8] and maintain a high quality of performance in time management, or to avoid the pitfalls and inevitable consequences of poor time management. The absence of any standards, education and training in time management perhaps goes some way in explaining why the trend over the last 20 years or so, of transferring more and more risk to C, has not resulted in a higher success rate in securing completion on time.

2–009 Whilst for many private developers, the bottom line is the primary driving force, for public authorities getting value for money and not frittering it away on the consequences of mismanagement are equally important. Perhaps one of the most spectacular failures to keep to time of recent years has been Holyrood, the Scottish Parliament building, which completed some three years late and in relation to which, in his report[9] Lord Fraser of Carmyllie QC said:

> "It is difficult to be precise but something in the region of £150m has been wasted in the cost of prolongation flowing from design delays, over-optimistic scheduling and uncertain authority."

As Mead observes[10], the fallout from such disasters can have far-reaching consequences, way beyond the interests of the immediate parties to the contract, including:

> "political and social impacts extending from public hostility to future projects right through to the burden placed upon judicial resources, as a result of the inevitable disputation that can arise as a result of risks and projects spiralling out of control".

2–010 Risk of delay to the completion of construction works may stem from six primary sources. First, there are those for which C, its subcontractors and suppliers are responsible. These normally include such risks as a failure to obtain the necessary resources, breakdown of plant and absenteeism, defective workmanship and materials, but perhaps the most insidious of C's risks, is one that is rarely discussed, namely the risk of a failure properly to plan, programme and control the works.

2–011 There are five other sources of risk, responsibility for the effects of which D is commonly required to take, namely:

1. variations voluntarily instructed;
2. variations impliedly instructed;
3. the acts, or omissions, of third parties;
4. other interferences, which cannot be foreseen by C, or D; and
5. D's own acts of impediment, or prevention.

8 Society of Construction Law, *Delay and Disruption Protocol* (2002).

9 The Rt Hon Lord Fraser of Carmyllie QC, *The Holyrood Enquiry* (2004).

10 P Mead, "Current trends in risk allocation in construction projects and their implications for industry participants" (2006) 22 BCL 407; (2007) 23 Const LJ 23.

2–012 From D's point of view[11], there are three broad variables in the success of any construction project which can be influenced by these categories of risk:

1. cost;
2. time; and
3. quality.

2–013 The American Society of Civil Engineers has summarised the principles of how the risk of the effect of these variables should be allocated as follows[12]:

> "(a) a risk should be assigned to the party best able to evaluate, control, manage, bear and reduce the cost of, and benefit from the assumption of that risk;
> (b) many risks are best shared; and
> (c) every risk has an associated and unavoidable cost which must be assumed somewhere in the process".

Similarly, in the United Kingdom, Professor Max Abrahamson has summarised these principles as[13]:

> "A party to a contract should bear a risk where:
>
> 1. The risk is within that party's control;
> 2. The party can transfer the risk (eg by insurance), and it is most economically beneficial to deal with the risk in this fashion;
> 3. The preponderant economic benefit of controlling the risk lies with the party in question;
> 4. To place the risk upon the party in question is in the interests of efficiency;
> 5. If the risk eventuates, the loss falls on that party in the first instance and it is not practicable, or there is no reason under the above principles, to cause expense and uncertainty by attempting to transfer the loss to another."

2–014 For the last 50 years, at least, it has been apparent that, if time is not managed effectively, cost never can be[14]. Notwithstanding, identifying risk, the allocation thereof and managing it by cost allowance alone appears to be the approach still taken in many complex projects involving multiple developers. The institutions concerned are identified as requiring advice on the following issues[15]:

cost;
design;
environment;
facilities management;
financial;
insurance;
legal;

11 If the viewpoint of other "stakeholders" in the construction industry is considered, other variables, such as safety and environmental factors, also come into play.

12 RJ Smith, "Risk identification and allocation: saving money by improving contracts and contracting practices" [1995] 40 ICLR 40.

13 P Megens, "Construction risk and project finance – risk allocation as viewed by contractors and financiers" [1997] ICLR 4.

14 For a short historical perspective on the various attempts to manage time over the last 150 years, see K Pickavance, *Managing the Risk of Delayed Completion in the 21st Century: The CIOB Research* (Society of Construction Law, 2009).

15 See A Akintoye and C Hardcastle, *et al*, "Achieving best value in private finance initiative project procurement" (2003) 21(5) *Construction Management and Economics* p.461 referred to in P Mead, "Current trends in risk allocation in construction projects and their implications for industry stakeholders" (2006) 22 BCL 407; (2007) 23 Const LJ 23 at 25–26.

supply chain;
surveying;
tax;
technical;
town planning;
traffic.

In light of the industry's continuing problems in managing time and the risk of delayed completion, it is perhaps of some significance that no mention appears on this list of a project controller and time manager, without whom time is not readily manageable, except on the simplest of projects.

2–015 Allocating the risk is one thing, but managing the risk that has been allocated is another matter entirely; Mead refers to the results of an Australian survey conducted by Engineers Australia and the Chamber of Commerce and Industry of Western Australia, who concluded that, in practice, the generally accepted principles of risk management are not being followed by the construction industry[16]. He observes that the survey concluded that:

risks were not allocated to the party best able to manage the risk;
formal risk assessments were not undertaken;
risk clauses varied from those in standard contracts;
risks were transferred to consultants and contractors, which were impossible for them to manage;
risks were not costed in tenders;
cost savings would have occurred had risks been more effectively allocated;
the implications of changing risk allocation were not known; and
disputes and claims increased as a consequence of changes to risk allocation.

It is often thought that one of the principal aspects of risk management in construction is the appropriateness, or otherwise, of the choice of construction contract, but the CIOB research indicated that the choice of contract has no material influence on the likelihood of completion on time[17]. In terms of timely completion, all that different procurement routes might achieve is a change in the allocation of *liability* for failure.

2–016 For risk of delay to be managed, it must first be identified. Once identified, a risk is not so much a risk as a management problem. This is because the likelihood of its occurrence and the consequences of that occurrence can then be assessed and steps taken to minimise its impact, or to accommodate it. The magnitude of the effects of the risk can then be assessed. Such an assessment is based upon the premise that experience of the past can be extrapolated into the future and that it will remain the same, unless something happens to change it, when the risk must be reassessed. Thus, there are five stages to the process of managing the risk of delayed completion:

1. identifying the risk;
2. considering how the possibility of the occurrence of the risk might be reduced;
3. assuming that the risk matures, suggesting possible action to reduce the consequential effects of the risk;
4. posing what the future will be like without action; and
5. posing any effects mitigatory action might have.

16 P Mead, "Current trends in risk allocation in construction projects and their implications for industry stakeholders" (2006) 22 BCL 407; (2007) 23 Const LJ 23 at 24.

17 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008).

2–017 Risks can be categorised in several different ways and academics have identified as many as 100 different types. However, for the purposes of discussing the risk of delay to completion and cost enhancement to construction contracts, those risks considered here will be:

1. project planning and programming;
2. legal;
3. dispute;
4. design;
5. buildability;
6. biddability;
7. construction;
8. financial;
9. political; and
10. insured.

Each of these will be dealt with in turn.

Standard form provisions

> *"The type of contract or procurement route selected from those currently available will have no effect on the incidence of delay to completion, simply because current standard forms of contract do not encourage and, in some cases, even inhibit effective management of time. All that current standard forms of contracts do is set a standard of performance and allocate liability for failure; they do not produce success."*[18]

2–018 The specification, the type of project and the intended relationship between the parties should influence the choice of contract[19], but perhaps the most important aspect of procurement is the degree to which time can be effectively managed under the chosen form of construction contract.

2–019 A Survey of Building Contracts in Use[20] carried out by the RICS in 2001 showed that, by the end of that year, the JCT family of standard forms of contract accounted for over 90% by number and 79% by value of works being let on the standard forms. Of those, JCT98 accounted for 24% of contracts let by value. The remainder of the JCT forms, that is PCC92, MWA80, IFC84, WCD81, MC87 and so on, accounted for 25% by value. By value in the sample, GC/Works forms accounted for 1.3%, the ICE forms 0.6% and the ECC2 form 0.7%. The partnering form (PPC2000) accounted for 1.2% and MF/1 and IChemE were used on just eight occasions.

2–020 In 2006, the RICS published another survey[21], reporting that, by 2004, 92% of building projects used a standard form of contract, down from 95% in 2001. 78% of all contracts employed one of the JCT standard forms, down from 91% in 2001; GC/Works and ICE7 both accounted for 1% each, ECC2 was used by 7%; PPC2000 was used by 2% and other standard forms accounted for 3%.

18 K Pickavance, *Managing the Risk of Delayed Completion in the 21st Century: The CIOB Research* (Society of Construction Law, 2009).

19 P Capper, "Overview of Risk in Construction" in J Uff, QC and M Odams (eds), *Risk Management and Procurement in Construction* (Centre of Construction Law and Management, King's College, London, 1995).

20 *A Survey of Building Contracts in Use during 2001* (Royal Institute of Chartered Surveyors, 2002).

21 *A Survey of Building Contracts in Use during 2004* (Royal Institute of Chartered Surveyors, 2006).

2–021 However, in light of the prolific standard forms of contract published by the various bodies concerned with the building and engineering industries, the CIOB research (carried out in 2007) revealed that a surprisingly large proportion (18% of all projects) were being constructed under a bespoke contract form[22]. Only 25% were being constructed under a standard form of lump-sum contract. Partnering contracts accounted for 11% of projects underway, but by far the greatest percentage of projects, 31%, was being constructed using a standard form of design and build contract. The research results showed no correlation between the types of procurement route taken and the incidence of delayed completion.

2–022 The standard forms of contract are generally drawn up by a committee of representatives from most of the typical interested parties, developers, contractors, specialist contractors and licensing authorities all being represented[23]. Those forms cover most of the risks in construction and they represent a compromise. Many commentators, however, consider that they favour one party, or the other, too much in their allocation of liability.

2–023 Notwithstanding that the majority of those who encounter the standard forms of contract will be without any specialist legal knowledge, the contract form is the first reference by which risk is assessed and, in the event of a dispute, the first source of reference for an analysis of the respective powers and duties of the parties. For this reason, any commentary on the standard forms must, to an extent, deal with the interpretation of the contract.

2–024 A construction contract is a trade-off between C's price for undertaking the work and its willingness to accept risk. The purpose of the contract form is thus to delineate, with some sophistication, the powers and duties of the parties, thereby apportioning risk in a way considered acceptable in the industry[24]. A contractor carrying risk should expect to see that reflected by an increase in the contract price, whilst a developer who carries a risk should thus expect to have to pay less for the project. However, experience tends to show that contracts that appear to transfer risks to the contractor without proper consideration as to whether C is the best-placed party to bear them are often ineffective and sometimes even deceptive.

2–025 The fact that so many important public and private projects, both domestically and internationally, have consistently run late and significantly over budget demonstrates that ill-considered risk transference simply does not work. It fails to achieve its objective because under no form of commercially viable contract can the risk of change be borne by C when D is the only one empowered to make that change. Moreover, delay, disruption and overspend are inevitable when all the risk of change, whether express or implied, is borne by D, but the only party given the tools to manage that risk[25] is C, which is also promised that it will receive more time[26] and more money[27] when

22 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008).

23 On the other hand, most subcontracts, apart from the FCEC subcontract ("the blue form"), are drafted without the benefit of consultation with representative bodies.

24 For a listing of those risks often borne by D under the standard forms, see Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), at App.1.

25 The programme and method statement, the records of progress achieved and the availability and productivity of resources.

26 Via the contract provisions for extensions of time.

27 Via the contract provisions for compensation for loss and/or expense.

those risks are not managed. Despite this approach being illogical, it is the approach that governs the administrative framework contained in all the current standard forms of construction and engineering contracts.

2–026 The first essential characteristic of a standard form should be that it is drafted with clarity, so that it is possible easily to ascertain from the wording precisely where the risk falls. However, this is a standard which has not yet been met by any of the standard forms of contract, discussed here, other than the 2009 edition of the Irish government standard forms and the CPC.

2–027 The absence from most of the standard forms of contract of any clear and unambiguous mechanism for calculating C's entitlement to compensation and time is one of the major sources of risk for D[28]. Take, for example, ICE7. This form leaves the noun "delay" open to at least two different interpretations in sub-clauses of the same clause. Clause 44(1) requires that C must notify the CA within 28 days of the date upon which the delay has arisen. Now "the delay (that) has arisen" must be a delay to progress (of one variety, or another), since otherwise it would have to be a delay to the completion date and that could not have occurred until after the completion date had passed, would be patently obvious and would not require any notice. Clause 44(3), however, goes on to say that, provided the CA is satisfied that "the delay suffered fairly entitles [C] to an extension of time", the CA is to grant an extension of time. An extension of time is for the relief of liquidated and ascertained damages, which are not recoverable for a delay to progress; they are only recoverable if there is a delay to a certain, specified, completion date. The second "delay" must therefore mean a delay to the completion date, and that cannot have been "suffered" (in the past tense) until after that completion date[29] has passed. It follows that, notwithstanding that they are given the same name, in this form, the "delay" for which an extension of time must be granted cannot be the same "delay" in respect of which notice must be given.

2–028 Unfortunately, this sort of problem is not unique in construction and civil engineering contracts and it is, perhaps, not surprising that the parties have difficulty identifying their rights and liabilities arising out of delay. Indeed, many CAs think it perfectly proper to receive applications for and to grant extensions of time under this form for periods of time entirely unrelated to the contract completion date.

2–029 Similar interpretational problems are provided by the new Hong Kong standard form of building contract, HK05, in which the word "delay" is not defined, but it is apparent from the phraseology used in Cl.25 that the word is probably used to mean at least three things:

1. an event at D's risk as to time and/or cost;
2. a delay to progress of the works; and
3. a delay to the completion of the works.

Under this contract form, C is required to provide final "particulars of the cause and effect and length of the '*delay*' to the works or a section beyond the completion date"[30] and those particulars are to be provided "within 14 days after the '*delay*' ceasing"[31].

28 PM Lane, "Disruption and delay: fair entitlement and the regulation of risk" (2006) 22 Const LJ 92.

29 The completion date in this sense must be the date after which liquidated and ascertained damages may be deducted, ie the contract completion date or the completion date as extended by an extension of time granted.

30 Cl.25.2(3)(c).

31 Cl.25.2(3)(c).

The "delay" to the works is obviously a delay to the completion date and the "delay" that ceased must be a delay to progress. Again, one of D's time risk events is described as "'*delay*' caused by a '*delay*' on the part of a nominated subcontractor"[32]. It seems that the "'*delay*' on the part of a nominated subcontractor" is probably a delay to the completion of the subcontract, but it is not necessarily so.

2–030 It is a common misconception amongst developers that, irrespective of the form of contract chosen, once the lowest tender has been accepted, the contract has been signed between C and D and work has commenced on site, most, if not all, of the risk of failure will rest with C[33]. Unrealistic expectations of the standard forms of contract, the failure to appreciate the strength of a claim because of a difference in appreciation of the facts, the law and the illusion of certainty are all common sources of dispute[34].

2–031 Managing the risk of change is a serious business. When people start thinking about construction, they are almost always thinking in at least six figures and sometimes in tens, hundreds or thousands of millions of pounds. They will also usually be thinking of using what they intend to construct for a specific purpose and, sometimes, that means other time-based commitments and, often, an anticipated financial return which must be achieved in order to justify the expenditure[35].

2–032 When a simple contract is entered into, for example to build, at a price, and within a particular period of time, the contract period is fixed by the contract terms and the risk of failing to complete on time is assumed by C. Thus, if C is delayed for any reason whatsoever, other than through D's default, C must, in theory, compensate D for any loss it may suffer as a result of its not having completed on time. On the other hand, the standard forms of contract have provisions for excusing C from many risks affecting completion time and placing those risks on D[36]. In most standard forms of contract, apart from voluntary design changes, D will typically also be required to take the risk of: implied variations arising out of express, or implied, instructions; a number of other interferences, including those arising out of the acts, or omissions of D, the CA, or of third parties; and delay to the completion of the works beyond the date arising out of the effects of a number of events, over which neither D nor C can reasonably have any control. Unusually, amongst standard forms, the Irish government standard forms of public works contract[37] provide a device for rendering some of the standard form risks job-specific by listing the apportionment of risk of time, or both time and cost.

2–033 Risk registers fulfil the useful purpose of cataloguing the pitfalls that may be encountered in the future. However, it is readily apparent that, no matter how many risk registers are set up and no matter how many times they are reviewed and revised, it is not possible to predict, for example: what plant will break down, or when; whether

32 Cl.25.1(3)(m).

33 In contradiction of that common perception, see Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), at App.1, where the common time-related risks which can be borne by D under the standard forms of contract are listed.

34 I Ndekugri, "Computer-aided resolution of construction contract claims and disputes" (1996) *Arbitration Journal* 62.1, 57.

35 For further discussion as to how contractors and developers allocate and manage risk, see Ch.10, "Project Control".

36 See Ch.4, "Standard form provisions for time and cost".

37 See, for example, IGBW/09.

D will change its mind about what it wants, or when; what drawings the architect will revise, or when; or when the weather will turn nasty. Moreover, it is not possible to predict what activities will be affected by such events, nor how they will be affected. Most of the standard forms provide that C is to notify D if a delay to progress occurs as a result of one of D's risks, but, in terms of risk management, it is of little use to D to be told that one of those events has adversely affected progress when it is too late to do anything about it or, even if there is an opportunity, in the absence of the power to do anything to manage the risk of the likely delay to the completion of the works, which will otherwise follow.

2–034 If D is to be able to manage those risks, it needs always to know what C intends to do, in what sequence C intends to achieve its aim, when it intends to execute particular activities, what resources it intends to use and how C's progress matches its intent. D also needs to know what other permutations are possible and the cost and time implications of any change to C's intent, but D has no enforceable right to any of that information under any of the current standard forms, same for the CPC.

2–035 One of the many difficulties with the currently available standard form contracts is that there is no commonality between the forms as to the distribution of risk and each must be considered individually. Indeed, there is not even any commonality between the forms as to the way the distribution of risk is set down in the forms. In the Irish government standard forms, the opportunity has been taken to follow the recommendations of the *CMS*[38] and list all the risks individually, in a separate schedule. In JCT98 and WCD98, D's time risk events are listed in Cl.25.4, with cross-references to the specific clauses in which the risks are described. A similar structure is contained in HK86 and in HK05[39]. By contrast, the engineering forms tend to refer enigmatically to "any cause of delay referred to in these conditions"[40], and the AIA forms, whilst referring to causes of delay at various clauses of the contract, do not cross-reference these to the extension of time clause at all, leaving the reader to familiarise itself with the document as best it can[41].

2–036 Another example of inconsistency can be found in "re-measurement" contracts[42]. Under this method of procurement, payment is made according to the amount of work actually carried out, at rates predetermined by the contract. Thus, for example, if significantly more earth needs to be excavated in a tunnelling contract than was estimated by D, or its advisers, under re-measurement forms, the risk is D's and it must pay for the additional work. Similarly, under lump-sum contracts based on quantities, a change in the quantities is a variation of the contract and, if based on drawings only, a change in the drawings that changes the quantities will also be a variation. On the other hand, in a contract that fails to provide for a method of adjusting the cost in relation to variations in quantity, C is entitled to be paid the contract price, even if it can be shown that what was accepted as complete did not comprise all the work for which C tendered. In *SWI v P&I Data*[43], the Court of Appeal upheld the decision of the district judge to the effect that, in a contract based upon a tender and drawings,

38 Pickavance Consulting and Fenwick-Elliott, *PFE Change Management Supplement* (2003) for use with the JCT98, 2002 edn series of standard forms of contract. See Appendix 2 to the 4th edn hereof.
39 Cl.25.1.
40 See, for example, ICE7, Cl.44(1)(c).
41 See A201/97 and A201/07 at Cl.8.3.1.
42 See, for example, GC/Works/1, ICE6, ICE7, PCC92, PCC98, PCC06 and ECC2 and ECC3.
43 *SWI Ltd v P&I Data Services Ltd* [2007] EWCA Civ 663.

in which any additional work required had been priced by reference to further tenders and drawings, it amounted to a lump sum contract and not a re-measurement contract. Waller LJ stated[44] as follows:

> "It seems to me that the question whether [D] can seek a reduction in the quoted price comes back to identifying the terms of the contract. If [D] had established that it was expressly agreed that [D] could reduce the contract work and pay less if they did so, they would be entitled to succeed, but they failed to establish that term as an express term. Even if there was an implied term that [D] could request variations and [C] were bound to agree, it cannot be said to be necessary to imply a further term that the price would necessarily be reduced if the contract was substantially the same as the one quoted for."

Furthermore, under lump-sum contracts based on approximate quantities, a variation in the measured quantities is not normally reimbursable unless the measured quantity is significantly different from the actual quantity[45].

2–037 In the absence of a completed design at project commencement, management contracting is sometimes considered to be a viable method of procurement and the Standard Form of Prime Cost Contract[46] is perceived by the construction industry to be a natural alternative to a management contract, since it occupies a middle ground between the JCT lump-sum form of contract, eg JCT05, and management contracts like MC08. Whilst PCC92, PCC98 and PCC06 resemble a management contract in form, because they are also prime cost contracts, they differ from a management contract in several respects. For example, in relation to claims by the management contractor against individual works contractors, there is an argument that a management contractor cannot successfully sue a works contractor. The reasoning is that, since the management contractor is itself indemnified by D under the management contract, the management contractor cannot itself suffer any loss, or damage, for which it can establish a claim. This problem does not, of course, apply under PCC92, PCC98 and PCC06 because of C's performance-specific obligations to D.

Allocation of risk

2–038 There is nothing intrinsically bad in assuming risk. The challenge is in identifying and quantifying the risk assumed and identifying a method of managing it. It is also important to recognise that the transfer of risk to others does not guarantee that it will be managed by them[47] and a risk which is transferred under some circumstances, may be retained under others.

2–039 There is usually a large number of parties involved in a building, or civil engineering project, with differing responsibilities: architects, quantity surveyors, civil structural engineers, mechanical and electrical engineers, project managers, main contractors, subcontractors and suppliers. Their different responsibilities inevitably lead to different priorities.

44 *SWI Ltd* [2007] EWCA Civ 663 at [25]
45 Compare, for example, Cl.51(4) of ICE7 with Cl.25.4.14 of JCT98 and see Ch.12, "Variation and change", at paras 12–075 to 12–109 and 12–190 to 12–195.
46 PCC06.
47 See, for example, the effect that a GMP contract is thought to have had on the management of risk on the Wembley Stadium project, G Bewsey, "No room for manoeuvre" (May 2006) *Construction Manager*.

2–040 It is in the nature of contracting (despite the good intentions of Latham[48] and the promotion of partnering through contracts, such as ECC3 and PPC2000) that the contracting parties will have conflicting interests: it is only during the construction period that C can profit from its labours but, for D, the only benefit occurs after construction has been completed and the works put into use and contractors by their nature tend to want to be paid as much as possible for as little risk as possible, whilst developers generally want to pay as little as possible and to transfer as much risk as possible[49].

2–041 Within limits, who bears what risk and at what cost is a matter of commercial negotiation and the outcome often depends upon the negotiating strength of the parties. However, even in terms of self-interest, this approach can be overly simplistic. If all the risk is transferred to C[50] and it has priced for those risks, then, if those risks do not materialise, D will probably have paid more than was necessary.

2–042 How risks are distributed will depend not only upon the method of procurement, but also the form of agreement under which the works are procured and the duration of the contract under which the risk is assumed. For example, a risk of an adverse economic shift in the demand for property, or materials, may be manageable over three months, but over a period of a few years that risk may be of an entirely different character.

2–043 There are many and varied theories of risk apportionment, some of them contradictory and none of them entirely satisfactory[51]. Some risks may result from several factors and be controllable by more than one party. Other risks, in particular financial and political, may not be susceptible to control at all. These latter types of risk are often insurable risks. The management of that risk is borne by the insurer, as opposed to C, or D, and the level of risk is reflected in the insurance premium, which may change over time if the risk changes. However, taken together, the following principles of risk apportionment are generally assumed to be efficient and fair in the industry at the moment:

1. Risks should be allocated to the party best able to control them, ie the party that is best able to forestall the risk, or to minimise its consequential effects, if it materialises[52].
2. Risk should not be allocated to a party that is unable to sustain the consequences if the risk does materialise[53].
3. Risk allocation should encourage risk management by the party best able to manage the risk. For example, under a management contract, the management contractor should shoulder the risk of delay caused by works contractors[54].

48 Sir M Latham, *Constructing the Team* (London: HMSO, 1994), Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the Construction Industry.

49 J Critchlow, *Practical Issues in Construction Contracts "Risk Allocation"*(London: S J Berwin & Co, 1996). An occasional paper.

50 There is always the possibility of conditions being encountered which neither D nor C could have foreseen, the risk of which is to be borne by C instead of, as traditionally, by D.

51 See for example, DS Jones, "Philosophies of risk allocation – the case for foreseeability" [1996] ICLR 570 and RJ Smith, "Allocation of risk – the case for manageability" [1996] ICLR 549. See also the discussion of the theories of optimal risk allocation at paras 2.3–2.5, above.

52 Whether the draftsmen of the standard forms have produced contracts which allocate risk according to this principle is doubtful. See Ch.10 – "Project control", generally.

53 On the other hand, risks which have very high financial consequences are frequently insurable.

54 However, whilst this may be sound in theory, it is not reflected in the standard forms. For example, MC87, MC98 and MC08 limit the management contractor's liability for the failure of works contractors to those costs it is actually able to recover from the works contractors. In other words, if the management contractor cannot recover the costs from the works contractor, D carries the cost.

4. The party that does not assume primary responsibility for risk should nevertheless be motivated to manage the consequence of the risk if it materialises[55].

2–044 How the risk of contracts is apportioned is usually a product either of the terms of a bespoke contract form written by D and/or of its advisers, or one of the standard building, or civil engineering, forms. The only thing that is certain in this is that, where a standard form is used, the risks of uncertainty will be left almost entirely with D and, where a bespoke form is used, then any ambiguities or inconsistencies in exclusions of liability for the effects of change are likely to be construed *contra proferentem*[56], again leaving liability with D.

2–045 The standard forms of building contract lay down specific rules for distinguishing the risks assigned to the parties. Unless there is also available an action outside the contract, for breach at common law, those risks stated to be in the control of D and those risks only, are risks that carry with them the possibility of C recovering its costs for disruption, or delay[57].

2–046 On the other hand, if it were only acts of "prevention" by D that gave rise to relief from damages for delay, the standard forms would deal only with such matters as late possession of the site, late supply of drawings and information, interference by D's workmen, variations and extras. In distributing the risk, there would then be no need to provide for an extension of time to be granted for neutral events, or those whose effect is sometimes thought to be containable by C, such as weather and strikes or events that go well beyond what most would regard as neutral, in ordinary circumstances[58].

2–047 How the risks on a construction project are allocated can be influenced not only by the contract and the parties themselves, but also by judicial interpretations of common law and statute. For instance, there is often scope for uncertainty as to whether it is the materials incorporated into construction works, or the works themselves, that are subject to implied terms of either good quality, or fitness for purpose. This uncertainty persists despite relevant statutory control[59] and irrespective of how tightly drawn the technical specification may be. In the United Kingdom, the courts have held that contracts that involve the supply of materials, together with labour and skill, as opposed to goods only, are governed by the common law as it stood before the Sale of Goods Acts[60] and therefore the fact that a particular transaction did not fall within the Sale of Goods Acts was of little consequence[61].

55 Whilst some of the standard forms of contract proceed on the basis that this can be by sharing the consequence of risk, for example, Cl.25 of JCT98 provides for C to be excused from the risk of bad weather delaying the work, but the costs of that delay are not recoverable from D under Cl.26. Rarely works as a risk-management device, see D Bordoli, "Weather claims in the United Kingdom construction industry" (2010) 26(1) Const LJ 18.

56 The legal doctrine that the interpretation least favourable to the person putting forward the term should be adopted against them.

57 In the latter part of the twentieth century, it became fashionable to exclude an action at common law by an "entire contract" clause. See, for example ECC3, Cl.12.4. and IGBW/09, Cl.10.1.2.

58 Such as C's inability, for reasons beyond its control, to obtain labour, or materials, in time.

59 See Supply of Goods and Services Act 1982 and Defective Premises Act 1972.

60 In *Young and Marten v McManus Childs* [1969] 1 AC 454, Lord Reid held that the distinction between a contract for "sale of goods" and a contract for "work and materials" was generally that, where C bought defective materials from a merchant, it would have a remedy under s 14 of the Sale of Goods Act 1893. But, if it was known to D and C when the contract was made that the sole manufacturer of the specified materials was only willing to sell on terms which specifically excluded that liability, it would be unreasonable to put on C a liability for latent defects in those materials.

61 This has now been codified in the Supply of Goods and Services Act 1982.

2–048 The apparent inconsistency between the obligation of the professional and that of the tradesman is a problem that has exercised both the courts and the draftsmen of construction contracts. Whilst professionals generally owe an obligation of reasonable skill and care and will be liable for a lack of fitness for purpose only if they are negligent, there is a growing tendency in the standard forms to seek to limit the obligation of the contractor who carries out design to that of a professional[62].

2–049 In general, professional advisers only accept a duty of "reasonable skill and care", leaving a residual risk with D[63]. This is also the case with contractors under the JCT design and build form and under ICE/DC. However, that is not the case with the FIDIC forms, which impose a duty of "fitness for purpose". In the event that C agrees to accept an absolute responsibility of "fitness for purpose", the assumption of such a liability, even if it can be insured, can reasonably be expected to result in a higher price being paid and a greater degree of control being required by C over the project than is normally available to it.

2–050 It has also become common for suppliers to exclude liability for fitness for purpose and to limit their liability for goods to be free of defect to an obligation to carry out the replacement of a defective product. Many suppliers include such restrictions in their standard terms of trading. It is not unusual for subcontractors to seek to cap damages, howsoever incurred, both liquidated and unliquidated, in order to attempt to restrict their exposure in a way that is commercially realistic.

Project planning and programming risk

2–051 Effective project planning and programming are at the very root of time control[64]. There are fundamental aspects of planning that require a conceptual approach similar to designing and it involves making decisions concerning:

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

2–052 The importance of the project programme to time management cannot be over-emphasised. Without a dynamic time model that will react dynamically to change, it is not possible to forecast when work is to be carried out, assess its criticality, the impact upon successor activities, the required resources, identify the likely effect of intervening events, nor to calculate and quantify liability for the consequences of delay to progress. The absence of any enforceable requirement for this compounded by the absence of consistency of approach to the requirements for programming does not encourage time control under any of the standard forms of construction, or civil engineering contract, same for the CPC. Some forms, whilst requiring a programme, give

62 J Uff, QC, "Standard contract terms and the common law" (1993) 9 Const LJ 108.
63 Architects, engineers and quantity surveyors are generally required to carry professional indemnity insurance and are thus restricted by the terms their insurers will accept.
64 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010).

no definition of its content, nor specification for its integrity and some have no requirement for a programme at all. The requirement, in some forms of contract, for a target schedule to be produced prior to contract, which is not to be changed without the CA's permission, actually inhibits effective time control.

2–053 By way of example, on the one hand, the requirements for the programme in HK05 appear to be detailed and a significant improvement upon HK86 (which contained no provision for a programme at all); but, on the other hand, the programming provisions are not well thought out, are based upon archaic provisions in earlier UK and Hong Kong forms and are unworkable as a result of the way they are expressed. In this regard, it is worth observing that HK05[65] provides that:

> "where any other part of the contract sets out requirements in respect of the submissions made by [C] under clause 3.1, the submissions shall be made in accordance with those requirements".

This appears to be a veiled invitation to draft in the contract specification, or bills more detailed functional requirements for the programme, to take priority over Cl.3.1. However, if that was the intention, then it is rather clumsily expressed and, in view of the fact that the conditions of contract are to take priority over anything written in the contract specification or bills[66], anything written therein, intended to overcome the inadequacy of this clause, would seem to fall foul of that hierarchy and provide a circularity that can only be overcome by a variation instruction to resolve it[67] (and that, in turn, is both a D's time and cost risk event).

2–054 Similarly, neither the AIA forms nor the JCT family of contracts make any provision at all as to the methodology of linking progress to a programme, or as to monitoring. The Irish government forms contain an eclectic mixture of desirable standards, irrelevance and ambiguity in their programming requirements. Except in the minor works form, which has even simpler requirements, these standard forms require C to provide a detailed programme to the CA before the starting date[68]. Bearing in mind that the starting date is identified as not more than 20 working days from the date of contract, in order to achieve that, within that period, C would have had to have, for every part of the works:

> the detailed design completed,
> the subcontractors appointed,
> the subcontractor's programmes agreed, and
> the subcontractor's resources and productivity identified.

Thus, in all but the simplest of build-only projects, to provide anything meaningful would appear to be impossible to achieve. Where it is anticipated that C will complete the design after commencement of the works (as in IGDB/09 and IGCEDB/09), the requirement to programme the works in detail within 20 days of the contract being awarded is difficult to rationalise.

2–055 On the other hand, Cl.4.9.1 only requires that the programme should be sufficient for "effective monitoring of the works" and it does not require that it should be sufficient for project control, nor for managing the parties' time risks under the contract and facilitating

65 Cl.3.1(4).
66 Cl.5.1.
67 Cl.2.4.
68 See for example, IGBW/09, at Cl.4.9.1.

a competent calculation of entitlement to an extension of time and/or compensation for prolongation of the works. In this, as with the JCT forms, the Irish government forms fall significantly short of what is reasonably necessary for effective time control.

2–056 Of all the standard forms currently available, only ECC3, C21/09 and the CPC contain anything like a sensible contractual link between the programme and C's entitlement to an extension of time. However, again, those forms are lacking in any requirement as to the integrity of the programme, or any enforcement provisions. Experience shows that, in the absence of powers of enforcement in the contract, the administrative arrangements contemplated are rarely followed[69].

2–057 In considering the effect of risk on timing of activities at the project-planning stage, it is one thing to acknowledge that time estimates are unlikely to be 100% accurate and that unforeseen events may occur, but a different thing entirely to do nothing at all about it. A common solution to the problem of estimating uncertainty is to add a contingency. For example, the Irish government public works contracts provide that C is to include in its programme a contingency period for delay to the completion date caused only by the compensation events identified in the schedule, Pt 1, section K to the conditions of contract[70].

2–058 Alternatively, in the absence of any contingency planning, C might hope to use float as contingency[71]; however, when float is thought of as contingency and is embedded in the programme, it is not unusual for it to cease to become contingency from the moment it is hidden. Another way of dealing with the estimate of risk in proactive planning is to use a Monte Carlo simulation to demonstrate the potential variances in duration of a particular activity and ultimately of the project as a whole. A simple risk analysis such as this can be helpful at the outset of a project, not only in identifying the options available to achieve completion on time, but also in assessing the amount of time and/or cost contingency that may reasonably be required in a programme, or budget.

2–059 Whilst most construction and engineering works will have many activities that can be categorised as "conventional" and that have low uncertainty levels, a few activities on most projects will have medium, or high uncertainty levels. Based upon probability estimates for each activity, in the early stages of a project the Monte Carlo model can be used to derive a probable completion date, although the date calculated will be dependent on how task uncertainties are modelled. In the end, the result calculated will simply be the result of the probabilities assumed.

2–060 The potential downsides of this type of risk analysis, however, are threefold:

1. it is difficult to apportion liability for the risks notionally provided for;
2. at anything other than low density, high level programming, it can inhibit efficient time management; and
3. there is an understandable reluctance, born of commercial pressure, to avoid using terms like "probably" and "a good chance that" when determining project time scales, but it is axiomatic that few things are certain.

2–061 Computerised simulation using systems dynamics techniques[72] can also be highly effective in identifying the potential effect of time risk events upon activities comprising

69 See, for example, *Masons v W D King* [2003] EWHC 3124 (TCC).
70 See, for example, IGBW/09, Cl.9.4.2.
71 See Ch.16 "Float and time contingencies".
72 The software employed was "I-Think", a product of Isee Systems Inc.

an amalgam of clearly identifiable repeated cycle times such as piling, pipelaying and tunnelling. The previous author used this technique successfully in identifying the potential risks of events and recovery measures in LNG gas pipelines and it has also been used in tunnelling[73]. Whereas a Monte Carlo simulation will produce a static set of multiple results accounting for the variety of potential input conditions, a systems dynamics model will produce a single output result, which can be dynamically adjusted in real time by altering the input to achieve the optimum balance of time and cost.

2–062 In essence, the process involves an analytical model of the operational cycle made up of statistical elements that can be addressed to achieve a model of the likely outcome of a combination of contingencies and recovery measures. The benefit of this sort of modelling is that the final model can be adjusted by varying the values to be applied, instead of using the deterministic values required by the Monte Carlo simulation, or spreadsheet modelling.

2–063 In relation to assessment of the credibility of completion periods at tender stage, BCIS[74] has conducted research over a broad range of project types and values to produce a report on typical construction periods[75]. It is accompanied by a computerised calculator, which can usefully be employed to assist in the assessment of the credibility of tender periods offered by contractors for a given project type and cost, or to assist in measuring the practicality of achieving the construction period required by D.

Legal risk

> *"It goes without saying that attention should be paid to the clear drafting of contracts. Uncertainty as to the meanings of contract terms reduces the effectiveness of project management as resources need to be channelled into discussions about the division of responsibility within the project. Ultimately, uncertainty may lead to conflict."*[76]

2–064 Those issues typically addressed by the standard forms of contract are:

1. which party is responsible for any inadequacy; and
2. whether the professionals, the contractor, specialist subcontractor, or the material supplier bears the risk of:
   - 2.1 the quantity of work required;
   - 2.2 the quality of work required;
   - 2.3 the cost of the work required;
   - 2.4 completion to the agreed dates;
   - 2.5 a defect occurring as a result of errors in design;
   - 2.6 latent defects arising as a result of bad workmanship, or faulty materials;
   - 2.7 safety and accidents; and
   - 2.8 damage and liability to third parties arising from the works.

2–065 Legal risks can arise in two ways. On the one hand, there is the possibility of a change in the law (or a change in the way the law is interpreted) after contract, which

73 PT Haylen and JC Senogles, *Application of Computer Simulation Techniques in Tunnel Construction, Planning and Risk Management*, Proceedings of the International Conference on Process Re-engineering, Queensland, Australia, July 1997.
74 Building Cost Information Service, a trading arm of the Royal Institution of Chartered Surveyors.
75 Building Cost Information Service, *Guide to Building Construction Duration*, 2004, and Building Construction Duration Calculator.
76 M O'Reilly, "Risk, construction contracts and construction disputes" (1995) 11 Const LJ 343 and see *Linden Gardens Trust Ltd v Lenesta Sludge Disposal Ltd* [1994] 1 AC 85.

affects the method of building, the acquisition of plant and materials, or the way in which labour is employed. In some contracts, such changes are treated as *force majeure* (defined under the contract, or otherwise). In others, they are separate risks, usually borne by D. Changes affecting the subject-matter of the contract, or the manner of construction, are unlikely to have retrospective effect, except in extraordinary circumstances. On the other hand, changes in the law affecting the acquisition of materials, plant and labour by, for example, import and export regulations, may come into force during the currency of a contract and, in some cases, can have significant effects on time and on cost.

2–066 The other form of legal risk arises out of a change in the way courts interpret contracts, legislation[77] and other legal obligations[78]. Unfortunately, however carefully the contractual provisions are drafted, it cannot always be guaranteed that the interpretation of the respective duties of the parties, as set out in the contract agreement, will be beyond doubt when subjected to review. In subcontracts and bespoke primary contracts, for example, it is often the case that the provisions for resolving claims apply in one direction only and they are either silent, or ring-fenced by an exclusion clause in the other direction. In such circumstances, the applicable law of the contract may imply various additional terms into the agreement and impose further obligations on the parties. To this extent, the introduction of implied terms into a contract is nothing short of a reallocation of risk by the court.

2–067 The risks arising out of a construction contract will fall either where they are designed to fall in the form of the contract used or, by interpretation, where the courts determine they should fall. It is sometimes the case, for example, that argument will be adduced to give what one party believes to be a "business common sense" interpretation so as to enable it to avoid the express terms of the contract to which it has failed to adhere. This interpretation may be quite different from what is expected by construction professionals, by those who have drafted the forms[79], or where the other party to the contract thought the risk might fall.

2–068 In *Cary v United of Omaha*[80], for example, the court determined that, in the American State of Colorado, every contract contained an implied duty of good faith and fair dealing, violation of which amounted to a breach of contract. This implied term was relied upon in *New Design v Hamon*[81], in which C was responsible for planning, scheduling and reporting the progress of the contracted work, but the subcontract gave C discretion to control the terms of the subcontractor's performance after the subcontract formation, by requiring the subcontractor to:

> "prosecute the work undertaken in a prompt and diligent manner whenever such work, or any part of it, becomes available, or at such other time or times as [C] may direct".

However, in spite of the express wording of the contract, in circumstances in which C failed to provide the subcontractor with a revised schedule showing how it had changed its method of working, C was held to have been acting unfairly and was unable then to hold the subcontractor responsible for delay to the date for completion of its work.

77 As to the risk arising from statutory duties and duties in tort, see paras 2–165 to 2–192, below [?].

78 Consider, for example, the continuing debate about what constitutes concurrency or a global claim and how it should be treated. See Ch.18, "Concurrency, parallelism and pacing", Ch.19, "Total time, total loss and global claims" and Ch.20, "Apportionment".

79 J Uff, QC, "Standard contract terms and the common law" (1993) 9 Const LJ 108.

80 *Cary v United of Omaha Life Insurance Co* 68 P 3d 462, 466 (Colo, 2003).

81 *New Design Construction Co Inc v Hamon Contractors Inc,* Colorado Court of Appeals No: 06CA2011, 26 June 2008.

Illustration

Facts: This was an appeal from the decision of Cranston J in *Compass Group UK and Ireland Ltd (Medirest) v Mid Essex Hospital Services NHS Trust.* The NHS Trust engaged Medirest to provide catering and cleaning services for two hospitals over a period of seven years. There were many shortcomings in Medirest's performance, which, together with reported, or observed, failures, attracted "service failure points". The service failure points awarded by the Trust were, however, often arbitrary. The parties fell out and each claimed that the other had repudiated its obligations and so sought to terminate the contract using the contractual machinery, both parties claiming substantial damages. Cranston J found that the Trust had breached its obligation to "co-operate in good faith" and that there was an implied term that, in operating the deductions from monthly payments and in awarding service failure points, the Trust would not act in an arbitrary, capricious, or irrational manner. He found that the Trust had breached its obligation, but that, since both parties were in breach, the termination notice given by each was valid. Since both parties were entitled to terminate, neither could recover post-termination losses. The Trust appealed. *Held*, by Jackson LJ, that the award by the Trust of an excessive number of service failure points did not amount to a "material breach"; that Medirest's notice of termination was invalid; that the Trust was entitled to pursue its claim for financial relief and therefore its appeal was allowed: *Mid Essex Hospital Services NHS Trust v Compass Group UK and Ireland Ltd (Medirest)*[82].

2–069 The interpretation of the standard forms by the courts generally creates legal authority, subject to the hierarchy of the courts. However, it has been argued that:

> "The decision on a particular contract cannot amount to a principle of law. It follows that a court should be open to persuasion that a decision, even of a higher court, on the construction of the same standard form was erroneous. The same applies *a fortiori* to arbitration."[83]

2–070 The late Ian Duncan Wallace QC also identified a divergence between the courts' expressed intention to interpret the parties' intentions under the contract and the express words used in the form of contract employed:

> "There seems to be an increasingly wide gap in the English courts between their rhetoric (which often effusively purports to offer liberal interpretation in the interest of business efficacy) and their practice which seems to fall back onto the most extraordinary degree of literalism, coupled with an expressed respect for the knowledge and experience of the draftsman, which defies reality and seems more appropriate to the construction of Parliamentary statutes."[84]

2–071 The learned commentator criticised the apparent divergence between what he called the "rhetoric" of such cases as *Antaios v Salen Rederierna*[85], in which Lord Diplock reiterated the long-established principle that the construction of a commercial contract must be made to yield to "business common sense"[86], and what the courts actually did

82 [2013] EWCA Civ 200.

83 J Uff, QC, "Standard contract terms and the common law" (1993) 9 Const LJ 108.

84 I Duncan Wallace, QC, "Beyond the contractor's control" (1991) 7 Const LJ 3.

85 *Antaios Compania Naviera v Salen Rederierna* [1985] AC 191, 201D. See further, Lord Wilberforce's express approval of Cardozo J's seminal "genesis and aim of the transaction" approach in *Utica City National Bank v Gunn* [1918] 118 NE 607 in *Prenn v Simmonds* [1971] 1 WLR 1381, 1384E–F and 1385.

86 Eg *Glynn v Margetson* [1893] AC 351, 357, per Lord Halsbury LC. Ian Duncan Wallace QC, above, fn 84 alluded to the even earlier formulation of the principle in *Ford v Beech* (1848) 11 QBD 852.

the resources applied can give some indication as to whether the labour applied bears the same proportionate relationship to the value of work done as it was intended to do at tender stage. An increase in labour without a proportionate increase in value may indicate a loss in productivity and give an indication as to the period that should be looked at in more detail through other methods.

[Please refer to Figure 9.2]

9–175 As a result of the advances made in the use of electronic spreadsheets over the last ten years or so, the production of automatic illustrations in various formats of the relationship of data has become commonplace.

CHAPTER 10

Project control

Introduction

> *"'Would you tell me, please, which way I ought to go from here?' 'That depends a good deal on where you want to get to,' said the Cat. 'I don't much care where – ' said Alice. 'Then it doesn't matter which way you go,' said the Cat. ' – so long as I get somewhere,' Alice added as an explanation. 'Oh, you are sure to do that,' said the Cat, 'if you only walk long enough'."*[1]

10–001 In its widest sense, project control involves everything to do with the construction process from preparing the contract documents, through document and information flow, quality control, valuation, cash flow and certification, progress, delay, recovery and acceleration. However, in connection with delay and disruption, project

1 L Carroll, *Alice's Adventures in Wonderland* (London: Macmillan, 1897), Ch.6, "Pig and Pepper".

control centres on those last four subjects: progress, delay, recovery and acceleration and, in its widest sense, the management of the risk of change[2].

10–002 Time and change are inseparable. It is fatuous to suggest that change over time can be avoided, or that it is unnecessary, or uneconomic, or unwieldy to facilitate the management of the risk of change within the contractual framework. It has been rightly observed[3] that, in some contracts, D tries to have the best of both worlds by "placing all the usual time obligations on [C] yet dictating and monopolising the management of its schedule". However, it is because D cannot transfer the risks of expressly instructed, or implied change at any price, and cannot transfer most of the other risks at a commercially realistic price, that projects entered into in such a mindset are often doomed from the start[4]. It is also clear that, without adequate controls and sanctions for failure to comply with requirements for the provision of records, provision of a competent schedule and for the revision and updating of the schedule as a result of slippage and other changes, the limited role played by the CA, D, or C on D's behalf, in the management of the effects of change is unlikely to be successful. We now live in a different society from that envisaged by the administrative structure of the standard forms of contract currently available[5]. Improvements in technology, moreover, have now made it both possible and eminently sensible for contractors to manage the construction process more scientifically than they have ever been able to before, and for developers to take a structured and disciplined approach to the management of their own risks of change[6].

10–003 Essentially, the choices available for effective project control and risk management are twofold: transfer D's risk to C so that the risk resides with the party with the tools to manage it, or give access to D of C's management information so that D then has the tools to manage the risk it retains. The former can never work, simply because it is commercially unrealistic. The latter is considered to be the only realistic method of achieving effective project control in construction projects.

10–004 In *Mirant v Ove Arup*, the late HH Judge Toulmin CMG QC reflected upon the benefits of effective project control by reference to a CPM network, saying[7]:

> "The critical path can be defined as 'the sequence of activities through a project network from start to finish, the sum of whose durations determine the overall project duration'.
>
> Duration is only the shortest time if activities on the critical path are carried out in the shortest time.
>
> There may be more than one critical path.
>
> It is important to look at activities at or near the critical path to understand their potential impact on the Project.
>
> Windows analysis, reviewing the course of a project month by month, provides an excellent form of analysis to inform those controlling the project what action they need to take to prevent delay to the project.
>
> Without such analysis those controlling the project may think they know what activities are on the critical path but it may well appear after a critical path analysis that they were mistaken."

2 For an example of project control, recovery and acceleration in practice, see JW Delaney and RR Ott, "A case study in the effective use of schedule control techniques – recovery schedules" (2004) *CM E-Journal,* Construction Management Association of America.

3 See, for example, J Dorter, "Delay and Disruption" (2001) 17 BCL 372, 373.

4 See, for example, *Masons v W D King* [2003] EWHC 3124 (TCC).

5 See Ch.7, "Planning and programming", at para.7–179.

6 See K Pickavance, "Renaissance" (2003) 19 Const LJ 131.

7 *Mirant Asia-Pacific Construction (Hong Kong) Ltd v Ove Arup & Partners International Ltd* [2007] EWHC 918 (TCC), [565]–[570].

Forecasting delay

10–005 Whilst it is recognised by the *SCL Protocol* that it is to everyone's benefit that computerised updated CPM networks are used to forecast the impact of change on completion, many developers, CAs and project managers have difficulty in interpreting CPM schedules and prefer something more simplistic, even if less accurate. The use of monitoring techniques such as: cash flow[8], cost[9], earned value[10] and CTS[11] that produce data, which can be translated into cumulative graphs and which, by extrapolation of the past into the future, can be used to illustrate trends are all useful for this purpose.

10–006 Without CPM-scheduling techniques, the forecast of delay is based on the concept that, if only half as much work as planned has been achieved, the whole task will take twice as long. This productivity ratio is true for any straight-line progression. By applying this concept and multiplying by the original schedule length on an "S"-curve progression, the extrapolation will give a lengthened completion time reflecting the tailing-off of the "S"-curve.

10–007 The line of actual progress can be projected forward to indicate the approximate completion date, assuming that the current performance to date is maintained. It is unwise, however, to make too early a projection, until such time as a consistent trend can be depicted and any irregularities between progress periods have been averaged out. It is sometimes thought that unless 20% of the work has been carried out, it is not possible to make a meaningful forecast[12].

10–008 However, whichever method of non-CPM project monitoring is used, in practice it must be remembered that forecasting the future based on current performance is always going to be an approximation, simply because, amongst other things, non-CPM methods cannot take account of criticality. Notwithstanding that the activities being progressed may be in float, any sharp fluctuations in the average rate of progress will nonetheless affect the predicted completion in non-CPM based monitoring methods. Consequently, such predictions should be recalculated after each review of progress and modified appropriately to reflect any special circumstances, which have had, or will have, a significant bearing on the baseline being used as the target and the average rate of progress.

10–009 The dynamic CPM time model[13], on the other hand, takes account of progress and changes in the critical path, and is the method most likely to produce an output, which bears some resemblance to reality. In particular, by using such a model it is often possible to demonstrate potential changes in construction logic that, if put into effect, could reduce, or eradicate the likely effects of delay to progress in critical activities.

8 See Ch.9, "Revising, updating, monitoring and reporting", at para.9–105.

9 See Ch.9 at para.9–111.

10 See Ch.9 at para.9–116.

11 See Ch.9 at para.9–128.

12 Consider, also, the effect of acceleration and voluntary re-sequencing. See Ch.11, "Mitigation, recovery and acceleration", throughout.

13 See Ch.7, "Planning and programming", at para.7–025.

10–010 The effective use of CPM scheduling, as a tool to minimise the effect of delaying events, depends upon the existence of a reasonable baseline, regularly revised and updated, against which to compare progress achieved[14].

10–011 The working schedule should be used as a tool to project and forecast the consequences of changes to the works, thereby providing management with the tool for control of the works. By impacting the intervening events on the CPM working schedule as and when they arise, the parties can see the likely effect of them on the future conduct of the works, notify the CA of the likely consequences of the event at that time and take corrective action. On the other hand, a failure to do this will often mean that the works fall out of control and will often result in delayed completion, the need for a retrospective delay analysis and dispute.

10–012 It is on the basis of the results of this analysis that C can support its notice of delay[15], if any, and predict the effect, if any, on completion. The narrative in the notice of delay can demonstrate the schedule as planned before the event, the schedule "A" that would result if the new activities took no time at all to complete and the new working schedule, which demonstrates the effect of the new activity on short-term progress and logically calculates the likely effects on completion of the new activity.

10–013 Such revision, impacting and updating requires the continuous attention of a scheduler, the commitment and full understanding of the planning team and the availability of a computer to provide a schedule update after each progress revision. However, once done, even if there has not been appropriate recognition of the rights and liabilities of the parties during the course of the works, it is very easy for an analyst to take that set of schedules and produce, at very little cost, a composite reasoned claim for an extension of time and compensation based on the master schedules, together with audit trails for supporting information. In the US case of *Sollitt v US*[16], the court observed:

> "When delays are entered into a CPM schedule, even without deserved time extensions this court can analyze the effect of the delays on the critical path of the project."

From this it can be seen how important it is to update and revise the schedule regularly throughout the course of a project and to produce good quality documentary evidence to support it. The *SCL Protocol* and the *CMS* require C not only to update its schedule at minimum regular calendar periods, but also to review and revise the schedule and impact the effect of D's time risk events upon the updated and revised schedule as they occur[17].

The *SCL Protocol*

> *"The Protocol came into being because there was widespread dissatisfaction from all interest groups with how delay and disruption was being treated both during the course of the works and after the contract was completed, if there was a dispute. The Protocol purports to provide a scheme for the management of change which is fair and balanced as between the differing interests of the parties to the contract and which is clear and comprehensive."*[18]

14 See Ch.9, "Revising, updating, monitoring and reporting", at paras 9–091 to 9–096.
15 See Ch.5, "Notices, claims and early warnings".
16 *George Sollitt Construction Co v The United States*, No 99–979 C (2005), 26.
17 See Ch.9, "Revising, updating, monitoring and reporting", throughout.
18 See "SCL Delay and Disruption Protocol: A Curate's Egg", *http://www.rics.org.uk* (accessed July 2010).

10–014 At a meeting of the Society of Construction Law, in London, a group of members got together to discuss the way delay issues were handled by both the parties and the courts, with a view to making the resolution of delay-related disputes more predictable. About two years later, in October 2002, the *Delay and Disruption Protocol*[19] was published: the thesis propounded was that, if the impact of events could be impacted upon a CPM network schedule, which was up to date at that time, the effect could be calculated and measured instead of guessed; further, this would be greatly to the advantage of everyone concerned with delay in construction contracts.

10–015 On its face, the *Protocol* is a guidance note for a transparent procedure for dealing with the award of additional time and/or money to the party not at risk for the effects of change. However, it is much more than that. It is also a guidance note for project control and the management of the effects of change. At once, through recognition that the schedule is a dynamic tool for the management of time, it advises that the likely effect of a delay to progress, or disruption arising out of both voluntary and unplanned change, can be calculated and, once the likely effects are recognised, the risk of subsequent delay to key dates can be minimised (or overcome entirely) by revisiting the planning and resource assumptions and re-scheduling to overcome the effects of that change.

10–016 Although, initially, it was drafted with a view to simplifying delay-related disputes and retrospective delay analysis, the *SCL Protocol* is primarily a guide to the way the drafters think that projects should be controlled and delay and disruption ought to be managed, contemporaneously. The purpose of managing the effects of delay to progress contemporaneously in this regard is to:

1. give D advance notice of the likelihood of delay to the date for completion;
2. provide speedy, contemporaneous resolution of issues of delay and extensions of time;
3. remove the guesswork in certifying extensions of time;
4. provide speedy, contemporaneous resolution of compensation for loss and expense;
5. remove the guesswork in identifying periods of reimbursable time loss;
6. improve C's cash flow during the construction period;
7. create a structure and discipline by which the implementation of efforts to avoid delay to progress and to completion can be monitored;
8. avoid the retrospective production of claims; and
9. reduce the likelihood of disputes.

10–017 It is not always appreciated that, conceptually, there are three distinct aspects to the *Protocol*. That which appears to be most commonly referred to is the guidance in section four. This concerns methods of retrospective analysis available to the parties if the recommendations of the *Protocol* for contemporaneous analysis of cause and effect have not been followed during the course of the work. That section is intended to be applicable to every form of contract, whether bespoke, or standard, in all jurisdictions. Accordingly, that section does not deal with contracts, or the law, it simply deals with methods of retrospective analysis of cause and effect available to the parties when the recommendations of the *Protocol* (as to contemporaneous analysis) either have not been followed or have failed[20].

19 The Society of Construction Law, "Delay and Disruption Protocol" (October 2002).
20 The fact that that is the part that has received most attention is a sad reflection upon the state of the construction industry. See K Pickavance, *Managing the Risk of Delayed Completion in the 21st Century: The CIOB Research* (Society of Construction Law, 2009).

10–018 The second aspect of risk management dealt with by the *Protocol* is the measurement of interim extensions of time during the course of the works. For this, the *Protocol* recommends the use of time impact analysis[21] to monitor the effects of progress and to demonstrate contemporaneously entitlement to an extension of time[22]. That guidance is relevant to any form of contract, which provides for relief from liquidated damages for the likely effect of an excusable event on completion. It applies to most of the JCT forms and several other forms available in the United Kingdom and some available in other countries (but not all the standard forms), and is applicable to all interim calculations of extensions of time. However, in order to put this part into practice under the standard forms of contract currently available, C has actively to wish to do it; it cannot be controlled by D, or the CA under the standard forms of contract as they currently stand.

10–019 Finally, the *Protocol* contains guidance and makes recommendations for contemporaneous project control. That part of the *Protocol* is not on all fours with the provisions of any of the standard forms of contract currently available[23], and it cannot be put into practice without substantial amendments being made to standard forms by the use of the *CMS*, or amendments of a similar scope and like kind[24]. The provisions of the *CMS* are an essential prerequisite of the process of contemporaneous change management under the 1998 series of JCT contracts and provide for D to have the information and power to manage the consequences of its own risks.

10–020 The *Protocol* recognises that C's schedule is the key to change management[25]. That is underlined by Core Guidance Note 1 which, under the heading of "schedule and records", states:

> "To reduce the number of disputes relating to delay, [C] should prepare and the CA should accept a properly prepared schedule showing the manner and sequence in which [C] plans to carry out the works. The schedule should be updated to record actual progress and any extensions of time granted. If this is done, then the schedule can be used as a tool for managing change, determining extensions of time and periods of time for which compensation may be due. Contracting parties should also reach a clear agreement on the type of records that should be kept (see Guidance Section 2)."

The *Protocol* requires C to prepare a schedule, using the critical path method, showing the manner and sequence in which it plans to carry out the works, on computerised planning software, which will react dynamically to change, and submit this to the CA,

21 Also referred to as a "modelled/additive/multiple base" analysis, see American Association of Cost Engineers International, *Forensic Schedule Analysis, Recommended Practice No 29R-03* (2009) and see Ch.15, "Forensic programme analysis" at paras 15–149 to 15–163.

22 See also, Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) which, at Pt 4, also recommends this as the method of keeping control of change. In *Forensic Schedule Analysis*, AACE International Recommended Practice No 29R-03, (2009) the method is referred to as an "additive/modelled/multiple base" analysis.

23 See Ch.6, "Extensions of time and time at large", at paras 6–044 to 6–068.

24 The provisions of the ECC2 and ECC3 forms of contract are consistent with the recommendations of the Society of Construction Law, *Delay and Disruption Protocol* (2002), as far as they go. They provide for C to warn D, from time to time, of what its risk is but, they fail to require C to provide a competent CPM network, or progress records, to be delivered to the CA electronically and contemporaneously and, although calling for updates, and inviting revision, they do not provide redress if the provisions are not followed. It also omits to provide D with any significant control over the management of its risks.

25 Guidance Section 2.

in electronic format, for acceptance[26]. The details of how this is to be achieved in practice is now the subject of Pt 3 of the *CIOB Guide*[27].

10–021 The *Protocol* recognises that, because it is impossible, at the outset, to get all the information necessary to plan the whole of the works to an adequate level, the schedule must be prepared in differing degrees of density and regularly reviewed and updated[28].

10–022 It is expressly recommended that the schedule should be a CPM network designed to react dynamically to change and the *Protocol* recommends that the schedule should avoid the use of total float constraints, open ends, negative lags, or mandatory constraints *which* are likely to prevent the critical path from being accurately identified and inhibit the schedule from adequately reflecting the effect of progress (or lack of it) on the likely completion date[29]. The reason for this is the underlying assumption that, unless both parties to the contract can identify relatively accurately what progress C has actually achieved in relation to the progress it planned to achieve at any given moment, it is not possible to take appropriate decisions as to what steps can reasonably be taken to effect recovery from delay to progress.

10–023 The *Protocol* advises that C's schedule should be prepared as a critical path network on industry-standard commercially available software[30]. Much has been done to advance project-planning software in the last decade or so. But, even now, the best project management software is by no means perfect. All have their foibles and deal with particular situations in different ways and much development work is still to be done[31]. As a result of the progress made since the times when hand-drawn bar charts were considered appropriate for monitoring progress, the *Protocol* advises that, although illustration of a network as a bar chart may be acceptable, except in the simplest of projects, bar charts alone are no longer an acceptable way of preparing schedules[32], and that, instead, schedules should be prepared as a properly worked out CPM network, preferably resource loaded[33] and supported by a method statement[34].

10–024 The guidance notes state that the activities on C's schedule must be identified as precisely as possible in the light of the information available at the time it is prepared[35]. Each activity and its relationship with each other activity is to be set out

26 Para.2.2. This is not called for by any of the current standard forms of contract, although it is common in bespoke form; see DB Giegerich, "Early warning signs of troubled projects", CDR.02, 2002 AACE International Transactions.

27 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010).

28 Paras 2.2.3–2.2.4. See also Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), throughout.

29 Para.2.2.8. See also Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 3.

30 Para.2.4.

31 See Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.3.6 and App.2 for a commentary on the suitability of much of the currently available scheduling software.

32 Para.2.2.1.1.

33 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) takes the view that it is unacceptable for the duration of activities and sequence at high density, short-term part of the schedule not to be calculated by reference to the resources to execute the work and the productivity they are expected to achieve.

34 See also Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), throughout.

35 See also Ch.7, "Planning and programming" for a description of how this is to be accomplished in practice.

in a method statement, which explains the sequence of activities on the schedule and both the schedule and the method statement are to be fully cross-referenced[36] and passed to the CA, in electronic format[37], for acceptance[38].

10–025 The *Protocol* adopts the position that the approved schedule should not be contractually binding upon C, or D; it is a dynamic management tool, which will model C's intended timescale of the contract scope of work and produce a prediction of the sequence of activities to completion, based upon the best information available at the time it is prepared[39]. The *Protocol* recognises that information will improve as the project goes forward, and as better information becomes available, so the schedule is to be reviewed and revised with better information[40]. Each "approval" is therefore not so much a shift in liability as an acknowledgment by the CA that, at the time it is approved, the schedule is as good as it can be and it can safely be used as a baseline from which to measure the likely effect of change on C's intent for the future conduct of the work[41].

10–026 Record-keeping is the second area covered by the principal recommendations of the *Protocol*. At Guidance Note 1.2.3, it advises that:

> "If the good practice promoted elsewhere in the guidance notes with regard to keeping of records and preparation, acceptance and updating of schedules is followed, then the scope for factual disagreement about a claimed entitlement to an extension of time will be reduced".

Furthermore, at Guidance Note 1.14.2, it states:

> "If [C] has made and maintained accurate and complete records, [C] should be able to establish the causal link between the [D's cost risk event] and the resultant loss and/or expense suffered, without the need to make a global claim. The failure to maintain such records does not justify [C] in making a global claim. The Protocol's guidance as to the keeping of records is set out in guidance section 2."

Notwithstanding this good advice, six years later the CIOB research found that the standard of record keeping in the construction industry was below an acceptable standard for project control. The executive summary to the report, records that[42]:

> "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.
>
> 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.
>
> 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.

36 Para.2.2.1.2.
37 Paras 2.2.1.5 and 2.2.3.
38 Paras 2.2.1.3 and 2.2.1.4.
39 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) refers to this as the "Time Model".
40 Para.2.2.3.
41 Para.2.2.2.
42 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), Executive Summary, at para.21.

> 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.
>
> 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."

10–027 The key to good record-keeping is an awareness of what the records are going to be used for and the provision of a storage system, which renders the information easily retrievable. The *Protocol* advises that records that do not keep the right information, or systems of record management, which render information irretrievable except over a long period and at a high cost, are inaccurate, or are simply not available to the party charged with the risk, are not acceptable[43]. The *Protocol* contains detailed recommendations for the drafting of contract clauses for the keeping of construction progress records. In principle, under this clause, D and C agree that there shall be regular records kept by C identifying generally the activities, labour, plant, subcontractor work on site, delivery of material to the site, list of any instructions given, weather conditions and any delays encountered. These records are to be submitted regularly to the CA or D on a weekly or monthly basis and summarised in a report format[44].

10–028 Next, the *Protocol* covers the update of C's schedule. This process always involves taking account of progress actually achieved and may also involve a review and amendment of the schedule depending on the circumstances prevalent at the time. The *Protocol* advises that updates should be carried out at regular intervals, probably no less frequently than monthly and, on some projects, more often[45].

10–029 Updating the schedule can be a time-consuming operation during periods of intense activity and, if it is to be effective, it requires good quality progress information. But this is the key to change management. Without good quality information about that which has happened in relation to that which was planned to happen, nothing can safely be decided about what to do about it in the future.

10–030 The recommendation that C should update its schedule regularly and hand it over in electronic format has not found a great deal of support from some parts of the legal profession, or from some contractors. From the legal point of view, the policy of the *Protocol* has been said to be contrary to what is sometimes thought to be a good idea in making the schedule a fixed and static diary of events that C is bound by

43 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) Pt 4 requires that all records are to be kept electronically on a database and recommends the use of a relational database.
44 A detailed description of what records should be kept and how they should be recorded and retrieved is set out in Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 4.
45 Para.2.2.1.5. See also Ch.9, "Revising, updating, monitoring and reporting".

contract to perform[46]. So, for example, in relation to the Australian standard forms of contract, it has been said that:

> "Construction professionals were of great assistance with the increasing emphasis on the schedule. Rapidly did it rise from a management tool to a contract document."[47]

To the contrary, the *Protocol* recognises that the schedule should not be contractually enforceable and that a schedule cannot be used as a management tool unless it functions dynamically to take into consideration the effects upon it of progress achieved, events as they occur and better information as it becomes available. It is a matter of common experience in the industry that a static schedule cannot be used as a management tool and historically has never been used for that purpose. Indeed much of the criticism of the schedule in the past has been based upon its failure to function in the light of change! It is apparent that fixing a tender schedule (which can rarely be more than an inspired guess) as a contract document with performance standards as to timing, which can only be enforced by the power of termination, is not in the interests of either party[48].

10–031 The reasons given for objection to D having electronic access to C's schedule and updates are many:

1. doubt about the reasonableness, or otherwise of the schedule and the competence of the planning;
2. reluctance to indicate that completion on time is unlikely to be met without some form of recovery, or acceleration;
3. absence of sufficient, or sufficiently competent planning engineers to reassess the schedule;
4. the cost of the management process of updating and re-sequencing;
5. the desire to hide the likelihood of culpable delay until it can be identified in association with delay caused by a risk for which D is responsible[49]; and
6. doubts about the way the scheduling software works; and many more.

Doubts about the competence of planners and their work product can obviously be dealt with in time by improved training and education[50]. Reluctance to be open and straightforward in the reporting of the current state of the work requires a change in mindset of contractors, which probably must be matched by a change in mindset of developers and CAs in dealing promptly with C's entitlement when it has any.

10–032 It is a mistake to think of the cost of effective project control as an additional cost. The comparison usually made to support such an argument is the gross tendered cost without the project controls against the gross tendered cost with project controls.

46 See, for example, AS2124, AS4000 and consider also the status of the time schedules in ACA98 and PPC2000.

47 J Dorter, "The effect of contract clauses on claims for delay and disruption" [2002] LCRL 312, 314.

48 See also Ch.7, "Planning and programming", at paras 7–222 to 7–228.

49 See, for example, Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), at Chart 48 for the reasons given for not promptly notifying delay to progress; and see also *Great Eastern Hotel Co Ltd v John Laing Construction Ltd* [2005] EWHC 181 (TCC) in which C was found to have deliberately falsified its schedule updates with a view to concealing its culpability.

50 In this regard, amongst other things, the CIOB has set up a working group under the chairmanship of David Tyerman to set standards of education and training with a view to establishing a respected qualification in time management. Further, the objectives of the Project Management Institute's College of Scheduling are to encourage and facilitate education, certification, and professionalism in project planning, programming and project management.

This superficial but false comparison between project cost without control and that with control is made on the basis of the mistaken assumption that the projects are directly comparable and that the project that is not controlled will complete on the same date and at the same cost as that which is project controlled. Research[51] and experience both tell us that the likelihood of that occurring is very small indeed in anything other than the simplest of projects. Research in the United States has shown this to be a false comparison when project out-turn is taken into consideration:

> "The application of modern scheduling techniques appears to pay off in better project performance. The analysis found that the application of four specific project scheduling practices early in the project life cycle have a positive and significant relationship with the ultimate success of the project. The study also presented a single measure of schedule definition, which is significantly correlated with all four measures of project success. The results from this study clearly support the assertion that using project scheduling techniques early in the project life cycle improves the chances of project success.
>
> In terms of the potential value added, the data show a significant improvement in outcome performance to justify the additional investment. Projects that reached the highest level of schedule definition at the time of authorization had, on average, 8 percent lower cost and 13 percent faster schedules than the projects with only milestone schedules at authorization. In addition, the projects with well defined schedules also were more predictable than the projects with only milestone schedules. They averaged 6 percent less cost growth and 23 percent less schedule slip. These benefits easily outweigh the cost of competent scheduling support, which should amount to less than one percent of the project cost."[52]

A reasonable comparison of cost can be made by taking into consideration the project risks and the likely prolongation costs, which will have to be paid in respect of a project not properly controlled against one that is. In most complex projects, that comparison will demonstrate that the costs of adequate project controls are not only not an additional cost, but actually represent a substantial saving over what is otherwise likely to have to be paid out.

10–033 In a recent example of the author's experience, concerning a complex road scheme, adequate project controls would have added about $5m to the tendered cost of around $150m where the delay analysis revealed that the unavoidable delay to completion would then have been about three months at a cost of approximately $30m in prolongation costs[53]. Properly controlled, this would have represented an additional cost to tender of about $35m. On the other hand, the absence of effective project controls resulted in a delay to completion of 18 months, a claim of $160m and dispute resolution costs of approximately a further $35m, an additional cost to tender of $195m. In this case, the cost of adequate project control would not have been an additional cost, but would have saved $160m, and not having adequate project control was more than five times the cost of having it. In the author's experience, those statistics are not unusual but are probably modest in relation to the difference that could have been made to the outcome of the Wembley Stadium[54] project and the Scottish Parliament building[55].

51 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century*, June 2008.

52 Dr AF Griffith, "Scheduling practices and project success" 2005, AACE International Transactions.

53 The cost of unavoidable but unforeseen changes in, amongst other things: scope, variations arising from ground conditions and subsurface services, etc.

54 See Ch.2, "The risk of development", at para.2–087.

55 See Ch.3, "Project procurement", at para.3–046.

10–034 It should be recognised that some cost of some project control is always required to be included in C's preliminaries, but it is not always easy to identify, not always expended and the amount included is not always sufficient to cover the specified scheduling and record-keeping tasks. If the costs can be clearly identified, it gives the CA control over what is done and ensures that D is not required to pay for something that is not ultimately provided. Doubts about the way some scheduling software works, and the facilities provided, which enable a lazy planner to produce something superficially convincing but useless, can be answered only by competent specification of standards, appropriate contracts and quality control.

10–035 It is not usually feasible to progress from a minimum standard of acceptability in scheduling to the highest standards reasonably possible in a single leap[56]. In the end, sensible progress can be made only by constantly striving for improvement in practices, whilst coping with the effects of changing standards as they are developed[57]. To those who doubt the wisdom or practicality of improving standards of planning there are only philosophical answers[58].

10–036 For the purpose of calculating its entitlement to an extension of time, the *Protocol* recommends that C should be required to update and review its schedule and impact upon it the sub-network describing D's time risk event before recalculating the completion date. It is this recalculation that determines what is the effect (if any) of D's time risk event on progress, what is likely to be the effect on future progress and what is likely to be the effect on the completion date (if any)[59]. If the calculated impact of the event demonstrates a likely adverse effect on the completion date, C must give notice of delay as the contract requires it[60]. If these new activities are in float, they will not affect the completion date and, in so far as the contract specifies that C is entitled to an extension of time only for those events, which are likely to affect the completion date, no extension of time will be due[61]. In relation to float[62], the *Protocol* recommends, that:

1. the ownership of float should be specified in the contract[63];
2. float can only be accurately calculated by reference to a CPM network, competently updated[64];

56 In the report Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), The CIOB said "The continuous pursuit of excellence in construction management is key to greater effective collaboration, the continued satisfaction of the industry's client requirements, and the sustained delivery of successful projects in the 21st century. With a view to reducing the incidence of delayed projects, The *CIOB* will provide standards in effective time control by facilitating education and accreditation. We will promote an increased awareness of the importance of project planning and scheduling in the industry. We will also provide: A career structure for project planners and schedulers, standards, education and qualifications in project scheduling and training in effective time control for other professionals in the industry." The first stage of that process was accomplished by the publication in 2010 of the Chartered Institute of Building's, *Guide to Good Practice in the Management of Time in Complex Projects.* However, notwithstanding that the *CIOB* has already set up a working group to develop it, it may well be five years or more before suitable education, training and accreditation delivers the first properly qualified, competent schedulers.

57 See, P Weaver, "A brief history of scheduling – back to the future" (February 2008) *PM World Today*, and K Pickavance, *Managing the Risk of Delayed Completion in the 21st Century: The CIOB Research* (Society of Construction Law, 2009).

58 Indeed, to those who would prefer not to travel at all rather than run the risk of incident on the way, there may be no answer at all.

59 Society of Construction Law, *Delay and Disruption Protocol* (2002), at paras 3.2.6–3.2.13.

60 See Ch.5, "Notices, claims and early warnings".

61 See Ch.6, "Extensions of time and time at large".

62 See Ch.16, "Float and time contingencies", throughout.

63 Para.1.3.3.

64 Para.1.3.9.

3. C should not rely on float as an implied time contingency, but should expressly identify its required time contingencies in its schedule[65];
4. there is an important distinction to be made between the way float affects entitlement to extensions of time and the way it affects entitlement to compensation[66]; and
5. the time aspect of residual float in the schedule (whether free float, or total float), should be available to C or D as is required by them[67].

10–037 The *Protocol*'s position on float has been strongly criticised by many. The criticisms have largely been directed at the fifth point, above, in relation to the current standard forms of contract in the United Kingdom and without reference to the other recommendations in the *Protocol*, and perhaps forgetting that the *Protocol* is intended to be prescriptive of the way the standard forms should work in the future, rather than descriptive of the way they work at the moment.

10–038 However, no matter what the contract says, it seems that most contractors would prefer to be entitled to an extension of time for the shift in timing of any activity, whether, or not it was likely to cause delay to completion, if only because that is easier to demonstrate than the effect of a delay to progress on completion. However, that is not the way HH Judge Hicks QC thought float should be treated in *Ascon*[68], and it is not the recommendation of the *SCL Protocol*[69].

10–039 The *Protocol* recommends that contracts should provide that, if the recalculation of the critical path (and hence the completion date) shows that any part of the added sub-network is on the critical path at any point, then the planned completion date is likely to be adversely affected and an extension of time should then be awarded to the extent of that calculated effect.

10–040 The additional time required to accommodate that event as calculated by the CPM software is added on to the contract period consistent with the recommendations of Colman J in *Chestermount*[70]. By making sure that any sequential slippage caused by matters at C's risk are first accounted for, the possible consequences anticipated by the dispute in *Malmaison*[71] are avoided. In the circumstances in which two concurrent events, that is one at the risk of D and the other at the risk of C, both occur to drive the completion date at the same time, then the guidance given by the Protocol[72] is the same as the position adopted by agreement between the parties in *Malmaison*:

> "if there are two concurrent causes of delay, one of which is a [D's time risk event], and the other is not, then [C] is entitled to an extension of time for the period of delay caused by the [D's time risk event] notwithstanding the concurrent effect of the other event."[73]

65 Para.1.3.8.

66 Core Principles 7 and 8.

67 Para.1.3.1.

68 *Ascon Contracting Ltd v Alfred McAlpine Construction Isle of Man Ltd* (2000) 16 Const LJ 316, 338–339.

69 Para. 1.3.1.

70 *Balfour Beatty Building Ltd v Chestermount Properties* Ltd [1993] 62 BLR 1, 32–34.

71 *Henry Boot Construction (UK) Ltd v Malmaison Hotel (Manchester) Ltd* (1999) 70 Con LR 32, 8–9.

72 Para.1.4.

73 *Henry Boot Construction (UK) Ltd v Malmaison Hotel (Manchester) Ltd* (1999) 70 Con LR 32, 8–9.

10–041 The *Protocol* advises that, once the sub-network has been introduced into the schedule, the actual cost of any disruption or delay to progress can then be monitored against the progress of the sub-network to ensure that C is immediately and adequately compensated for the knock-on costs of the change[74].

10–042 Finally, the *Protocol* recognises that complex scheduling and record-keeping requirements cost money and, if left to competitive tender, these requirements are likely to be omitted, or under-priced. It also recognises that such provisions are useless unless they can be enforced and it provides guidance for setting costs for the provision of management information in the contract and on the sort of redress that might reasonably be contemplated for a failure to produce the information required[75].

10–043 The *SCL Protocol* is published as a best-practice guide for the way entitlement to extensions of time and compensation for delay and disruption should be calculated, but it is also a public health guide for managing change on site and securing effective project control. Through the implementation of a rigorous approach to the keeping of records, updating of calculations and the dissemination of information previously held only by the contractor, by the application of the principles of the *Protocol* the CA will now be able to assist D to manage its risks[76].

10–044 It follows that, if the CA can read, understand and use the information that will then be available, it can also help D to manage the effects of any changes, or acts of interference imposed on C. That management function can then be used productively, so that difficulties can be overcome, or their potential knock-on effects reduced during the course of the works by re-planning, rather than being left to take their own course and then the effects resolved in adjudication, arbitration, or the courts, after it is all over, by compensation[77].

The *Change Management Supplements*

> *"it is far better to have no standard form than a bad standard form. Equally, it is far better to have a good standard form of unilateral provenance than a bad standard form of joint, or agreed provenance."*[78]

10–045 In the absence of any significant movement on the part of any of the drafting bodies of the standard forms of contract, in 2004 the *CMS*[79] was published as an amendment to each of the 1998 series of JCT standard forms of contract to enable

74 Para.1.6.

75 Para.2.2.1.4.

76 In this regard, Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 3, recommends extensive internal quality control and external third party audit.

77 The proposals contained in the Society of Construction Law, *Delay and Disruption Protocol* (2002), are consistent with the thrust of The Latham Report: *Constructing the Team* (London: HMSO, 1994), Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the Construction Industry and with the Egan Report: *Rethinking Construction* (July 1998), the report of the Construction Task Force to the Deputy Prime Minister, John Prescott, on the scope for improving the quality and efficiency of UK construction, although both devised different solutions to the problem they both identified.

78 I Duncan Wallace, QC, "A criticism of the RIBA Joint Contracts Tribunal contracts" (1973) *The Institute of Quantity Surveyors Journal.*

79 That for use with JCT98 appears at App.2 to the 4th edn hereof.

that series of standard forms to perform to the standards recommended by the *SCL Protocol*[80].

10–046 In the same way that other supplements to the standard forms (such as "sectional completion" and "contractor's design") are not suitable for all projects, the *CMS* may not always be appropriate. On the other hand, it seems that for those departments of the state and local government that spend public money, those responsible for the use of trust funds, and those private developers such as the defendant in *Masons v W D King*[81], where completion on time is far more important than the choice between a "horse-deal" and retrospective litigation, the *CMS* may produce a more acceptable way of managing D's risks under a construction contract.

10–047 Each *CMS* contains different conditions according to the contract it is intended to amend, but there are some common themes:

1. the management information structure;
2. changed definitions;
3. new definitions;
4. the role for the risk manager;
5. change management;
6. schedule preparation;
7. schedule update;
8. additions to the appendix to the contract; and
9. schedules of project-specific requirements.

The management information structure

10–048 For the *CMS* to give effect to the recommendations of the *SCL Protocol*, it is generally the case that some significantly different arrangements from those contemplated by the standard forms must be made for construction scheduling, record keeping, provisions for extension of time and compensation. The *CMS* also introduces some new concepts relating to information gathering and electronic exchange and acceleration and the linking of the scheduling provisions to the extension of time provisions. The provisions of the *CMS* replace, augment, or amend some obligations, or impose new obligations in addition to those in the 1998 series of JCT standard forms.

Definitions

10–049 The standard forms are inconsistent in the way they define the date by which C is to complete the works and do not recognise that C could plan to complete by any other date. For example, JCT98 defines the "completion date" as:

> "the date for completion as stated in the appendix, or any date fixed under the provisions for an extension of time, or in a confirmed acceptance of a collateral agreement".

This is unsatisfactorily circuitous and does not provide for a planned completion date independently of a contractual obligation. In contrast, the *CMS* defines the

80 In the light of the recurring criticism of the Society of Construction Law, *Delay and Disruption Protocol* (2002), on the theme of its guidance being inapplicable to current contracts, there has been surprisingly little comment from the industry in relation to the publication of the *Change Management Supplements*. See, however, M Hanson, "Keep taking the supplements" (30 January 2004) *Building* magazine, 48 and A Helmsley, "Protocol's progress" (13 August 2004) *Building* magazine, 41.

81 *Masons v W D King* [2003] EWHC 3124 (TCC).

"completion date" as being the date set down in the appendix as that by which the works are to be completed, or a variation of that date fixed by means of an extension of time, or by collateral agreement, whilst the "date for completion" is identified as that indicated on any schedule by which C plans the work to be finished. In other words, the "date for completion" is what C's schedule indicates will be the date on which the works are likely to be finished, irrespective of the date by which C is contractually obliged to complete the works.

The programme

10–050 Consistent with the usage in the contract, the *CMS* uses the word "programme" for the programme, but defines it as a *CPM* network, together with a method statement, the two of which are to be read together. This principle is also reflected in the *CIOB Guide*, which advises:

> "Consultation and effective communication are pre-requisites of a meaningful and effective schedule and planning method statement.
>
> The purpose of the planning method statement is to facilitate the understanding and co-operation of the participants. It should make clear what constraints have been identified, what assumptions have been made in the process of risk management, planning, scheduling, review and update of the schedule and the reasoning underpinning those constraints and choices.
>
> Because it will have a life independent of those who, from time to time, may be required to work upon it, it is important that the planning method statement is designed for use by those independent of the project.
>
> The content of the planning method statement will change during the development of the project and must be designed to accommodate change in subject-matter, content and source, without compromising transparency between the planning method statement and other time-related information.
>
> Any amendments made to the underlying assumptions contained in the planning method statement will also need to be carefully recorded in a clear and concise manner."[82]

The requirements for the CPM network and the method statement are set down in appended schedules. Initially, the network and method statement are together referred to as the "draft schedule". Once accepted, they together become the working schedule, referred to in the *CMS* as the "master programme".

10–051 The *CMS* recognises that the schedule is to be prepared in stages and regularly reviewed and updated, and because it is impossible, at the outset, to get all the information necessary to plan the whole of the works to an adequate level, the schedule is to be prepared in differing levels of density and regularly reviewed and revised as a rolling schedule. The *CIOB Guide* follows the same principle, but envisages the working schedule as being in different densities dependent upon the proximity of work and the standard of information available[83].

10–052 The activities on the critical path network must be identified as precisely as possible in the light of the information available at the time it is prepared. Each activity and its relationship with each other activity is to be set out in a method statement, which explains the sequence of activities on the critical path network.

10–053 The *CMS* requires that the draft schedule be accepted before it becomes the "master programme" and that any subsequent update of it be similarly accepted as

82 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 2.

83 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 3.

being in conformity with the contract. The *CIOB Guide* advises that, if any submittal is made, it must be accepted, or rejected promptly and should be accepted unless a submittal constitutes, or will lead to:

> an illegal operation;
> a breach of contract;
> a hazard to health and/or safety in the process of construction;
> a hazard to the safety and/or stability of the permanent work; or
> a method, or sequence, which is not conducive to effective time control.

It is further advised that "any positive control of revision to the schedule should encourage safety, contract and legal compliance and effective time control"[84].

10–054 The purpose of requiring contractual acceptance in the *CMS* is to enable D to be sure that C has complied with the contract and that the parties have an agreed baseline in place for calculating the time effect of a D's time, or cost risk event when it occurs. However, the *CMS* makes it clear that acceptance does not require that the works are to be constructed in accordance with the accepted schedule, that such acceptance does not relieve C from any of their obligations under the contract and that C is not entitled to rely upon acceptance as indicating that the schedule is feasible.

10–055 The *CMS* ties the programme requirements to those clauses concerning an extension of time and specify[85] that the accepted schedule is to be used for:

1. planning the intended periods of activity and sequence of those matters identified in the schedule;
2. identifying the dates and logic by which the information described in the information release schedule, or any other request for information required is to be supplied in relation to the activity, or activities to which any such requirement relates;
3. identifying the intended dates and logic by which plant, materials, or goods are to be supplied, or work to be carried out by D, or those engaged, or employed by it in relation to the corresponding activity, or activities;
4. identifying any time contingency required by C, any nominated subcontractor and/or nominated supplier in relation to all activities and any one or more key date or dates;
5. identifying free float and total float, which is available to be used by C and/or D for managing the expenditure of C's time contingencies, or the effect of D's time risk events;
6. calculating the likely effect of delay to progress on the completion date, if any, caused by a D's time risk event for the purposes of extensions of time;
7. calculating the effect on progress and/or the date for completion, if any, caused by a D's cost risk event for the purposes of compensation; and
8. recording the degree of progress actually achieved from time to time.

Electronic submittals

10–056 Generally the standard forms of building contract require that schedules, if required to be provided at all, are only required to be issued in the form of hard copy.

84 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at Pt 3.

85 See App.2 to the 4th edn.

None of the standard forms of contract currently require the schedule to be distributed electronically in editable format. The *SCL Protocol* recognises that that is not satisfactory and that management information must be provided electronically in a form in which it can be interrogated and from which calculations can be made. Accordingly, the process of issuing electronic copies of the schedules is defined in the *CMS* as "to publish" and those to whom the electronic files are to be published are to be set out in a schedule to the *CMS*. It is intended that those who prefer to work with hard copies can then print their own, in the format in which they require to see them, rather than having the format predetermined by others.

10–057 The *CIOB Guide*[86] goes one stage further and sets out what is to be done with submittals by way of quality control and auditing, setting out standards by which it can be considered suitable for competent project control, under such headings as: buildability, schedule content and schedule integrity.

Progress records

10–058 The CIOB research found that the standard of record keeping in the industry was generally poor and inadequate for competent project control[87]. In this regard, the *CIOB Guide*[88] sets out a detailed performance specification for record keeping and makes the point that:

> "Records that cannot be retrieved are useless. Accordingly, the process of record keeping is inseparable from the process of record retrieval. It follows that in order to identify an adequate means of keeping records in the first place, consideration must be given to how they can be retrieved and used.
>
> The increasing speed and sophistication of databases and spreadsheets has provided the industry with the facilities for sorting and filtering data into specific reports at the press of a button and it is now no longer acceptable to proceed to keep records on paper alone. It follows that unless records are kept as database records in the first place, they must be re-keyed as database records before they can be retrieved and used."

The progress records, which are required to be supplied, are those that are to be described in a schedule to the *CMS*. The purpose of requiring C to prepare and to deliver them to the persons prescribed is to keep informed those who should properly be informed about progress and to facilitate contemporaneous checking of the as-built record against the working schedule. It is thus important that whatever is specified for the period of supply of historical records is reasonable in regard to the nature and content of the work to be monitored and the period of schedule updates anticipated.

Key dates

10–059 Until the publication of ECC3[89] in July 2005, none of the standard forms made provision for D to be able to monitor, or control the progress of the work in any way. Whilst they do make provision occasionally for C to manage and to monitor its progress, how that is generally to be accomplished is left for C to determine.

86 See Ch.8, "Presentation and approval of programmes", at paras 8–054 to 8–091.
87 See below, Ch.13, "Construction records", throughout.
88 *Managing the Risk of Delayed Completion in the 21st Century* (Chartered Institute of Building, 2008), at Pt 4.
89 Cl.31.2.

10–060 Whilst it is common to think of monitoring the effect of change by reference to the completion date, or one or more sectional completion dates, the *CMS* recognises that it is also often desirable to monitor, independently of sectional or overall completion, the start, or completion of individual activities or chains of activities. A "key date" that is not necessarily a sectional or overall completion date against which liquidated damages and extensions of time apply may be monitored in such a manner[90].

Roles and relationships

10–061 In 1823, when the CIOB and the RIBA were inaugurated, the first railway line had just been opened, the postage stamp had yet to be invented and the job of the "measurer" was to quantify the building work carried out to establish what the finished article had probably cost. Little could be done in those days to control the construction process proactively.

10–062 By the mid-nineteenth century, the construction industry in the United Kingdom had begun to think about developing some form of proactive cost control: the "quantity surveyor" was born and became increasingly important over the next 100 years. However, by the middle of the twentieth century it had become evident that managing cost alone could not achieve certainty of delivery and performance. Indeed, it became universally recognised that, if time could not be managed, cost never could.

10–063 By the 1970s , the trend was to think that effective time management lay in the hands of a new professional: the project manager. In those days it was thought that the project manager, by defining relationships and managing people and information, could achieve what cost management alone could not. However, by the turn of the twenty-first century it had become clear that, without competent project control and contracts that permit effective process management, managing people and information could not secure timely completion either.

10–064 The management of the construction process so as to deal with the risks of change, consequent disruption and delay to progress and to manage them so as to minimise, or avoid entirely, their effects on the completion date, requires the ability to use techniques, which may not always be found among staff normally employed[91]. That is not to say that the design team, CA, project manager, or clerk of works in any particular case will not have the skills to conduct the tasks anticipated by the *CMS*. Much will depend upon each individual case. Whether it is considered to be necessary to appoint a separate individual to carry out these tasks, or to allocate the tasks to a member of the design team experienced in the techniques required, is a matter of commercial policy for D to determine. The *CMS* specifies that, by default, the role is played by a separate individual, who is referred to as the risk manager. The role of the risk manager is to look after D's interests as to extensions of time, time-related compensation periods and recovery from the effects of delay to progress. By analogy, the risk manager's role as to time is akin to the role of D's quantity surveyor as to construction economics, interim valuation and final account. In relation to recovery measures, the risk manager's task is to provide a structure and discipline to the performance of C's overriding obligation to complete the works by the completion date.

90 See also Ch.9, "Revising, updating, monitoring and reporting", at paras 9–119 to 9–121.
91 See above, Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008).

10–065 The *CMS* recommends that the strategic management of time should commence during the latter part of the design stage in identifying, in conjunction with D and its advisers, those significant features of the project design in relation to the intended method of procurement that are likely to be important in the management of time during the course of the construction process.

10–066 The risk manager will advise D and its design team on the techniques to be used to prepare the schedule, the software to be used and the general shape and feel of the management information, which will be required from C.

10–067 Once C has been appointed and the schedule has been prepared and is submitted for acceptance, it is the risk manager's task to examine C's submittal and to advise the CA as to whether it complies with the contract. The purpose of this is to secure quality control of the product. The *CIOB Guide*[92] advises that quality control should be a two-stage process involving an internal quality assurance process and external third-party audit; at Pt 3, the *Guide* advises:

> "Quality assurance audits are best performed by an independent party, unassociated with the project, or any of its participants; the absence of any implied knowledge ensures that the right questions are asked and appropriate and understandable answers are given.
>
> The first validation should be carried out at inception.
>
> The assurance of quality and integrity in the schedule is achieved by both an initial validation of the development schedule and continuing checks against review and revision schedule updates, which audit the contemporaneous database for accuracy and completeness against work content and actual performance.
>
> Subsequent and more detailed audits should then be carried out on the working schedule prior to any work stage commencing.
>
> It should be borne in mind that the longer the period between audits, the longer the examination will take and the more serious are likely to be the consequences of any errors found. Accordingly, detailed audits should be carried out against revisions and updates at intervals no greater than two to three times the reporting period, depending on the nature of the work being carried out.
>
> Typically, the scope of validation will include examination of:
>
> schedule content
> schedule integrity
> buildability."

10–068 Once the works have commenced on site, C is required to produce progress information in conformity with the schedule to the *CMS*. It is then the risk manager's task to examine the progress information submitted and to advise on whether it complies with the contract requirements for the proper monitoring of the progress of the works by means of updating the master schedule.

10–069 With the provisions of the *CMS* in place, D is also able to control the risk, not only of a delay to the date for completion, or sectional completion, but also of delay to a key date. Simply put, the project does not have to run late merely because C has been awarded an extension of time. The provisions for delay management in the *CMS* require the risk manager and C to work together to investigate whether and, if so, how, the future schedule of work can be re-sequenced, or re-scheduled, or the resources modified, or the works otherwise re-organised so as in whole, or in part to overcome, or avoid the delay, which was likely to occur as a result of the change. In effect, the task of the risk manager under these circumstances is to provide D and his

92 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010).

advisers with the information they need in order for the CA to be able to give appropriate instructions to C to overcome or reduce the effects of those D's time risk events for which D takes the risk of time and/or cost.

10–070 Once the works have been completed, then it is the risk manager's task to check C's final calculations of delay to progress, disruption, prolongation and concurrency and to advise the CA and/or the quantity surveyor of those time periods for which C may properly be reimbursed for loss, or expense, if applicable.

Managing the effect of change

> *"If every activity is a problem, then nothing is really a problem. It all blends into the overall morass of project difficulties, and the most appropriate target of management attention and available resources fades into the mist."*[93]

10–071 There is an unnatural reluctance on the part of developers to select a contractor and negotiate a mutually satisfactory price, even though this is probably the most effective way of reducing the risk of delay owing to change. It is self-evident that, when in competition for the contract at the lowest price, the lowest tendering of contractor is also the one faced with the highest danger of loss unless they can encourage instructed changes that will provide a channel for making a profit. Only the very naive developer can be unaware of how much time is spent by the lowest tendering contractor in search of ways to reduce losses and redress the balance after the contract has been let.

10–072 In general terms, a variation is likely to entail one or more of the following:

- additions to, or omission from, the quantity of described work;
- changes in the method of execution of the described work;
- changes in the materials or goods to be used in the described work;
- changes in the sequence in which construction activities are to be performed;
- restrictions or other changes in the permitted working hours;
- changes in the kind, quantity, timing, sequence or method of work to be carried out by others;
- changes in the timing of supply or quantity or quality of goods or equipment to be supplied by others; and/or
- changes in key dates.

Unless the work is subsequently re-sequenced, or the resources, or their productivity outputs, are changed, work that absorbs more labour or plant than was anticipated by the tender rates, will take longer to carry out than anticipated. Whether the extended period of performance also brings with it an extension of the contract period for performance depends entirely upon whether the activity in question is, at the time it is carried out, critical to completion of the works in the way it is being built. If it is not, then, simply because, at its lowest, it is not likely to affect completion at the time that it is instructed, or impliedly required, C is not usually entitled to an extension of time[94]. Compensation for loss and expense arising out of additional work, if it is to be made,

93 M Hatfield, "Got float?" (December 2001) *PM Network*.

94 But see the Australian standard form C21/03 referred to in Ch.4, "Standard form provisions for time and cost", at para.4–006.

will depend upon proof that loss or expense has flowed from the additional work for which reimbursement is not included in a revaluation of the work according to the contract rules governing the valuation of change.

10–073 Accordingly, the significance of change must be considered in relation to whether the effect of change:

> is discrete to the change itself;
> has consequences beyond itself; and
> requires action to minimise its effect;
> and also:
> whether there are choices available and, if so, which one is appropriate; and
> who needs to know about it.

10–074 Some changes can be accommodated without affecting C's construction schedule at all[95]. However, it may not be sufficient simply to attend to discrete changes. Construction activities normally follow logical sequences and, whilst it is true that some changes do not cause delay to progress on the site and can (in the case of omissions that reduce the content of work) sometimes actually accelerate progress[96], the consequential advances in one part of a schedule may be counterbalanced by disruption to another, even in the case of omissions. On the other hand, all changes cause some disruption, which may in turn cause a quantifiable loss, even if it is only in relation to the additional work that has to be done by administrative staff in accommodating the change.

10–075 A 1980s report of the National Economic Development Office[97]found that the most significant cause of delay to completion in construction projects was not in fact the extent of the work carried out as a result of the change, but the delay to progress arising as a result of the need for instructions to effect a change. Typically, in a case in which delay to progress in the refurbishment of hotel bedrooms occurred, one of the most significant delays to progress resulted from instructions required in respect of the wall finishes when the existing wallpaper was stripped from the walls to reveal defective plaster. Although the work involved in the additional task of taking off defective plaster, patch plastering and cross-lining added, in fact, no more than a few days to the total contract period, the delay in providing instructions while D and the CA decided what to do about it took several months[98]!

10–076 It has often been recommended that, if the cost and time of a building project are effectively to be controlled, the design of a project should be "frozen" before construction detail drawings and specifications or bills of quantities are produced. However, this rarely happens in practice, and it is not unusual to find that, even under lump-sum contracts[99], in which C is required to construct only that which is specifically described in the contract documents, the design continues to be developed as the building work

95 A change of manufacturer for a particular fitting of like type will not of itself change the time taken to procure, deliver and fit it.

96 For example, the consequence of change in foundations based on deep stepped strip footings for a domestic swimming pool, to deep trench fill, whilst costing more to produce, may be found to save time in the construction of the substructure.

97 The National Economic Development Office, *Faster Building for Industry* (London: HMSO, 1983). The Report of the Building and Civil Engineering Economic Development Committees' Joint Working Party.

98 *John Barker Construction Ltd v London Portman Hotel Ltd* [1996] 83 BLR 31.

99 For example, JCT80, JCT98 and JCT05, IFC84, IFC98 and IFC05, MWA80, MWA98, MWA05.

proceeds. Indeed, contracts are often made on the basis of incomplete design information, for which allowance is made in the specification and bill of quantities by the incorporation of provisional sums and contingency items. However, the rationale ought to be that the design be *frozen* at a time when it does not inhibit change which is likely to have an adverse effect on subsequent progress. There is no reason, for example, why changes in internal arrangements that do not affect the services or structural envelope of a building should not be made during the early stages of construction. On the other hand, tenants' "fitting-out" schedules can cause considerable delay to construction if D responds too readily to demands for fundamental changes from prospective tenants during the installation of secondary and tertiary elements of a project. If delay, disruption and compensation claims are to be avoided, then incompatible fit-out should be carried out as an entirely separate contract or after the principal construction works have been "sectionally completed"[100].

10–077 The NEDO report recommended that, in order to avoid claims, the effect of variations should be negotiated with C before they are put into effect, very much along the lines of the "change order" procedure used in the AIA standard form of contract, A201/97 and A201/07[101], and common in US government contracts and has been replicated as an option in a number of other standard forms[102]. In practice, however, whilst that is sometimes a practical proposition, it requires that:

1. the CA should be able to say exactly what is required;
2. C should have the staff time available fully to investigate the likely consequences; and
3. D and the CA should have the management information available to be able to assess the acceptability of C's predicted effects on time and cost.

10–078 Some changes just have to be made ad hoc, simply because the total picture is not available[103]. It is also apparent that contractors are rarely interested in committing themselves to the time consequences of change during the progress of the works when they do not have the appropriate scheduling, record-keeping and project-control techniques in place to enable them to produce the data on which to base the forecast[104].

10–079 The *CMS* envisages that the schedule update and revision process will always have three steps to it and may have four, or five, depending upon the circumstances prevalent at the time.

First step – programme update

10–080 The first step concerns only that part of the programme to the left of the data date. This step in the updating process is to identify what has actually happened since the programme was last compiled. Then the data gathered must be used to update the programme. Those activities, which have started, must be changed from planned activities to activities with actual start dates. Where activities relating to the contract works (but not intervening events), which had been overlooked, have started, they must

100 *George Sollitt Construction Co v The United States*, No 99–979 C (2005), 26.

101 Cl.7.2.

102 See, for example, JCT05 Cl.5.3 and Sch.2 and ECC3 Cll.61.1 and 61.2.

103 For example, adverse ground conditions.

104 See Ch.10, "Project control".

be incorporated into the programme with appropriate logic[105]. Where planned activities have started in an order, or sequence different from that planned, they must be corrected to illustrate the sequence actually followed. Those activities in progress must have their degree of completion estimated. Those activities that have finished must have their planned finish date changed to an actual finish date. Where contingency periods have not been absorbed entirely, they must be reallocated in whole, or in part, or discarded.

Second step – programme review for better information

10–081 The second step in the updating process is a review of the information upon which the planned schedule was produced and concerns only that part of the schedule to the right of the data date. The purpose of this is to see if there was any error in the working schedule for the future conduct of the works, or whether, because of information now available, which was not available earlier, there should be additions, or changes to the planned sequence, resources, or productivity, going forward. For example, amongst other things, the schedule should be reviewed to see whether there is now any better information than before about how subcontractors, statutory undertakings, or utilities are likely to perform. When that review has been completed, the critical path (and hence the likely date for completion in the light of that update) must be recalculated. This is usually referred to as revising the schedule. At that point, the risk manager, C, D and any other persons identified in Sch.1 to the *CMS* will know where C is in relation to where they planned to be.

Third step – recovery

10–082 The third step in the updating procedure is that in which the first phase of the project-control process can be applied (at this point there has not yet been any consideration of the occurrence of a D's time risk event, or instructed, or implied change). This is where C must consider what to do concerning the progress actually achieved in regard to the working schedule. If the schedule illustrates that the works are ahead of time, C should ask themselves whether all successive activities have been allotted sufficient durations. If so, will the design team have to produce information more quickly to keep up? And can they do that? If so, at what cost? Alternatively, should additional time be allowed for the provision of information? What other contractor's contingency periods could usefully be adjusted? If the recalculated date for completion illustrates that work is behind schedule, have any activities and their sequences been overestimated? Can they be executed any more quickly with the same resources[106]? Can the resources sensibly be increased to achieve faster progress than

105 If the recommendations of the *CIOB Guide* are followed to programme in detail, with resources and productivity, the short-term, high density programme for the three-month future of the project, this should be a rare occurrence.

106 Recovery should not contemplate the reduction in duration of activities the durations of which are not calculated by reference to resources and productivity. For example a reduction of the available medium or low density commissioning period can result in disaster when, shortly before the due completion date, the high density resourced commissioning period is found to require an even longer duration than originally planned. At that stage, there may be no contingency left on which any recovery can be planned and C is left with weekend working and overtime, both of which lose productivity and cause costs to escalate.

was planned? Can areas of work be taken off the critical path by re-sequencing? Or can the allotted contractor's contingency periods safely be used to absorb the lost time? And so on.

10–083 The object of this reassessment must be to reorganise the schedule where it can be changed, to identify what needs to be done to achieve completion on time and to set the train in motion by re-scheduling the work. This is a step that is called for by most standard forms of contract. Sometimes it is called mitigation. Sometimes it is referred to as "the contractor's overriding duty to overcome or avoid delay". Nowhere, in any standard form of contract, is there any guidance, or structure for doing it. However, the *CMS* calls for this to be done regularly during the update process and requires that whatever decisions are taken, they must be recorded in an updated critical path network and method statement and be accepted by the risk manager[107]. In other words, the *CMS* requires structure and discipline to be given to the mitigation process and, at Pt 4, the *CIOB Guide*[108] now also sets out how such structure and discipline is to be achieved, in practice.

Potential fourth step – event impacting

10–084 The fourth step in the updating process arises only in connection with the occurrence of one or more of D's time risk events. In this step, C must identify what has happened to change the works in a way that is at D's risk as to time or cost. C must identify in a sub-network the new activities and/or durations comprised in D's time risk events, what sequence they must follow and the interface between each sub-network and the revised, updated schedule. Having done that, C must again recalculate the date for completion. It is the recalculation of the critical path in the light of those additions that determines what is the effect (if any) of D's time risk event on progress, what is likely to be the effect on future progress and what is likely to be the effect on the date for completion and/or the completion date. If the calculated impact of D's time risk event demonstrates a likely adverse effect on the date for completion after the completion date, C will usually be entitled to an extension of time[109]. The *CIOB Guide*[110] sets out the procedure for carrying out this stage as being a time impact analysis that complies with the *SCL Protocol*[111].

Potential fifth step – acceleration

10–085 The fifth and final step in the project-control process is the management of the effect of D's time risk events on the future conduct of the work. It is the review

107 For the danger of not recording the reason for the changes in a method statement and having it accepted or approved, see *Great Eastern Hotel Co Ltd v John Laing Construction Ltd* [2005] EWHC 181 (TCC), in which the court found that the creation of recovery schedules had been a deliberate attempt on the part of C to conceal its liability.

108 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010).

109 Depending upon the contract provisions and any conditions precedent to entitlement that may have to be met; see Ch.6, "Extensions of time and time at large".

110 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010).

111 The time impact analysis is referred to as a "modelled/additative/multiple base" analysis in American Association of Cost Engineers International, *Forensic Schedule Analysis, Recommended Practice No 29R-03* (2009). See also Ch.15, "Forensic programme analysis", at paras 15–149 to 15–163.

contract is used specifically because of uncertainty as to actual requirements under the contract, [C] entering into such a contract assumes most risks of an underrun, or overrun. However, [C] does not assume all risks under these circumstances."

12–194 In *Carney*[260], it was also confirmed that, if the contract had a standard variations clause, a substantial error in the estimated quantity of base course for a road might warrant relief under the theory of constructive change where the government could be shown to have failed to exercise due care in estimating quantities. The Board found that, whilst a change between the estimated and actual quantities did not, of itself, establish negligence on D's part, or provide C with any ground for relief, the use of the term "estimate" did not transfer the responsibility for D's substantial miscalculation to C.

12–195 Thus, it appears that, where a negligently prepared estimate of quantities results in additional costs to a contractor, C should be entitled to reimbursement for such costs. In these circumstances, in advancing an estimate of quantities for tender invitation purposes, D is not required to be clairvoyant, but D is obliged to base that estimate on all relevant information that is reasonably available to it.

Consequential changes

12–196 Consequential changes are really just another form of constructive change, although they are often more difficult to identify. Consequential changes represent additional work, or costs that come about as a direct consequence of some other more obvious change. The cost and time effects of a consequential change include all those that can occur as a result of any other change (ie direct costs, delay to progress and completion and associated prolongation costs and disruption costs).

12–197 Whilst, in the best of all worlds, C will include all consequential effects of change in its notice to the CA following any directed change, unfortunately consequential impact is often not foreseeable until after the original variation has been instructed. Under the provisions in the NEC and JCT forms for the agreement of the effect on time and cost of a directed change, it will be difficult to recover for the effects of consequential change which C has failed to foresee in its agreement. However, whenever the facts of a consequential change become apparent, C should immediately notify the CA and follow the procedures for monitoring constructive change.

260 *BJ Carney and Co* (1977) ASBCA No 76,114, 77–1 BCA, at 12,285.

CHAPTER 13

Construction records

Introduction

> *"When you believe you have a claim under a construction contract, thorough and comprehensive records are needed for proving that you are entitled to damages, and the amount of damages you should recover. Too often, contractors are able to show that something went wrong on a project, but because they lack records are unable to identify the exact causes of the problem, or prove that claimed costs are attributable to the problem."*[1]

13–001 A study carried out by NEDO identified unclear, or missing, information as a serious cause not only of construction defects, but also as a recurring cause of disputes in themselves[2] and, perhaps predictably, poor management has often been the cause of poor record-keeping[3]. However, effective project and change control cannot be achieved without good records of what has been achieved, where, when, by whom and with what resources. A little experience in construction disputes will also soon demonstrate that the earlier good quality facts are established, the earlier the claim is likely to be settled, which, in turn, results in lower litigation costs and more successful settlements.

13–002 Whatever facts there are in support of a claim for an extension of time, or additional costs arising out of a change of circumstances, they must first be presented to the CA. If the CA does not accept them, they must be presented to C's lawyer or claims consultant for attempted negotiation and representation before proceedings. If they are not accepted at that stage, they must then be presented to an adjudicator, arbitrator, mediator, or court. Although it beggars belief, it has been estimated that arbitrators spend as much as 90% of their time simply trying to establish the facts in a construction dispute[4]. If the facts cannot be demonstrated clearly and unambiguously, at each hurdle, not only will it be impossible effectively to control the works, but the claim can also be expected to fail. The burden of proof rests on the claimant: "he who asserts must prove" is the burden of proof in all civilised legal systems, and it is a sad reflection on the construction industry that many claims, which might otherwise be accepted, fail simply because of the absence of corroborating evidence[5].

Record keeping

13–003 Essentially, there are five classes of information that, in any construction project, must be recorded in order properly to control the work and the risk associated with it. They are the data associated with:

1 "Construction Project Records Basic Principles and Guidelines", Federal Publications No 79–6, November 1979.
2 The National Economic Development Office, *Achieving Quality on Building Sites* (London: HMSO, 1987). The Report of the Building and Civil Engineering Economic Development Committees' Joint Working Party.
3 I Ndekugri, "Computer-aided Resolution of Construction Contract Claims and Disputes" [1996] *Arbitration Journal* 62.1, 57.
4 D T Simmonds, "Evaluating Contractors' Claims: Presentation of Claims by Contractors" (1979) *The Chartered Quantity Surveyor.*
5 V Powell-Smith and J Sims, *Building Contract Claims*, 2nd edn (Blackwell Scientific Publications, 1988).

contract;
quality control;
document control;
project progress; and
change control.

13–004 Whilst all are important to successful risk management, in relation to delay analysis, it is largely the information concerning project progress and change control that are likely to be in issue. In relation to progress records, the *CIOB Guide*[6] identifies that:

> "Records of progress actually achieved will be used for identifying the start and completion dates of activities, the degree of progress achieved from time to time and for identifying the productivity actually achieved by particular resources. They can also be used for verifying productivity trends, the timing of the constituent parts of intervening events and identifying lost productivity as a result of disruption. In other words, progress records are the lifeblood of effective time management."

13–005 For D, good quality progress and change management records are the antithesis of an unprovable global or total loss claim[7]. From C's point of view, provided it can be mounted, the beauty of a global or total loss claim is self-evident – it is very simple, quick and cheap to produce. It simply says:

> "you have done all this to me and have caused me all this loss. I do not have the factual records to separate the loss caused by one event from that caused by another but as you have caused everything, I do not have to separate them; please pay up."

13–006 From D's point of view, the inconvenience of a global claim is self-evident. On the one hand, D does not accept C's claim is a total loss claim, but, by showing that a not insubstantial part of the loss has been caused by events for which C does not allege that D is liable and is thus a global claim, D will also go to prove (by default) the amount for which C is truly entitled. Not only that, but in doing so, D as defendant will have all the costs of putting together a detailed case that C (as claimant) would ordinarily have had to bear[8].

13–007 From D's point of view then, it should be reasonably apparent that the single most effective defence to a global claim or modified total loss claim is good factual records of what was planned from time to time and what actually happened from time to time. Without facts, all C can put up is argument and insinuation. This in turn can only be met by D with counter-argument and insinuation: a notoriously fragile platform upon which to go to war in a formal dispute resolution forum. Not only will it cost a lot of money to prepare the claim and counterclaim, and to hear the witnesses and the arguments, but also the outcome may often be no better than the roll of a dice, or the toss of a coin. The Canadian case of *Foundation v United Grain Growers*[9] demonstrates particularly well how the cost of defending a dispute can be adversely affected by poor documentation. The trial in the Supreme Court of British Columbia lasted 132 days, including legal argument. Of those 132 days, only five days were taken up by examination-in-chief, cross-examination and re-examination of the two expert witnesses. The majority of the remaining 127 days of trial were taken up by hearing ordinary witnesses testify as to what had actually happened on the project.

6 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) at para.4.3.5.1.
7 See Ch.19, "Total time, total loss and global claim".
8 See Ch.19, "Total time, total loss and global claim". See also, K Pickavance, "A case for the defence" (September 2006) *RICS Construction Journal.*
9 *The Foundation Co of Canada Ltd v United Grain Growers Ltd* (1995) 25 CLR (2d) 1 (BCSC); (1996) 62 ACWS 3d 29.

13–008 If the CA's determination of entitlement is to be anything better than an inspired guess, claims for additional time during the course of the works, should reasonably have to be accompanied by the factual data records to show:

- what was C's planned timing of the works in the absence of the occurrence of any event at D's risk;
- by reference to what has already been achieved, the planned timing for the future conduct of the work was realistic and practically achievable at the time of the event;
- the nature and timing of the time risk event which actually occurred;
- D's time risk event is (at its lowest) likely to have an adverse effect on the timing of one or more planned activities;
- One or more affected planned activities were, at the time, on the critical path to one or more completion dates; and
- the calculated effect on the planned timing of the affected activities and on completion.

13–009 Similarly, claims for loss or expense should reasonably be accompanied by the factual data records to show:

- what were C's costs likely to be in the absence of the occurrence of any event at D's risk;
- the planned costs are factually supportable by a tender cost breakdown and were realistic and practically achievable at the time of the event;
- the nature and timing of the cost risk that actually occurred;
- D's cost risk event caused C to suffer a loss, or additional cost, in the absence of which C would not have suffered such loss or cost;
- the quantified loss, or additional cost, actually suffered as a result of D's cost risk event.

13–010 If the evidence in point is no better than argument and insinuation, the claim ought to be dismissed. Three apposite examples of a reluctance of US tribunals to accept C's claims, in the absence of such substantiation, come from the US Boards of Contract Appeals. In *Fru-Con*[10], the Board found that there was insufficient evidence of exceptionally hot weather having caused delay which C alleged it had overcome by acceleration, but the Board rejected the claim, saying:

> "the record remains deficient. In the absence of notice and supporting documentation, [C] is unable to demonstrate an excusable delay and therefore unable to prove acceleration."[11]

13–011 In *Earth Tech Industries*, whilst accepting that C had proved it had accelerated progress, the Board said that C:

> "cannot recover for increased costs of accelerating the work because it has failed to prove that any of the additional measures taken resulted from the [CA's] order."

13–012 In *L & C Europa Contracting*, in the absence of records proving the resources used, the Board declined to infer that any work had been carried out at all. In this

10 *Fru-Con Construction Corporation v The United States* (1999) 43 Fed Cl 306.

11 See also, *Broome Construction Inc v The United States* (1974) 203 Ct Cl 521, 531–32, 492 F 2d 829, 834–35, *Park Construction* (1995) 95–2 BCA 138,529; *McNutt Construction* (1985) 85–3 BCA 92,279; and *Electronic & Missile Inc* (1964) ASBCA 9031 64 BCA (CCH) 4338 (where C made 30 unanswered written requests for extensions of time due to adverse weather, it was entitled to recover for constructive acceleration).

case, the Board observed that the daily reports indicated that C performed intermittently from February to September 1997. During that time, there were no site records, no proof that work was performed, and no evidence establishing that C was affected by any of D's time risk events. The Board found that:

> "there is no evidence detailing precisely when the alleged delaying events transpired, or their specific impact on overall completion of the contract. To the extent that daily reports are available, they are cursory, generalised and inconclusive at best. In no instance, has [C] attempted to identify and track the allegedly delayed work in the daily reports and account for the delay period. Only the [pre-construction schedule] is in evidence. There are no updated schedules in the record that might demonstrate the relationship of the alleged delays to other work at the site, or the timing and impact of alleged delays on overall completion of the contract. The record does not permit segregation of any delays attributable to [D's] fault from other non-compensable delays including delays caused by [C] and/or delays extending over unexplained gaps in [C's] on-site performance. With respect to the nature of the proof offered by [C] generally, [C] for the most part relies on general, unspecific and conclusory testimony that was not credible."[12]

13–013 Similarly, in *Bay Construction*[13], in which C claimed compensation for lost productivity, the Board observed:

> "[C] has the fundamental responsibility to prove by a preponderance of the evidence that [D's] action caused its [labour resource] to be less efficient than planned as well as the extent of that impact[14]. [C] wholly failed to present probative evidence of lost productivity. [C's] lack of contemporaneous project documentation of the impact of the delays and its failure to proffer credible testimony, impeached the overall reliability of its evidence. While [C's expert] was very willing to assume [D]-caused delay and interference, there was very little evidence in the record to back up his assumptions.
>
> Given the size and complexity of this project, the number and nature of changes reflected in the [variation instructions] were not so momentous as to impact the project in the significant and serious ways that [C] claims. As we recently stated in *Clark Construction Group, Inc*[15], '[t]he after-the-fact, conclusory assessments of the [CA], or the opinions of its experts are not sufficient substitutes for [C's] underlying obligation to contemporaneously document the severe adverse impact on [labour] efficiency it now claims resulted from the changes and RFIs.'
>
> We conclude that [C's] evidence failed to provide proof of change to working conditions or loss of productivity. To the extent that [C], or [D] raised other issues of arguments related to these appeals, we have fully reviewed and considered them and found them unpersuasive."

13–014 Accordingly, it can readily be appreciated that the need to establish clear and well-thought-out schemes for documenting and retrieving project information cannot be overemphasised. The project documentation should provide the information needed effectively to tender, plan, manage and construct the work, and an accurate and complete record of on-site conditions, problems encountered and their effect on progress. If the project is delayed, or disrupted, this information will be needed to evaluate, support, and successfully resolve the claim for more time, more money, or both.

12 *L & C Europa Contracting* (2004) ASBCA No 52848.

13 *Bay Construction Co* (2002) VABCA Nos 5594, 5625–5626, 5628, 5831.

14 See also, *Centex Bateson Construction Co Inc* (1999) VABCA Nos 4613, *et al*, 99–1 BCA 20,153, *Dawson* (1993) 93–3 BCA 26,177, *Triple "A" South* (1994) ASBCA No 46866, 94–3 BCA 27,194, *Bechtel National Inc* (1990) NASA BCA No 1186–7, 90–1 BCA 22,549.

15 *Clark Construction Group Inc* (2000) VABCA No 5674, citing *Fru-Con Construction Corporation v The United States* (1999) 43 Fed Cl 306, *affirmed* (2000) 250 F 3d 762 (Fed Cir); *Centex Bateson* (1999) 99–1 BCA 20,153; *Triple "A" South* (1949) 94–3 BCA 27,194.

Progress records

13–015 Good progress records help avoid confusion and assist in reaching agreements by defining facts, roles and responsibilities during the progress of the work. They also help co-ordination of activities during the progress of the work and, in the process, help to reduce the incidence of disputed claims[16]. A detailed listing of the types of records that should be maintained during the currency of a project appears at App.2.

13–016 Effective records management will usually require an holistic approach to discussion and agreement on the type, form, and timing of records to be kept by C, C's subcontractors and suppliers, the CA, the design team, D, D's separate contractors, subcontractors and suppliers and so on. In doing so, the questions of who will need to access the records, how they will be retrieved, for what the records will be used, and how they will be applied should be at the forefront of agreement on form, content and timing and submittal.

13–017 Despite the importance of progress records to time management and proof of claims, research carried out by the CIOB into the way time had been managed on nearly 2,000 projects, over a three-year period[17] showed that there was little understanding in the construction industry as to what progress records were needed, or how they should be kept. Figure 13.1[18] indicates the percentage of respondents who kept, or were familiar with the keeping of the necessary basic data, in relation to labour resource records.

13–018 Those who are concerned with dispute resolution may not be particularly surprised by this, but anyone employed in proactive project control and project management should be seriously concerned at the evidence of the failure of the industry to keep even the basic data about the resources employed. When asked about the data kept on the work carried out, barely two-thirds identified the work being carried out by reference to a description on a schedule (see Figure 13.2)[19]. For the one-third that did not, the work recorded as having been carried out would be impossible to identify in relation to what was planned to be carried out.

[Please refer to Figures 13.1 and 13.2]

13–019 The CIOB report identified that:

> "It is apparent from the response to this question that approximately one third of respondents are familiar with 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 the master programme or short-term programme. 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."

13–020 The report found that slightly more attention was given to the basic data for plant records, where approximately 80% of the respondents to the questionnaire were found to keep adequate basic plant data, but only a little over 50% recorded adequately the work upon which the plant was engaged[20].

16 The Kellogg Corporation, *Avoidance and/or Mitigation of Construction Claims* (Kellogg Corporation, 1993). A seminar paper given to The Colorado Department of Transport.

17 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century*, June 2008.

18 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), at chart 35.

19 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), at chart 36.

20 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), at charts 37 and 38.

13–021 In relation to project control records, the *CIOB Guide* advises[21] that:

> "The records to be kept are those which will help in the management of the works going forward and the establishment of the facts surrounding the work, which has gone before.
>
> Unless the correct information is kept in relation to the purpose for which it is to be used, no matter how accurate it is, or how well it is presented, it will be ineffective and of little use. It follows that the purpose for which the records are to be used will be the overriding factor as to their content. However, there are some types of data which are essential to any record, no matter for what purpose it is to be put. These are:
>
> coordinating code
> activity description
> date of record
> resource used
> start and finish dates
> the author of the record.
> progress data."

13–022 However, more specifically, in relation to work carried out, the *Guide* advises[22] that data should be kept on such matters as the answers to the following questions:

What and how much work was done (on an activity-by-activity basis)?
How much duration is remaining to complete the activity worked upon?
Who did it – the labour resource?
With what was it done – the plant and material resource?
When was it done – the date and timing of the activity?
Where was it done – the location in which it was carried out? and
How was it done – the process adopted?

13–023 In regard to progress of an activity, the *CIOB Guide* advises[23]:

> "If an activity is started and completed in its entirety in a reporting period, the work done will be self-explanatory. However, if it is not, then the quantity of work achieved in the reporting period, together with the date upon which the record was made, must be identified. Without a degree of progress identified by a certain date, for some purposes, the record will be useless."

13–024 Apart from the necessity of keeping such records in order to substantiate C's position at the time an event occurred, the *CIOB Guide* points out that the value of such information to C, in the forward planning of its work, is in connection with the management and control of repetitive tasks and improvement of its scheduling on future projects. In relation to repetitive tasks, the *Guide* advises[24]:

> "Trends in productivity achieved, derived from the as-built productivity data, should be used to verify the planned schedule for the remainder of those activities. If a discrepancy is found between what is planned to be achieved and what, by reference to the progress records, can be proved to be achievable, changes should be made to the schedule to accommodate the discrepancy. In relation to an activity such as piling, for example, each rig's productivity should be analysed (in order to ascertain the optimum pile-cycle achievable and the effect

21 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.4.3.6.

22 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.4.3.13.5.

23 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (2010), para.4.3.13.1.

24 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (2010), paras 4.2.4.4–4.2.4.6.

of any prior departures from it). The demonstrable, achieved productivity cycle can then be used to verify the activity durations planned for the remaining piling works.

If it should be found that the productivity which has been achieved, is insufficient to maintain the schedule, changes can then be made in good time to the planned resources and/or to the sequence of the works in order to bring the work back on schedule.

One of the advantages of this repetitive-sequence review is that in the case of an occurrence which disrupts productivity, the bench-mark proven optimum productivity will be the best possible baseline from which to calculate the effects of the disruptive event."

13–025 As to using as-built data for benchmarking for the purposes of better proactive scheduling of future projects, the *CIOB Guide* advises that[25]:

"If the principles of this Guide are followed, every project will provide a plethora of data from which many uses can be made in the improvement of performance in future projects.

The data will have been captured throughout the life of a project by reference to the progress-records database, the updated working schedule and the impacted schedules, and these can be used effectively to identify any departure between the investigated state and the desired standard in any particular case.

There are two aspects to benchmarking. On the one hand, the process will establish achieved norms of productivity and activity durations for common and project-specific working conditions, work types, trades, resource and so on and, on the other hand, for common data it will provide some degree of comparison between the time model performance and industry best practices, or standards."

Change control

13–026 Notwithstanding the clarity and eloquence of the many judicial expositions on the rationality of causation[26], there is no doubt that those at the work-face, particularly, it seems, in the construction industry, have some difficulty understanding issues of causation and demonstrating the link between a loss suffered and its cause. Construction projects necessarily involve complex factual matrices, frequently complicated by questions of parallelism, pacing and concurrency[27], multiple issues, a shifting time-frame, and several parties with differing contractual obligations, and so on, which together, go to produce hugely complex problems.

13–027 In earlier times, the impracticality of proving C's actual costs suffered as a result of D's liabilities may have been relatively easy to argue. However, with the forms of computers, communications, record-keeping, accountancy and database facilities commonly available at the beginning of the twenty-first century, it ought to be a formidable hurdle to clear. The more so for major contractors who boast the high quality of their management expertise.

13–028 Good records of the events leading to and supporting a contention that a change in quality, quantity, timing, circumstances, or process occurred and had a quantifiable effect, can mean the difference between settling a claim for an extension

25 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (2010), paras 5.4.1 to 5.4.3.

26 See Ch.14, "Cause and effect", throughout.

27 See Ch.18, "Concurrency, parallelism and pacing", throughout.

of time and/or a financial claim there and then, and waiting some years to represent the arguments before an adjudicator, judge, or arbitrator.

13–029 Apart from feedback for management purposes during the course of the project, thorough documentation of change is important because, if the project is delayed, or disrupted, the contemporaneous project documentation will become the source for evaluating, supporting, and successfully defining the issues of cause and effect in a delaying event. Records of project activities are of particular importance as a source of facts for evaluation of issues in proactive project control and as evidence of events in case of dispute.

13–030 In *HMAGFI v Gordon Forbes*[28], it was held that the expression "contemporaneous records" meant original, or primary documents, or copies thereof produced, or prepared at, or about the time giving rise to the claim; it did not mean witness statements or other anecdotal evidence. In this case, it was held that, in the absence of such contemporary records as was required by the contract in question, the claim for reimbursement of alleged losses would fail.

13–031 Accordingly, it should be the job of all those concerned to ensure that project records are:

made contemporaneously with the event;
made by, or based upon, information from persons with knowledge of the event;
kept as a matter of company practice; and
sufficiently detailed to permit a third person to reconstruct from them the sequence and timing of the affected activities.

13–032 In their commentary on the effects of *Wharf Properties*[29] (a case before the Privy Council, in which the claim was struck out because the pleadings did not show the necessary link between cause and effect), the editors of *Building Law Reports* said:

"it seems that it will in future be necessary for [C] to be quite specific as to the delay which it is alleged was caused by an event such as a breach of contract, or an instruction giving rise to a variation it will mean that proper records will need to be kept, or good use will have to be made of existing records to provide the necessary detail. It will no longer be possible to call in an outsider who will simply list all the possible causes of complaint and then by use of a series of chosen 'weasel' words try to avoid having to give details of the consequences of those events."

13–033 Clear factual evidence is crucial to a successful claim for an extension of time and/or reimbursement of loss and/or expense. A typical example of the effect on costs of the records available is demonstrated by a case in which C had been caused delay by multiple changes of design and structural difficulties on a £4m conversion of an existing building in London, England. The contract period had extended from 72 weeks to 106 weeks, costing C nearly £2m more than it had been paid on the value of certificates. Had the records been kept adequately, even if only on paper, it could reasonably have taken six weeks to analyse the daily site records[30] and to determine the nature of any case to be put forward. However, in order to find out what work had been carried out and where it had been carried

28 *Her Majesty's Attorney General for the Falkland Islands v Gordon Forbes (Falklands) Construction Ltd* (2003) 19 Const LJ 149.

29 *Wharf Properties Ltd v Eric Cumine Associates* (1991) 52 BLR 1.

30 Say, one site diary page per day for 104 weeks at, say, 15 minutes per page.

out, it first took three months to examine over 12,000 records in 4,000 documents. After that, C's staff of four took a further six months to find out what had happened in the periods when no satisfactory records were kept, in identifying the logical flow of work that had actually taken place, and in separating the contract work from the changed work.

[Please refer to Figure 13.3]

13–034 The CIOB research[31] found that, when asked about the data kept in support of claims, 22% of all respondents replying to the question said that they were not cognisant of any records at all being kept of compensation-related or delay-related events. Figure 13.3 illustrates the results of the questionnaire, in this regard, which shows that only 14% of respondents were familiar with additional work being identified by relation to an activity ID on the schedule and 3% or fewer related that logically to the programme to be able contemporaneously to gauge its likely effect on completion. 61% experienced details of the source of the change being recorded and 39% the description of any additional tasks being recorded. 51% were familiar with the labour resource and 34% the plant and equipment resource allocated to the change being identified. Fewer than a third of respondents were familiar with materials allocation records being kept.

13–035 In light of the apparent failure to keep good progress records, it is perhaps unsurprising that, when asked to consider a delayed project with which they were familiar and invited to indicate to what extent an extension of time had been awarded, the results indicated that, in 80% to 85% of cases, C was likely to be held liable for the delay to completion[32].

13–036 The *CIOB Guide* advises[33] that, in relation to excusable or compensable events, in order to undertake any meaningful analysis of the effect thereof, most important will be:

> the identification of the date upon which the event itself was initiated; and
> the chain of causation arising therefrom.

13–037 This is because:

> it will clarify whether events have happened sequentially, in parallel, concurrently, or simply to keep pace with other work and assist in distinguishing the effect of one event from that of another;
> it will determine the calendar date after which an event can possibly have an effect;
> it may determine the point from which a notice under the contract may be required to be given; and
> it may determine the time at which statutory limitation of liability provisions commence.

13–038 Whilst the detail of what is required by way of supporting data will differ between events of different character, in principle, in relation to every intervening event,

31 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), chart 39.
32 Chartered Institute of Building, *Managing the Risk of Delayed Completion in the 21st Century* (2008), chart 12.
33 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.4.5.7.4.

of any sort, the *CIOB Guide* advises[34] that the points that must be addressed in data capture are:

> a unique event identifier;
> description of the event;
> originator and/or authoriser;
> relevant contract clauses providing for extension of time;
> relevant contract clauses providing for compensation;
> date the event is instructed/occurred;
> responsible parties;
> the activities added, changed, or omitted;
> the labour and plant resources for each added or changed activity;
> the date and timing of the added, or changed activities;
> the location in which any added work was carried out;
> the workflow process adopted in carrying out the change.

13–039 In relation to workflow, the *Guide* advises that:

> "The logic of the intervening event should be set out clearly, together with the activity which it affects, and the way it affects it. If, for example, a planned activity has actually started, when late, or revised information is provided, that later information cannot logically inhibit the start of the activity. That will be so, even if the logic of the sequence was planned on the basis that all information was to be provided before the activity in question could start. Under those circumstances, if the later information has any effect at all, because the activity has already started, the effect of it will be to increase the planned duration of the activity either:
>
> by the time it takes to carry out the additional work in relation to the planned finish of the activity; or
> as a result of the delaying effect of the disruption caused."[35]

13–040 The crucial importance of keeping appropriate records of changed circumstances can be illustrated by the case of *Clark Construction*[36], in which the Board took the view that the absence of labour allocation records in relation to its allegation that delayed response to RFIs had caused lost productivity implied that there was in fact no lost productivity at all, and rejected expert testimony to the contrary, saying:

> "[The subcontractor's expert] testified that [the subcontractor's] record keeping, primarily its tracking of labour and material being expended, was better than that of most large mechanical subcontractors. [The subcontractor's expert] also opined that it was not practical to maintain records to track labour productivity by a specific cause. [The subcontractor] here claims that it and [its sub-subcontractor] are owed over $1.5 million for the portion of the almost 50% overrun in labour allocated to [D's] liability. [The subcontractor] knew very early in the project that its labour costs were greatly exceeding estimates, that the entire planned construction sequence changed and that the site was wet. In the face of the alleged, pervasive, [D]-caused inefficiency, we reject the notion that [the subcontractor], a self-described large, experienced and sophisticated mechanical contractor could not track or document the severe effects on its labour efficiency as they occurred.

34 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.4.5.3.
35 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010), para.4.5.7.6.
36 *Clark Construction Group Inc* (2000) VABCA No 5674 at 65.

> The liability for tardy RFI responses is established by showing that the late responses somehow reflect the [D's] failure to fulfill a contract obligation. [The subcontractor] also has to prove both that the changes and late RFI responses caused changes to working conditions beyond the parameters of the conditions the parties could reasonably anticipate and that the changes and late RFI responses lowered the productivity of its labour. The after-the-fact, conclusory assessments of the project managers or the opinion of its experts are not sufficient substitutes for PKC's underlying obligation to contemporaneously document the severe adverse impact on labour efficiency it now claims resulted from the changes and RFIs."

13–041 On the other hand, in *Grumman*, the Board thought that the workmen on site would not necessarily know whether what they were doing amounted to a change so as to come up with a calculated cost of the effect of the events at D's liability. The Board observed:

> "An early awareness of potential impact is not the same as the ability to collect separately the costs. Similarly, the early engagement of experienced professionals may not guarantee the result. On the other hand, the inability of an experienced professional to come up with the data might indicate that it could not reasonably be done. We are not prepared to fully subscribe to [C's] claim that it would have had to assign a person to every [C's] worker on the production floor and monitor the worker's activities each day. However, we do think there is merit to the view that any type of charging system would have required the individual [C's] worker to know what was a change and what was not a change and to record accurately the impact of the [D's cost risk event] changes."

Record retrieval

13–042 The CIOB research revealed that the construction industry tended to give little thought to how the records were likely to be used and how they could be retrieved. At chart 34, the report found that:

> "Only 7% of those familiar with record keeping 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. 40% had experience of the records being kept on a spreadsheet either by direct entry or by transcription from paper records, requiring some analysis to be able to detect trends and effects of progress achieved. An alarming 53% of respondents answering this part of the questionnaire were familiar with records being kept only on paper, rendering them virtually useless for contemporaneously detecting trends, managing the effects of lack of progress and identifying the factual data relative to loss-causing events."

13–043 In relation to the retrieval of records in complex projects, the *CIOB Guide* advises:

> "Records which cannot be retrieved are useless. Accordingly, the process of record keeping is inseparable from the process of record retrieval. It follows that in order to identify an adequate means of keeping records in the first place, consideration must be given to how they can be retrieved and used."[37]

13–044 Accordingly, the *Guide* advises that, for complex projects, record management can only properly be achieved by keeping the necessary progress and change control records in a database to which all those needing them can have access[38].

37 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) para.4.3.1.1.

38 Chartered Institute of Building, *Guide to Good Practice in the Management of Time in Complex Projects* (Chichester: Wiley Blackwell, 2010) para.4.3.3.1.

13–045 Apart from the advantages of using a computerised document management system for information control, it is in the processes of sort, search and retrieve that the computerised database is at its best. The concept is simple: records are created in such a way that they can be found by looking for them in different ways. When located, they are then automatically sorted, ordered and presented in a contemporaneous report independent of the records themselves. The computer report can be displayed on the computer screen for momentary inspection, or a topical chronology can be printed in hard copy. This process can be repeated indefinitely in producing reports of differing content for different purposes or issues, although the records need only be "entered" or "created" once.

13–046 Thus, the purpose of installing data onto a computerised database is to enable any evidential issue to be quickly accessed, so that the fullest available information in relation to that issue is always at hand.

13–047 When a computerised document control system is not used, identifying hard copy documents giving evidence of the cause and effect of change in the course of a construction project is not easy. If locatable, the relevant documents should be kept in a separate "dispute file". Correspondence fixing key project events, such as notices to proceed, strikes, release of retention, approval of submissions, or submissions that cross the contract manager's desk and could have a bearing on an issue in contention should be tagged and copied to this file.

13–048 At the close of the project, if the dispute file has been maintained, C, its lawyers, or its experts can prepare an accurate and cost-effective reconstruction of the project history. Provided that this is done effectively, a decision as to whether a claim might fruitfully be pursued, or defended, can then be made quickly and at a fraction of the cost of those in which dispute files have not been maintained.

13–049 In the case of a construction contract where a dispute has arisen, and in the event that a quick settlement does not appear likely[39], then a memorandum should be sent to all the offices and locations affected, requesting staff to deliver up all hard copy documents (including both originals and all copies of originals) for inclusion in the dispute file. Particular care should be taken to ensure that documents and files are not defaced, destroyed (either specifically or in accordance with a company practice of destruction after the lapse of a stipulated number of years), annotated, or marked in any way.

13–050 If the matter settles without going to trial, that will usually be because of the attention given to the assembly of factual information. The cost of any time taken to do that should be seen in that light.

Electronic data exchange

13–051 Two key factors have emerged in favour of the adoption of electronic data exchange systems between the parties to a construction contract and their subcontractors and suppliers: the growth of the number of systems available and the reduction in relative cost.

13–052 Electronic communication capabilities have been notable for their exponential growth in recent years. This growth has occurred in relation not only to capacity, but also to the types of technologies that are available to businesses, for example:

> the emergence of the internet;
> the widespread use of email;

39 For example, within the course of a few weeks.

improvements in mobile telephony;
the emergence of wireless technologies such as Wi-Fi;
improvements in handheld and portable computing technology;
digital camera technology;
scanning and optical character and handwriting recognition technology;
voice recognition technology; and
improvements in data security, such as firewalls and electronic signatures.

13–053 However, in spite of the emergence of all of this technology, the construction industry, as many commentators have noted, has been slow to incorporate it into its usual practices. A 1999 survey commissioned by the UK Building Centre Trust, for instance, showed that, at that time, some 80% of communications on construction projects were on paper[40]. Anecdotal evidence suggests that this percentage has not decreased dramatically since then. Thus, a key objective of the EDI protocols is to encourage the industry to improve its use of new technology.

13–054 Since about 1995, there has been, in the United Kingdom and elsewhere, a growing recognition of the long-term advantages that can accrue when parties on a project join together in "a spirit of mutual trust and co-operation", as the ECC2 and ECC3 contract forms put it[41]. This has manifested itself in new contract forms and in greater (although not universal) acceptance of the possibility of adopting "partnering" and "collaborative" project procurement arrangements. Such endeavours represent an attempted cultural shift away from what might be described as the traditional adversarial, or confrontational tendencies of parties to construction contracts. Project data exchange systems, therefore, might be considered to represent some of the technological aspects of that cultural shift.

13–055 An important consideration in the implementation of standard practices in a data exchange system will be the parties' respective policies and rules across corporate and contractual boundaries, in relation to electronic data, software, and information technology. This tends to be embodied in a collateral agreement known as an "Electronic Data Interchange" (EDI) agreement. The standard forms of EDI agreement, which incorporate the ICC rules[42] for the exchange of data in the context of international trade, are not specific to any industry and are intended to be used either bilaterally or multilaterally (that is, among two, or more parties).

13–056 NZ03, SIA80, HK86, the 2009 edition of the Irish government forms, the GC/Works series of UK government forms, ECC2, ECC3, the ICE forms and HK05 currently make no reference to an electronic exchange protocol of any sort. The current FIDIC[43] forms simply say that communications shall be in writing, "or transmitted using any of the agreed systems of electronic transmission as stated in the Appendix to Tender". Similarly, MC08 says that communications may be in electronic form, but gives no guidance as to a protocol for electronic exchange[44]. Although a collateral agreement, in JCT98 it is incorporated into the contract documents. For example,

40 P Goodwin, *The PIX Protocol Guide and Toolkit* (Building Centre Trust, 2004), p.3.
41 *The Engineering and Construction Contract – Guidance Notes*, 2nd edn (London: Thomas Telford, 1995), p.27.
42 *Uniform Rules of Conduct for Interchange of Trade Data by Transmission*, International Chamber of Commerce.
43 At Cl.1.3(a).
44 Cl.1.8.

JCT98 specifies at Cl.1.11: "Where the Appendix so states, the 'Supplemental Provisions for EDI' annexed to the conditions shall apply."

13–057 The Supplemental Provisions for EDI[45] provide that:

"1. the parties are to enter into an EDI agreement prior to entering into the construction contract;
2. nothing in the EDI agreement is to take precedence over the conditions of contract;
3. whilst anything specified to be in writing can be validly made if made in compliance with the EDI agreement, that does not apply to the following which nevertheless, are to be in writing:
   a. determination of the employment of C;
   b. suspension of the work by C;
   c. the final certificate;
   d. any reference to the dispute resolution procedures; and
   e. any collateral agreement."

13–058 On the other hand, JCT05, DB05, IFC05, IFWCD/05, MP05 and PCC06, provide that where information is to be transmitted that may be achieved other than by hard copy,

"..any documents to be supplied may or (where so required) shall be sent or transmitted by the means (electronic or otherwise) and in such format as the parties from time to time agree in writing for the purposes of this contract."[46]

13–059 By a footnote to that clause, these forms add the advice that:

"The parties should agree a communications protocol before entering into the contract or as soon thereafter as is practicable. If the medium or format to be used for [C's] design submission procedure (schedule 1) is not stated in [D's] requirements or [C's] proposals, that also should be covered by the protocol."

13–060 MC08, WC/08, CM08 and TC08, on the other hand, invite D to identify what it requires by way of electronic communications in the recitals to the contract, where D is invited to specify:

"the communications that may be made electronically and the format in which those are to be made (if none are identified, all communications are to be in writing, unless subsequently agreed otherwise)."[47]

13–061 The recognition of the benefits of efficient project data exchange systems has led to some significant progress in codifying and standardising procedures. For example, the *PIX Protocol Guide and Toolkit* has been created to provide a practical template and guidance document for the creation of a data exchange system on construction projects. The resultant EDI agreement following implementation of the "toolkit" is called a "PIX Protocol"; PIX being the acronym for "*P*roject *I*nformation e*X*change"[48].

13–062 As far as the PIX Protocol system in particular is concerned, its key elements, according to its guidance document, are as follows:

a definition of the client's information requirements, both during and at the end of the project;

45 Annex 2 to JCT98.
46 See, for example JCT05, Cl.1.7.2.
47 See, for example MC08, Cl.1.8.
48 P Goodwin, *The PIX Protocol Guide and Toolkit* (Building Centre Trust, 2004).

agreement within the team on which information is to be exchanged electronically; common formats for exchange and agreed rules for re-use of electronic information;
alignment of design management principles for the project; this means agreeing items such as drawing origins and grids and that design co-ordination processes are followed;
alignment of document management principles, such as file-naming conventions and document-numbering systems;
agreement on computer aided design (CAD) standards to be used; this means agreeing alignment in areas such as common software platforms, CAD modelling approaches and layering conventions within CAD models; and
agreement on standards for project communications, such as minimum speeds for internet communications, how electronic files are to be transported and agreement on maximum file sizes that can be produced for each communication channel.

13–063 The "team" in this context refers to the collaborating entities on a project (D, its consultants, designers, suppliers, the CA and C and its subcontractors and so on). In order for a PIX Protocol to operate, it needs to be agreed. The guidance document recommends that the Protocol forms part of the contractual specification, to encourage higher levels of compliance and to avoid the prospect of "some team members only paying lip service to the concept". To obtain the necessary information as to the capabilities of each party, standard questionnaires are issued by D for the other team members to complete. This process is termed the "team capabilities review" and is intended to cover all relevant technical subject-matter of the data exchange agreement. Whilst it is said that the questionnaire is designed to interrogate the minutiae of each team member's existing practices and capabilities in the various subject areas listed, it is unfortunate that none of this is referable to management information, schedules, or progress records.

13–064 Following the questionnaire, a PIX Protocol can then be drafted and agreed taking this information into account. Typically, if it is not simply going to be a case of all parties matching the lowest common denominator (which would in any case be inconsistent with the stated aim of achieving "best practice" across the project), for some team members conformance to the PIX Protocol will mean upgrading their existing capabilities. The guidance document recognises that such upgrades are likely to need to be negotiated on a commercial basis with D.

13–065 The guidance document also recommends that implementation should ideally commence in the feasibility stage of a project – before the team has been selected. In that way, the team capability review can take place in conjunction with the tender selection process and the requirements for conformity with the Protocol can be negotiated in the same way as any other part of the specifications.

13–066 If this does not occur and the team is already appointed, the guidance document suggests that a "team leader" be appointed to conduct the team capabilities review, before publishing draft and final PIX Protocols in conjunction with the other team members. Alternatively, a meeting of all the team members can be held with the aim of agreeing a Protocol straight away. If a project data exchange system can be implemented, it can, according to the promoters of the PIX Protocol, potentially save up to 10% of project cost[49].

49 P Goodwin, *The PIX Protocol: A Risk Reduction Tool for Construction Projects* (2004), p.13.

Building Information Modelling

13–067 Building Information Modelling (BIM) is an "intelligent" three-dimensional computer aided design (CAD) model, although it differs from a CAD model in that a BIM is not just an illustration of the design but a simulation of it. The intelligence in the BIM comes from each component part of the model containing information about material specification, weights, thermal capacities and the like in a three-dimensional environment. A useful BIM definition is provided by the National Institute of Building Studies[50] as follows:

> "A Building information Model, or BIM, utilises cutting edge digital technology to establish a computable representation of all the physical and functional characteristics of a facility and its related project / life-cycle information, and is intended to be a repository of information for the facility owner/operator to use and maintain throughout the life-cycle of a facility."

13–068 The successful implementation of a BIM would help to eliminate duplication of design effort, ensure consistency across discipline interfaces, ensure consistency of communication, facilitate advanced value engineering and ensure effective project control. Theoretically, a single project-wide BIM could be used to overcome such common deficiencies in information management as[51]:

providing a single data entry for multiple users. Traditionally, design data may be duplicated (and confused) by multiple users; a single project-wide BIM would enable the data to be entered once and to be used and analysed by many;
improving design efficiency; a single project-wide BIM would eliminate the need for 2D drawings and hence design interface data requirements between different designers;
minimising inconsistencies; clash detection is inherent in 3D modelling;
improving estimating; as the model is "intelligent", material take-offs may be automatically produced for estimating purposes;
improving communications; value engineering options can be more readily understood;
improving time control; linking the schedule to the 3D model could provide a 'real time' construction model, facilitating the examination of the effect of alternative construction strategies; and
providing a source of recorded information; the "as-built" BIM model may be handed over to the client for effective facilities management in use.

13–069 The value of a single project-wide BIM would be in the speed and accuracy of the communication process. However, in practice, many of the potential advantages are currently lost, simply because the BIMs in use tend not to be a single project-wide model in which all data resides, but multiple models, held by various parties built for specific purposes[52]. Such multiple BIM models then sit in isolation from each other,

50 The National Institute of Building Science, through the building SMART alliance, is developing a National BIM Standard (USA).
51 See also, H Ashcraft, *Building Information Modelling: A Framework for Collaboration* (Society of Construction Law, 2009).
52 D Larson and K Goldon, "Entering the brave new world: an introduction to contracting for BIM" (January 2008) *Mortenson Construction*.