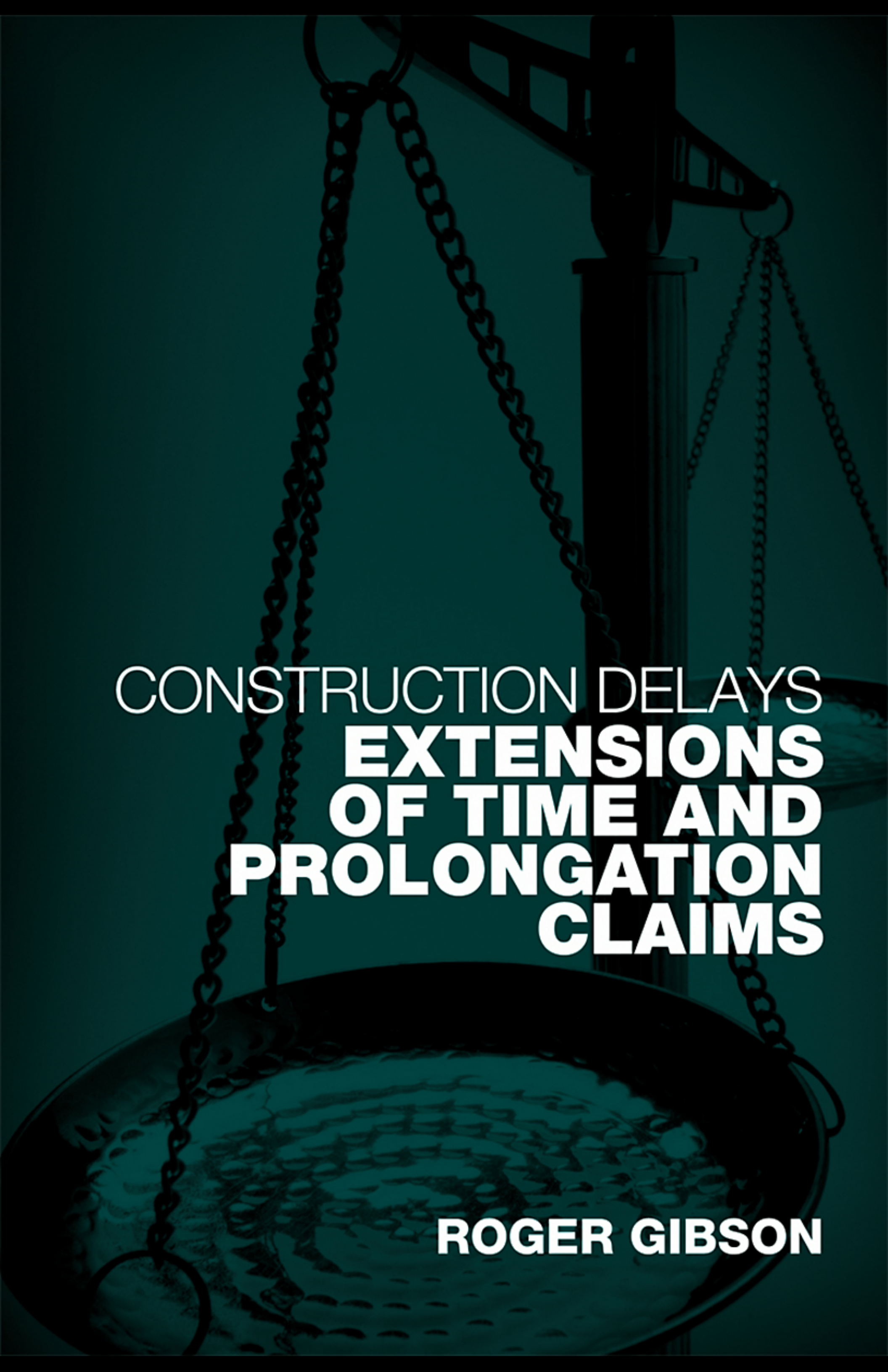
CONSTRUCTION DELAYS
EXTENSIONS OF TIME AND PROLONGATION CLAIMS
ROGER GIBSON

Construction Delays

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Construction Delays

Extensions of time and prolongation claims

Roger Gibson

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Contents

Preface

I have been involved in the construction industry in the UK and overseas for over 45 years, both at project level in planning and project positions and in head office organisations in managerial roles. During this time, and in particular during the last 20 years, which I have primarily spent involved in time-related disputes and claims, I have become increasingly aware of the lack of a comprehensive, easy-to-understand, practical and 'down-to-earth' reference book for those involved in the preparation and assessment of extensions of time and prolongation claims.

The views expressed by me in this book represent many years' experience of looking at projects that have gone wrong and resulted in a dispute or disputes between the parties. In practice many projects are completed without major claims and, where these do occur, they are settled promptly and professionally without escalating into a formal dispute. Unfortunately, a claim that evolves into a formal dispute often stretches the resources of the parties and their consultants, and this added financial pressure does not facilitate resolution of the dispute.

Many construction firms, large and small alike, lack staff with the skills required to produce well-presented extension of time submissions and time-related delay claims. Similarly, the receiving party, architect, engineer or employer, often lacks the in-house skills to review such submissions and claims thoroughly, and delays making a proper decision or resorts to external consultants for assistance.

A criticism I have with many books dealing with time-related claims is that they answer all the simple questions, but often avoid the thorny issues of 'who owns the float' and 'concurrency'. This book deals with these issues in detail and offers pragmatic advice.

Finally, this book aims to provide guidance and practical help in preparing extension of time submissions and time-related delay claims.

Roger Gibson
Summer 2007

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I am indebted to my family and Anne-Mette for their encouragement and support during the writing of this book. Thanks are also due to my past and present colleagues who have offered numerous helpful suggestions.

Finally, the views expressed in this work are my own and I take full responsibility for them.

Part I

Introduction

1 The aims of this book

There are a number of excellent books on construction claims; and many other construction books that devote sections and chapters to construction claims. However, the majority of these works give very little guidance on the preparation of time-related delay claims, and even less guidance on the preparation of extension of time submissions.

Throughout this book the term 'delay analysis' is used, being a generalisation to cover both extension of time submissions and the time-related aspects of delay claims. Although there are various sophisticated delay analysis techniques around today, in its essence delay analysis is a fact-based process.

The aim here is to provide this guidance, particularly in relation to extension of time submissions. The contents of this volume are intended to outline the information and practical details to be considered when formulating extension of time submissions and time-related delay claims.

One of the recurring themes is good record keeping on projects. While a lack of progress-related records may not be fatal to a claim, it does make reaching a reasonable settlement an uphill battle. Readers will observe my continuing advice on good record keeping.

The book has been arranged in six parts, or sections:

Part I, 'Introduction', details general principles relating to extensions of time, delay claims and the SCL protocol.

Part II, 'Programmes and record keeping', deals with the fundamental matter of the project programme, together with the associated matter of record keeping during the project.

Part III, 'Contracts and case law', looks at the relevant time-related clauses in the JCT and NEC contracts, plus case law concerning time-related issues.

Part IV, 'The "thorny issues" ', deals with the 'thorny issues' that appear in many extension of time submissions, namely, (i) float, (ii) concurrency, (iii) acceleration and (iv) time at large.

Part V, 'Extensions of time', gives details of the various extension of time/delay analysis techniques together with some worked examples.

Part VI, 'Prolongation claims (and time-related costs)', gives details of the claim heads for a prolongation claim together with some worked examples.

A brief synopsis of the contents of each section

Part I: 'Introduction'

The chapters on 'Extensions of time' and 'Prolongation claims' give brief overviews of these important subjects, while the final chapter in the section, 'The SCL protocol', highlights the core principles of the protocol together with the author's views and opinion on these and the other sections of the protocol.

Part II: 'Programmes and record keeping'

Although this section primarily considers the project programme and record keeping, it begins with a chapter covering the background and history of planning. Following this are four chapters concerning programming and programmes. The final chapter gives advice on record keeping during the project.

Part III: 'Contracts and case law'

The second chapter in this section reviews the time-related clauses of the two most popular forms of contract in the UK, namely the *Joint Contracts Tribunal's 2005 edition* (JCT) and *The New Engineering Contract 3rd edition* (NEC).

The remaining chapters, under the headings of 'case law' refer to cases from 1952 to 2005 held initially in the Official Referees Court, and then the Technology and Construction Court. This review of some 15 cases highlights the time-related issues of each dispute followed by a commentary reviewing the important issues such as concurrency, float and delay analysis methodology.

Part IV: 'The "thorny issues"'

There are many 'thorny issues' in the construction dispute arena which could have been included in this section. However, the four issues selected are considered to be the thorniest, if that is the correct phrase, and a chapter is dedicated to each one.

They are float, concurrency, mitigation and acceleration, and time at large.

Part V: 'Extensions of time'

This section reviews and discusses the various types of Delay Analysis methods and techniques. The final chapters give worked examples of prospective analysis and retrospective methods; the techniques chosen are 'time impact' and 'windows' methods of analyses.

Part VI: 'Prolongation claims (and time-related costs)'

This final section looks first at the contractual requirements and conditions for monetary compensation for time-related delays. This is followed by a chapter detailing the various 'heads' of a prolongation claim, followed by worked examples.

The author hopes that this book will provide useful guidance for those responsible for preparing extension of time submissions and time-related delay claims as well as for those dealing with them, the aim being that they can be resolved amicably, professionally and without either party being seriously disadvantaged.

2 Extensions of time

Just when you thought you knew all there is to know about how to prepare or analyse extension of time (EOT) claims, identify critical paths in programmes, and support your conclusions with well-reasoned arguments supported by the facts, something new comes along. Over the past 20 years extension of time methodologies have grown more sophisticated.

Delay analysis has evolved from crude hand-drawn charts in the early years of CPM to sophisticated modelling of impacts and delays using computers and state-of-the-art software. However, more recently, that very software has received criticism for allowing shrewd manipulation of the programme and analysis to favour a particular party.

Awarding extensions of time under a construction contract ought to be easy.

If the form is JCT 2005, the contractor notifies of a delay and the reason for it. The contract administrator reviews the application and, if they believe it to be the result of a 'relevant event', they award a fair and reasonable extension of time and fix a later date for completion of the project. The NEC contract has a more structured compensation event procedure and is specific about the programme information that has to be provided, so should achieve an answer more easily.

Most of the time these processes are applied fairly well, although there are often difficulties when contract administrators do not comply with the time scales for making the awards set out in the standard contracts: 12 weeks for the JCT, usually two weeks with the NEC. Unfortunately, the majority of EOT disputes concern the contract administrator's assessment technique or lack thereof. Most contractors have had experience of their EOT submissions being assessed through a 'wet finger in the air' and/or a quick guess at what 'they can get away with' technique, rather than the application of a logical and analytical method involving the programme and a critical path analysis-based technique.

EOT submissions are common sources of construction disputes. Submissions/claims for extensions of time on construction projects are made by a contractor to:

1 avoid/reduce liquidated damages that could otherwise arise; and/or
2 establish an entitlement to monetary compensation during the extended period.

Extension of time clauses should be drafted so as to include for all delays which may be the responsibility of the employer. Then, if the employer, either personally or through his architect or professional team, hinders the contractor in a way which will delay the date for completion, the architect will have the power to fix a new completion date and thus preserve the employer's right to deduct liquidated damages.

If the employer intends that liquidated damages are to be payable if the contractor fails to complete the works, then a date for completion must be stipulated in the contract. That is because there must be a definite date from which to calculate liquidated damages. There is an implied term in every contract that the employer will do all that is reasonably necessary to co-operate with the contractor and that he will not prevent him from performing. In this respect, the employer also has a duty to ensure that the architect and other professional team members employed by him carry out their duties properly. Alongside the implied term of co-operation, there is an implied term that neither party, employer or contractor, will do anything to hinder or delay performance by the other.

The meaning and purpose of liquidated damages

Construction contracts usually have a time or date by which the contractor must complete the work. The importance of a prescribed time or date for completion is that it facilitates a claim by the employer for damages for delay by the contractor in finishing the work. If there is no prescribed time, the law implies a term that the contractor must complete within a reasonable time. Therefore, the existence of an agreed time is very important for the employer. On the other hand, contractors prefer a reasonable time.

Linked to the problem of proving when the contractor is in breach for delay in achieving the date for completion is the problem of proving what damage was caused to the employer by the contractor's breach. To overcome this, most forms of contract have a provision for the parties to agree upon a daily, weekly or monthly amount as damages for delay by the contractor. This amount is called liquidated and ascertained damages (LADs).

The main purpose of LADs is to stipulate the employer's entitlement to damages for the contractor's breach of the obligation to complete by the agreed date. Even if the employer's actual damages exceed the LADs, the employer cannot recover more by way of damages. Similarly, if the employer's actual damages amount to less than the LADs, the employer can still recover LADs.

3 Prolongation claims

It is generally accepted that failure to give notice of delay for extensions of time purposes is not usually fatal to an extension of time claim. However, failure to give notice in accordance with the contract in respect of additional payment, e.g. prolongation, or loss and expense, claims, may bar or severely prejudice a claim.

Damages act as a means of compensating an innocent party for loss or harm suffered as a result of another party's breach of contract. The generally accepted rule is that contractual damages should be sufficient to compensate for such losses as may fairly and reasonably be considered as arising from the breach of contract.

In order to justify entitlement to damages for breach of contract, the injured party will have to prove that:

- the breach actually causes loss;
- the particular loss is recognised as giving an entitlement to compensation;
- the loss is not too remote;
- the quantification of compensatory damages is fair and reasonable under the circumstances.

The burden of proving that the breach has actually caused loss rests with the claimant, and he will need to produce contemporary records in support of the claim. The quantification of damages must be based upon factual records and not upon theoretical calculations.

There is a mistaken belief in the construction industry that after an extension of time has been granted there is an automatic entitlement to the recovery of loss and expense.

Under the JCT 2005 form of contract extensions of time and recovery of loss and expense are dealt with under separate clauses. For example, in the *JCT 2005 Standard Building Contract with Quantities*, section 2, clauses 2.26 to 2.29 inclusive, deal with extensions of time; while loss and expense is dealt with under section 4, clauses 4.23 to 4.26.

Under the NEC form of contract the situation is somewhat different.

This contract includes core clause 6 entitled 'Compensation events', and under this clause a contractor is entitled to the resultant time and money.

It is common practice for decisions and awards on extensions of time to be made and issued before considering prolongation claims. Once an extension of time has been awarded, the intention of most construction contracts is for the contractor to be reimbursed for the additional costs which have resulted from the employer-responsible delays. Basically, this involves a comparison between the contractor's actual costs incurred and what the contractor's costs would have been had no delay occurred.

When should the delay costs be evaluated?

If, for example, a critical delay occurs to the external envelope works, awaiting details for the external windows, and the contractor is awarded a six-week extension of time, for what period should the delay or prolongation costs be evaluated? Should it be the contractor's costs associated with the six weeks on site following the original contract completion date, or would a more accurate evaluation be achieved by assessing the costs incurred during the six-week period when the information was late in arriving?

The Society of Construction Law's 'Delay and Disruption Protocol' offers good advice on this matter in paragraphs 1.11.2 and 1.11.3,

> *Arguments commonly arise as to the time when recoverable prolongation compensation is to be assessed: is it to be assessed by reference to the period when the Employer Delay occurred (when the daily or weekly amount of expenditure and therefore compensation may be high) or by reference to the extended period at the end of the contract (when the amount of compensation may be much lower)?*
>
> *The answer to this question is that the period to be evaluated is that in which the effect of the Employer Risk Event was felt.*

This is a sensible solution, and it is recommended that it is followed.

Finance charges

A contractor's prolongation, or loss and expense, claim will invariably include a sum in respect of finance charges, the argument being that they have been 'underpaid' for considerable periods of time, which has necessitated borrowing to make up the shortfall or, if money has been taken off the deposit, there has been a subsequent loss of interest.

It is clear from established case law that contractors are entitled to finance charges as part of their prolongation, or loss and expense, claims. However, the contractor will still need to show that the loss was actually suffered.

The 'heads' of a prolongation, or loss and expense, claim

Time-related claims are, as the phrase implies, derived from the time analysis, which has identified: (i) prolongation to the contract period, and (ii) other non-critical delays to work activities.

Both of these elements should be included in a prolongation claim, which under the JCT form of contract is referred to as a 'loss and expense' claim.

4 The SCL protocol

In October 2002, the Society of Construction Law (SCL) published its 'Delay and Disruption Protocol'. This protocol provides guidance to people dealing with submissions for extension of time and delay claims, both during a contract and after completion of the works. The protocol runs to some 82 pages and was drafted by a group of experts from all sections of the construction industry.

The protocol envisages that decision-takers (e.g. contract administrators, adjudicators, dispute review boards, arbitrators, judges) may find it helpful in dealing with time-related issues.

There are 21 'core statements of principle' in the protocol. These are:

1 *Programme and records; to reduce the number of disputes relating to delay, the Contractor should prepare and the Contract Administrator (CA) should accept a properly prepared programme showing the manner and sequence in which the Contractor plans to carry out the works. The programme should be updated to record actual progress and any extensions of time (EOTs) granted. If this is done, then the programme can be used as a tool for managing change, determining EOTs 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.*

2 *Purpose of extension of time; the benefit to the Contractor of EOT is only to relieve the Contractor of liability for damages for delay (usually liquidated damages (LDs)) for any period prior to the extended contract completion date. The benefit of an EOT for the Employer is that it establishes a new contract completion date, and prevents time for completion of the works becoming 'at large'.*

3 *Entitlement to extension of time; applications for EOT should be made and dealt with as close in time as possible to the delay event that gives rise to the application. The Contractor will potentially be entitled to an EOT only for those events or causes of delay in respect of which the Employer has assumed risk and responsibility (called in the Protocol 'Employer Risk Events'). The parties should attempt so far as*

possible to deal with the impact of 'Employer Risk Events' as the work proceeds, both in terms of EOT and compensation.

4 *<u>Procedure for granting extension of time</u>; the EOT should be granted to the extent that the Employer Risk Event is reasonably predicted to prevent the works being completed by the then prevailing contract completion date. The goal of the EOT procedure is the ascertainment of the appropriate contractual entitlement to an EOT; the procedure is not to be based on whether or not the Contractor needs an EOT in order not to be liable for liquidated damages.*

5 *<u>Effect of delay</u>; for an EOT to be granted, it is not necessary for the Employer Risk Event already to have begun to affect the Contractor's progress with the works, or for the effect of the Employer Risk Event to have ended.*

6 *<u>Incremental review of extension of time</u>; where the full effect of an Employer Risk Event cannot be predicted with certainty at the time of initial assessment by the CA, the CA should grant an EOT for the then predictable effect. The EOT should be considered by the CA at intervals as the actual impact of the Employer Risk Event unfolds and the EOT increased (but not decreased, unless there are express contract terms permitting this) if appropriate.*

7 *<u>Float, as it relates to time</u>; unless there is express provision to the contrary in the contract, where there is remaining float in the programme at the time of an Employer Risk Event, an EOT should only be granted to the extent that the Employer Delay is predicted to reduce to below zero the total float on the activity paths affected by the Employer Delay.*

8 *<u>Float, as it relates to compensation</u>; if as a result of an Employer Delay, the Contractor is prevented from completing the works by the Contractor's planned completion date (being a date earlier than the contract completion date), the Contractor should in principle be entitled to be paid the costs directly caused by the Employer Delay, notwithstanding that there is no delay to the contract completion date (and therefore no entitlement to an EOT), provided also that at the time they enter into the contract, the Employer is aware of the Contractor's intention to complete the works prior to the contract completion date, and that intention is realistic and achievable.*

9 *<u>Concurrent delay – its effect on entitlement to extension of time</u>; where Contractor Delay to Completion occurs or has effect concurrently with Employer Delay to Completion, the Contractor's concurrent delay should not reduce any EOT due.*

10 *<u>Concurrent delay – its effect on entitlement to compensation for prolongation</u>; if the Contractor incurs additional costs that are caused both by Employer Delay and concurrent Contractor Delay, then the Contractor should only recover compensation to the extent it is able to separately identify the additional costs caused by the Employer*

Delay from those caused by the Contractor Delay. If it would have incurred the additional costs in any event as a result of Contractor Delays, the Contractor will not be entitled to recover those additional costs.

11 *Identification of float and concurrency; accurate identification of float and concurrency is only possible with the benefit of a proper programme, properly updated.*

12 *After the event delay analysis; the Protocol recommends that, in deciding entitlement to EOT, the adjudicator, judge or arbitrator should so far as is practicable put him/herself in the position of the CA at the time the Employer Risk Event occurred.*

13 *Mitigation of delay and mitigation of loss; the Contractor has a general duty to mitigate the effect on its works of Employer Risk Events. Subject to express contract wording or agreement to the contrary, the duty to mitigate does not extend to requiring the Contractor to add extra resources or to work outside its planned working hours. The Contractor's duty to mitigate its loss has two aspects – first, the Contractor must take reasonable steps to minimise its loss; and second, the Contractor must not take unreasonable steps that increase its loss.*

14 *Link between extension of time and compensation; entitlement to an EOT does not automatically lead to entitlement to compensation (and vice versa).*

15 *Valuation of variations; where practicable, the total likely effect of variations should be pre-agreed between the Employer/CA and the Contractor, to arrive if possible at a fixed price of a variation, to include not only the direct costs (labour, plant and materials) but also the time-related costs, an agreed EOT and the necessary revisions to the programme.*

16 *Basis of calculation of compensation for prolongation; unless expressly provided for otherwise (e.g. by evaluation based on contract rates), compensation for prolongation should not be paid for anything other than work actually done, time actually taken up or loss and/or expense actually suffered. In other words, the compensation for prolongation caused other than by variations is based on the actual additional cost incurred by the Contractor. The objective is to put the Contractor in the same financial position it would have been if the Employer Risk Event had not occurred.*

17 *Relevance of tender allowances; the tender allowances have limited relevance for the evaluation of the costs of prolongation and disruption caused by breach of contract or any other cause that requires the evaluation of additional costs.*

18 *Period of evaluation of compensation; once it is established that compensation for prolongation is due, the evaluation of the sum due is made by reference to the period when the effect of the Employer Risk*

Event was felt, not by reference to the extended period at the end of the contract.

19 *Global claims; the not uncommon practice of contractors making composite or global claims without substantiating cause and effect is discouraged by the Protocol and rarely accepted by the courts.*

20 *Acceleration; where the contract provides for acceleration, payment for the acceleration should be based on the terms of the contract. Where the contract does not provide for acceleration but the Contractor and the Employer agree that accelerative measures should be undertaken, the basis of payment should be agreed before the acceleration is commenced. It is not recommended that a claim for so-called constructive acceleration be made. Instead, prior to any acceleration measures, steps should be taken by either party to have the dispute or difference about entitlement to EOT resolved in accordance with the dispute resolution procedures applicable to the contract.*

21 *Disruption; disruption (as distinct from delay) is disturbance, hindrance or interruption to a Contractor's normal working methods, resulting in lower efficiency. If caused by the Employer, it may give rise to a right to compensation either under the contract or as a breach of contract.*

Further background and guidance on each of the 21 core principles is contained in the four 'guidance sections', which are:

i Section 1: Guidelines on the protocol's position on core principles and on other matters relating to delay and compensation.

ii Section 2: Guidelines on preparing and maintaining programmes and records.

iii Section 3: Guidelines on dealing with extensions of time during the course of the project.

iv Section 4: Guidelines on dealing with disputed extension of time issues after completion of the project – retrospective delay analysis.

Observations

First, I present some observations on the core principles,

1 Core principles 2 to 6: Extensions of time
The position on extensions of time is generally good and the advice is sound, although fairly general in nature.

2 Core principle 7: Float, as it relates to time
One of the more controversial principles in the protocol, the nub of this principle is,

i Should the contractor be awarded an extension of time and so preserve the float period for its own use; or
ii Should no extension of time be awarded on the basis that the employer's delay is simply absorbing float and not impacting the contractual completion date?

The protocol's recommendation is that float is available to the project. In other words, it is available to whichever party uses it first; contactor or employer.

3 Core principle 8: Float, as it relates to compensation
Where a contractor plans to complete before the contract date for completion, the protocol recommends that he is entitled to compensation, but not an extension of time, if he is prevented from completing to his own planned date, but finishes before the contract date for completion. This is a complicated topic. However, the basic recommendation must be rejected. The position is that in deciding this question all the circumstances must be taken into account.
4 Core principle 9: Concurrent delay – its effect on entitlement to extension of time
The protocol's approach seems to be to take a particular position on the subject of concurrency on the basis that it is a complex topic and a compromise situation is necessary. A basic principle is that no concurrent cause of delay which is the result of any fault of the contractor should reduce the extension of time to which he would otherwise be entitled. This approach basically follows the 'prevention principle' of English law where an employer cannot take advantage of its own breach of contract, by imposing liquidated damages on the contractor.
5 Core principle 13: Mitigation of delay and mitigation of loss
A clear exposition of the situation. More could have been said in the protocol about the contractor's rights, or otherwise, to claim reasonable costs of mitigation.
6 Core principle 15: Valuation of variations
The protocol recommends a mechanism similar to the current JCT price statement for dealing with the valuation of variations and associated extension of time and loss and expense.
7 Core principle 16: Basis of calculation of compensation for prolongation
It is rightly stressed that ascertainment must be based on actual additional costs incurred by the contractor. However, there appears to be some confusion between a contractor's claims for loss and expense under the contract machinery and claims for damages for breaches of contract. The former are reimbursable under most standard forms of contracts while the latter, being a claim outside the contract, are not so reimbursable.
8 Core principle 17: Relevance of tender allowances

It is refreshing to see that the protocol considers that tender allowances have little or no relevance to the evaluation of the costs of prolongation or disruption.

9 Core principle 19: Global claims
It is good to see that global claims are discouraged.

10 Core principle 20: Acceleration
This is a broadly correct interpretation of the position, but the reference to the possibility of accelerating by instructions about hours of working and sequence of working is to be doubted.

11 Core principle 21: Disruption
The definition of disruption does not adequately explain that disruption can also refer to a delay to an individual activity not on the critical path where there is no resultant delay to the date for completion. The protocol also states that most standard forms do not expressly deal with disruption; that, of course, is true. However, the JCT forms refer to regular progress being materially affected. That appears to be broad enough to encompass both disruption and prolongation.

The protocol's 'Guidance section 2' deals with guidelines on preparing and maintaining programmes and records. However, there is not a great deal of guidance on maintaining records generally.

Stress is placed on obtaining an 'accepted programme'; that is a programme agreed by all parties. There are several problems with this. Perhaps the foremost is that the architect will be unlikely to have the requisite skills and/or experience or indeed the information required to accept the contractor's programme. He is probably capable of questioning parts of it, but highly unlikely to be possessed of sufficient information to be able to satisfy himself that the programme is workable. The protocol, rightly, accepts that the contractor is entitled to construct the building in whatever manner and sequence he pleases, subject to any sectional completion or other constraints. The protocol states,

> *Acceptance by the CA merely constitutes an acknowledgement by the CA that the Accepted Programme represents a contractually compliant, realistic and achievable depiction of the Contractor's intended sequence and timing of construction of the works.*

This is placing a responsibility on the architect (or CA as the protocol prefers) which he is not required to carry. There appears to be no need for a programme to be accepted. It is sufficient if the contractor puts one forward as the programme to which he intends to work. The architect is entitled to question any part which appears to be clearly wrong or unworkable. But, in the light of the contractor's insistence that he can and will carry out the works in accordance with the submitted programme, it is difficult to refuse a programme unless firm objections can be raised.

The protocol also recommends that the 'accepted programme' be updated with progress at intervals of one month, and more frequently on complex projects.

The protocol describes the updating process as follows:

> *Using the agreed project planning software, the Contractor should enter the actual progress on the Accepted Programme as it proceeds with the works, to create the Updated Programme. Actual progress should be recorded by means of actual start and actual finish dates for activities, together with percentage completion of currently incomplete activities and/or the extent of remaining activity durations. Any periods of suspension of an activity should be noted in the Updated Programme. The monthly updates should be archived as separate electronic files and the saved monthly versions of the Updated Programme should be copied electronically to the CA, along with a report describing all modifications made to activity durations or logic of the programme. The purpose of saving monthly versions of the programme is to provide good contemporaneous evidence of what happened on the project, in case of dispute.*

All of this is good and sensible advice.

'Guidance section 3' gives guidelines for dealing with extensions of time during the course of the project. It provides much good practical advice including the importance of calculating extensions of time by means of various programming techniques. Although every architect should be familiar with such techniques, careful consideration should be given to the aptness of any particular technique in a given situation.

The protocol suggests that extensions of time should be made as close in time to the delaying event, and that these are dealt with promptly by the CA. The protocol recommends that 'the "Updated Programme" should be the primary tool used to guide the CA in determining the amount of the EOT'.

Again sound advice, with one proviso; the facts surrounding the alleged delay event(s). As Mr Justice Dyson noted in his judgment on the Henry Boot Construction v. Malmaison Hotel case, 'It seems to me that it is a question of fact in any case, as to whether a relevant event has caused, or is likely to cause, delay to the works beyond the completion date.'

'Guidance section 4' deals with disputed extensions of time after completion of the project, and spends some time examining the different types of analysis that can be employed.

Conclusion

The protocol sets out ways of dealing with delays and disruption. Most of it is in line with what is generally understood to be the law on these matters. However, in some instances, the protocol steps outside this boundary in order to suggest what it clearly considers to be a simpler or fairer way of dealing with the practicalities. All parties involved in construction contracts must be aware that the protocol does not take precedence over the particular contract in use unless it is expressly so stated in the contract itself. Therefore, the protocol's recommendations should be viewed with caution.

It will be of no avail for the architect, contract administrator or employer to argue that he has acted strictly in accordance with the protocol if the contract prescribes action of a different sort.

Part II

Programmes and record keeping

5 Background and history of planning

From earliest recorded times groups of people have been organised to work together towards planned goals and planners co-ordinated and controlled their efforts to achieve desired outcomes.

The early days

Considerable planning skills were required by, for example, the ancient Egyptians to build their pyramids, the ancient Chinese to build the Great Wall of China, and the Romans when building their roads, aqueducts and Hadrian's Wall.

These time-enduring construction projects required large amounts of human effort with planning, organisation and co-ordination; and all with no computers, faxes or combustion engine!

After the fall of the Roman Empire, the great Dark Ages descended, and it was not until the mechanical clock and Guttenberg's moveable typefaces were invented, that any further major development in 'planning' was forthcoming. The clock, invented by Heinrich von Wych in Paris in 1370, permitted accurate work measurement. The printing press enabled communication by the printed word; and it was while at an early version of the Octoberfest that Guttenberg visualised the technique of combining the small dies used for coin-punching with the mechanics of a wine press. This produced a printed page, made up of moveable individual letters, rather than a single engraved block.

Developments in planning and production management then began. In 1436 a Spanish visitor to the Arsenal of Venice reported:

> *And as one enters the gate there is a great street on either hand with the sea in the middle. On one side are windows opening out of the house of the arsenal, and the same on the other side, and out came a galley towed by a boat, and in the windows they handed out to them, from one the cordage, from another the ballistics and mortars, and so from all sides everything which was required. When the galley had reached the end of the street all the men required were on board,*

> *together with the complement of oars, and she was equipped from end to end.*

This was an example of the planning of a production line, half a millennium before Henry Ford!

It was not until the First World War that simple barcharts were used by the British army for planning military exercises. Then some 15 years later, in 1930, construction began on the Empire State Building, which on completion was the tallest building in the world and remained so for over 40 years. However, during its construction it was a marvel of programming excellence, the works being elaborately planned and programmed by Andrew Eken, the chief engineer of the contractor. The site in downtown Manhattan was very congested with virtually no lay-down areas. Material deliveries were carefully planned to coincide precisely with the installation works. Another impressive fact about this project is that the building's 56,000 tons of structural steel were erected in six months at the remarkable rate of 4.5 floors per week, again without the aid of a CPM programme or a computer!

Modern times

Mention 'planning' to the average person nowadays, and he or she will think of a barchart, which is the most common form of visually representing a project. The barchart is strictly speaking a Gantt Chart, named after its inventor, Henry Laurence Gantt, an American engineer. He is the first known person to publish a plan in a barchart format – and probably the first to be told off for a project not going to plan!

The Gantt Chart, for which Henry will be remembered, is a visual display chart used to present a schedule or programme of activities. It is based on time, rather than quantity, volume or weight. In other words, a Gantt Chart is a horizontal barchart that graphically displays time relationships. In effect, it is a 'scale' model of time because the bars are different lengths depending upon the amount of time they represent. Gantt Charts have been around since the early 1900s and provide a method of determining the sequence of events and time required to achieve a given objective.

The critical path method (CPM)

The next major development in 'planning' was the advent of PERT and the emergence of critical path method (CPM) programmes.

PERT is an acronym of 'Project Evaluation and Review Technique', and is a variation on CPM programmes that takes a more sceptical view of activity durations. To follow this technique, for each activity you estimate: (i) the shortest possible time the activity will take; (ii) the most likely length of time for the activity; and (iii) the longest time that might be taken if the activity takes longer than expected. Using the following formula, the duration for each activity is calculated thus:

$$\text{Shortest time (i)} + 4 \times \text{most likely time (ii)} + \text{longest time (iii)} \backslash 6$$

Using the PERT technique helps to bias activity durations away from the unrealistically short time scales sometimes assumed.

CPM programming has been around since the 1950s. The first known use appears to be in North America by E.I. DuPont Nemours Co., which developed a CPM programme in 1956 for construction of its $10 million chemical plant in Kentucky. The CPM was run on a large mainframe computer, called a UNIVAC, some 25 feet high and 50 feet in length containing 5,000 tubes and 18,000 crystal diodes.

The type of CPM used in those days was the Activity Diagram Method (ADM) form of network.

However, the first high-profile application of a CPM was the Polaris project in 1957. The team on this huge project had to understand the development process for the most complex machine ever devised by man. Seeking a technique that would get the missile developed and into action, management consultants Booz, Allen and Hamilton used the Critical Path Method to draw their maps of time. Polaris went on to hit the target of 'time'. Everyone celebrated the new behemoth, and the modern version of 'planning' was truly born.

The use of computers and planning software

CPM, preceded by its reputation, spread to other industries and to other environments. In the early 1970s, CPMs were run on mainframe computer systems, which few people owned. The rest of us rented time at a now extinct breed of companies known as 'computer bureaux'. The procedure was that, after hiring time at a computer bureau that was running a critical path software programme, such as Projacs, we worked alongside a data entry person (and it was always a woman in those days). From our data entry sheets, she would type an incomprehensible series of characters and numbers into on-screen forms to create a series of punch cards. These were fed into the mainframe computer and processed. The result was a printout of our project plan, often containing thousands of tasks or activities, and requiring long corridor walls for the huge printouts of green-and-white striped paper containing the network diagram. Computer people in the 1970s all had white coats, little white hats and a supercilious smile. Nowadays, only the white coats and hats have gone.

In the 1980s, a great advance in computing took place in a garage in California; Steve Jobs was astounding the techie world with his Apple II. The Apple II, a small computer that sat on a desktop, changed many people's lives. A huge push was given to the personal computer industry when IBM developed the PC. PCs sprouted everywhere and computer packages and planning software, such as MicroPert, were specially written for the new PCs. Critical path diagrams increasingly took a backseat as far simpler barcharts were quickly and easily drawn by the new software.

The advent and development of personal computers and planning software packages specially written for them allowed the planning of a large construction project to be done on site. The other effect was that these affordable, small computers and planning systems spread into other industries and onto smaller projects. Critical path diagrams and barcharts appeared on walls in offices throughout the world.

Precedence Diagram Method Networks (PDMs)

At the turn of the millennium, the Precedence Diagram Method (PDM) supplanted the Arrow Diagram Method (ADM) form of network as the preferred planning method for CPMs.

The Precedence Diagram Method was developed in the early 1960s by an American company, H.B. Zachary, in conjunction with IBM. It was common in the 1970s and 1980s for planning software programmes to accept and perform calculations for either ADM or PDM networks. However, from the 1990s new software was written only for PDM networks. For example, when Primavera software writers created a Windows version, they opted to use PDM as the platform for the programme.

6 Planning and programming

Time is money, so the old adage says. However, poor planning/programming still ranks in most surveys within the top three problem areas that lead to project failure.

Therefore the 'planning' of a project is a necessity for success; and one would expect that, in this day and age, with computers and planning software available to assist project managers and planners, delays would have been significantly reduced. However, results reveal that the opposite is true.

Time is money; therefore planning shouldn't be ignored. Sadly, the statement that 'if you fail to plan, then you plan to fail' is often true, and sadly too many planners nowadays rely solely on a bit of computer software for 'planning'. The manner in which computers and planning software deal with activity logic and relationships through an interactive screen is an improvement from the days of creating a network programme through punch cards. However, it also encourages planners to generate programmes with illogical activity relationship links; and often this ill-conceived planning is a hindrance in time-related disputes.

Planning and programming are two separate functions, but are often linked together under the general term of 'planning'. However, before you prepare a programme, you must have a plan.

Planning

To plan a project means to identify the tasks or work activities to be performed and logically interrelate them. The question of time for performance and resources required are answered as part of the programming function.

The first stage is a broadbrush approach, and it is best to start with a blank piece of paper – not a computer.

Take a six-storey concrete-framed commercial building for example. First assess how long it will take for the main elements, i.e. (i) substructure works before starting superstructure work, (ii) superstructure work, (iii) envelope and cladding, (iv) services works, (v) internal finishes.

For example, let's say the three main tasks in the substructure work are bulk excavation, piling, and concrete works being pile caps, ground beams and ground floor slab. Taking a broadbrush approach, these are assessed as two weeks, four weeks and six weeks respectively. However, the planner, using his experience, allows for overlapping between these main stages and his conclusion is that work to the concrete frame superstructure can begin ten weeks after starting the bulk excavation.

The next key element, superstructure, is approached in a similar fashion. However, for this element, the key is the cycle time for a typical floor of 400m^2. Now the planner has to go into more detail, to assess how long to follow for fixing the formwork and reinforcement for this area of concrete slab. He also has to take into consideration crane hook-time; that means how many lifts the single tower crane positioned in the central core area must perform. For the example we are using it is probably the crane hook-time that is the governing factor in assessing the cycle time for a typical floor.

On a construction project, 'planning' covers all aspects from overall planning, such as, building 'A' must be completed before building 'B' can start, down to detailed planning, such as the activity 'excavate for foundations' has to be completed before its successor, 'pour concrete in foundations' can start.

By planning the works in detail, and linking activities in a logical manner, a contractor creates a network of activities and their dependencies or interrelationships as shown above. If this is done in a proper manner encompassing all works and all restraints on the project, then this is the basis for a critical path network.

The next stage is to calculate the time each activity will take. This phase is the start of preparing the programme for the project. For example, for 'excavate for foundations', the contractor will know he has 1,000 cubic metres of soil to dig out, and at a productivity rate of 100 cubic metres per day this activity will take ten days. This is known as the activity's 'duration'.

After completing this exercise for all activities, he then has a 'time frame' for the project. For example, 'excavate for foundations' will start on day 1 and, because it has a duration of ten days, it will finish on day 10. Its successor, 'pour concrete in foundations', will start on day 11 and, as it has a duration of, let's say 15 days, will finish on day 26. The contractor now has a programme.

Programming

In its simplest terms, programming (or 'scheduling' as it's sometimes called) is a method whereby the work activities necessary in order to achieve project completion are arranged in a logical order.

A properly developed programme will not only show the sequence in which the activities are intended to be carried out, but will also enable the participants of the project to monitor progress. In addition, the programme will be able to project future work while providing historical data that could be useful in analysing the past. This most common type of programme is a barchart; either hand-drawn or, more likely nowadays, computer-generated using commercially available project planning software.

CPM programmes

A critical path method (CPM) programme refers to the development of a logic-linked network that enables the identification of a critical path. The critical path is the longest activity path from the start of the project to its completion.

Activities on the critical path have no float; conversely, an activity not on the critical path will have float. Float is the amount of time an activity can be delayed without it becoming a critical path activity. Any activity on the critical path that experiences a delay will consequently delay the project completion date.

The calculations necessary to determine activity start and finish dates, together with float and the identification of the critical path, are very simple arithmetic. These CPM calculations can be performed manually, but with computers and project-planning software the thousands of calculations representative of a typical construction project can be effectively compiled and organised into an intelligible format in a matter of seconds.

A network programme, or CPM, provides the ability to analyse the effect of every activity on the project completion date, and far outstrips other methods for progress monitoring, reprogramming or evaluating new factors. At any time, you can determine if an activity is or is not on the critical path, and whether there is any float associated with that activity. If there is float, you will know precisely how much that activity can be delayed without it impacting the project completion date. This knowledge enables the project team to track and control progress, and to mitigate delay to the project completion date should critical activities be delayed.

However, a word of warning. The level of detail that will exist in a CPM programme is largely a matter of judgement on the part of the planner. Too much detail could conceal significant factors, while too little detail may result in a programme that is not very meaningful.

What is the use or benefit of a CPM programme?

By preparing a CPM, a contractor reassures himself that he can complete all the works and achieve completion of the project by the contract completion date. He knows when he has to have available key resources or equipment. Using the earlier simple example, he knows that he is going to ‘pour concrete in foundations’ starting on day 11, therefore he will have to have his concrete-producing equipment up and running by this date.

The benefit of a CPM programme for the employer or contract administrator is that they are also reassured that the contractor can complete the project on time, and that he has planned the works in a reasonable and logical manner. Again using the earlier example, the employer knows at an early date that the contractor intends to start to 'pour concrete in foundations' on day 11 and that he has to provide the drawings for this work before this date.

Pitfalls in the use of CPM

Although the above paragraphs extol the virtues of CPM, one should be aware of the associated inherent dangers. Detailed below are four of the most common pitfalls.

1 Quality of the CPM programme

Readily available, user-friendly project-planning software makes it possible for almost any computer-literate person to create a CPM programme that appears to be reasonable. It is very easy to input the various activities comprising a project into the software and string them together in such a way that, when looking at a barchart printout, the work seems to flow in a way that seems entirely sensible. Unfortunately, there is no way to tell simply by looking at the printed barchart whether this is a true CPM programme, or simply an 'attractive barchart'. Very often, no network logic, or activity relationship links, are issued with the programme, and therefore the barchart printout on its own is essentially useless.

Flawed programme logic can be hidden from all project participants unless someone works directly with the project-planning software on the computer. Without this direct examination of the electronic file, the programme may, either intentionally or unintentionally:

- i contain flawed logic;
- ii include activity constraints that interrupt the calculation of the critical path and/or float;
- iii show only those activities that the contractor wishes the employer or contract administrator to see;
- iv misrepresent project status at a progress update.

Therefore, the only way to avoid these circumstances is to require electronic copies of the baseline, or as-planned programme and all subsequent updates to be submitted with the barchart printout and paper reports.

2 What is critical today may not be critical tomorrow

The critical path identified in the original baseline, or as-planned programme, will only remain the critical path if everything goes according to plan. As everyone knows, this is almost never the case, as the calculated project completion date is directly dependent upon the completion of every activity on the critical path taking no longer than originally estimated.

Furthermore, if an activity not on the original critical path is delayed by more than its available float, then it will become critical and in effect the project's critical path has changed.

3 Unrealistic activity durations

For many programme activities that are delayed the as-planned duration may have been entirely appropriate, but this is not always the case. All too often the duration of activities in a CPM programme are wild guesses that are unrealistically short, or in some cases excessively long. All activities on the critical path and those that are near critical should have supporting data as to how their durations have been calculated.

4 Managing the programme and regular updates

Unfortunately, many contractors view a programme as nothing more than a requirement of the contract, and do not take it seriously enough to properly develop a CPM programme and maintain this as a management tool. Without proper attention the CPM will become nothing more than a list of activities and a convenient way to record actual start and finish dates.

One of the principles to be followed in maintaining a CPM programme is the regular monitoring of the work by periodically reviewing the programme. Programme updates should be performed on a regular basis for the purpose of gathering progress information and revising programme logic as appropriate. The project-planning software takes this contemporaneous information and recalculates the critical path so that management knows which activities are now driving the project completion date. The update also records project history, as well as projecting start and finish dates for future activities. Unless the CPM programme is updated on a regular basis, it will quickly become inaccurate and consequently useless.

This update information must be collected, inputted and analysed relatively quickly so that the update reports can be distributed to the project's participants while there is still time to react. A CPM programme is dynamic in nature and the critical path is continually evolving over time. Failure to disseminate the update information in a timely fashion may render the information useless from the standpoint of being able to proactively manage the project.

Types of 'programmes'

The construction industry uses a number of different types of programmes to manage projects. The two most common types are the 'barchart' and the 'network'.

The most frequently used of these two types is the barchart, which comprises a list of activities involved in the project. The planned start and planned finish of each activity is shown in a time grid and connected in a bar. The bar therefore represents the duration of the activity. The assumption usually made is that the bar represents a continuous uninterrupted activity, but this may not be the case. It is usual to include a tabular listing of the activities on the left-hand side of the barchart, which may include calendar start and finish dates together with overall durations for each activity.

An example of a simple barchart is given in Figure 6.1, showing the construction of a garage.

The barchart is easily prepared and can be used to show estimated timing and duration of activities, and to record actual progress. It does not require special software or computers and can easily be drawn by hand. The types of activities are not limited in any way, since the barchart is simply a diagrammatic representation of the time characteristics of an activity.

The barchart does not model the interrelationship between activities, and does not model the consequences on the project completion date, if the actual timing or duration of an activity is not met. So, for example, if an activity is started later than shown on the programme, the barchart does not allow the effect on completion to be analysed, without additional information. The barchart simply shows that an activity started later than planned. Similarly if an activity takes longer than its duration as shown on the programme, the barchart only reflects this fact. The barchart therefore simply provides a model of the time characteristics of the activity, and does not model the relationship of the activity with the time characteristics of the project and in particular with the project completion date.

The absence of logic links between activities means that the use of barcharts is limited to monitoring progress rather than forward-planning of the project. It is often used in the initial stages of delay analysis to compare planned and actual progress so as to identify problem activities. Care is required, since the implicit assumption that the planned durations were an accurate and still valid estimate, may not be correct.

The second type of programme, the network, is a model not only of the activities and their durations, but of their interdependence and association with the completion of the project.

The most common network programme is the critical path method (CPM), which models the construction logic links between the activities. The construction logic represents those factors which define the construction sequence of the project and include:

- the method of working – showing how the project is to be carried out and the sequence of activities;
- the construction constraints – which may be access dates for parts of

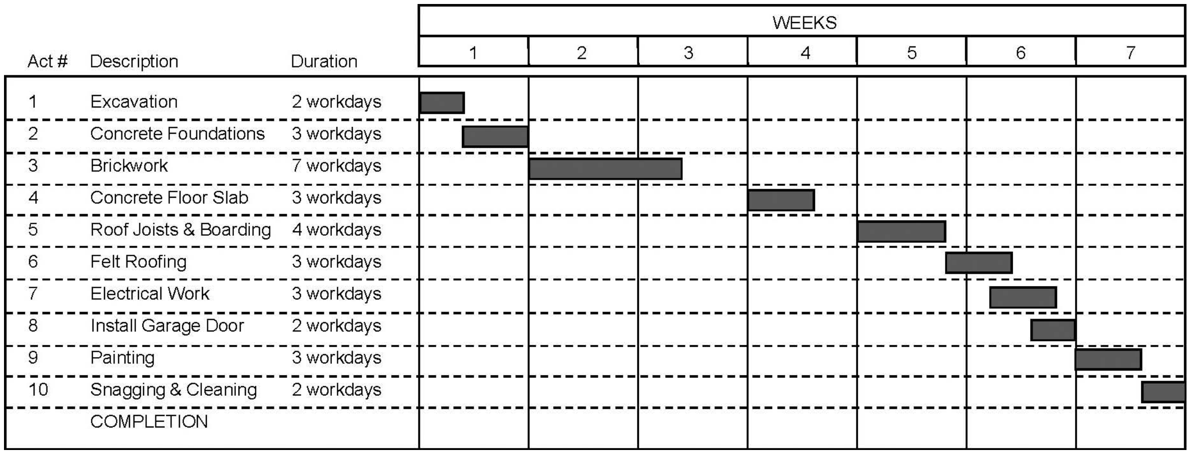

Figure 6.1 Example of a simple barchart.

the site or release dates for information or delivery dates for work by others.

There are two types of CPM programmes: Activity-on-Arrow and Activity-on-Node.

The Activity-on-Arrow programme produces an arrow network in which each node represents either the beginning or end of a discrete activity and the arrow linking the nodes is the activity. The nodes are numbered and the activity is identified by the numbers of the nodes at the start and the finish. The example below shows the activities for the construction of a garage (as used in the barchart programme example in Figure 6.1 above). Activity 'Excavation' is identified as Activity 21–22. Node 21 represents the beginning of Activity 21–22 and node 22 the end of Activity 21–22. Node 22 is also the start of Activity 22–23. This demonstrates the logic inherent in the Activity-on-Arrow, which is *finish-to-start*. The arrow activity is not drawn to a time scale but the duration is annotated as shown in the example In Figure 6.2. The Activity-on-Arrow network is helpful in representing the flow of work, but its use has declined in construction.

In the Activity-on-Node programme each node is an activity with a duration and the arrows represent the logic link between the activities. The programme uses *finish-to-start* relationships or links which are the same as used in the Activity-on-Arrow programme. In the example in Figure 6.3 for the construction of a garage, Activity 36 is 'felt roofing' and is linked to Activities 37 and 38. Activity 38 can start once Activity 36 is completed, while Activity 37 can start two days after Activity 36 has started and can only finish one day after the finish of Activity 36. The Precedence Network Method is now the most common form of Activity-on-Node programme and exploits the possibility of defining the links between activities by relationships other than *finish-to-start*. This method permits not only *start–finish* links, but *start–start* and *finish–finish*, as well as allowing a time dimension to be added to the link in the form of a *lag* or *lead*. The choice of logic link depends on which link accurately models the particular restraint.

The facility to define the relationship of activities both in terms of the type of logic as well as with a time dimension, makes the Precedence Network Method a most powerful and flexible method of programming. The assumptions made must be carefully examined when carrying out any delay analysis or management through programming analysis. If for instance the initial design of the equipment in the above example is delayed, then the lag in the above *start-to-start* link will need to be adjusted to take account of the delay. In any analysis, the time dimension of links which are not based on real-time factors needs to be examined carefully to establish that it still accurately models the relationship between activities.

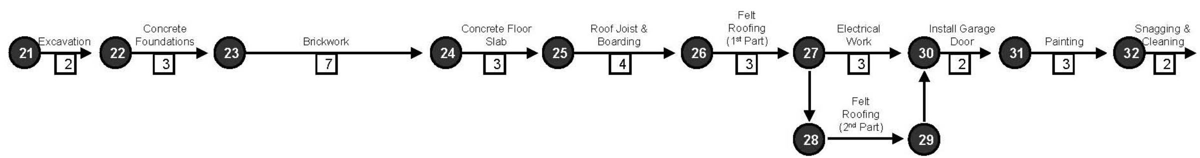

Figure 6.2 Activity-on-Arrow network.

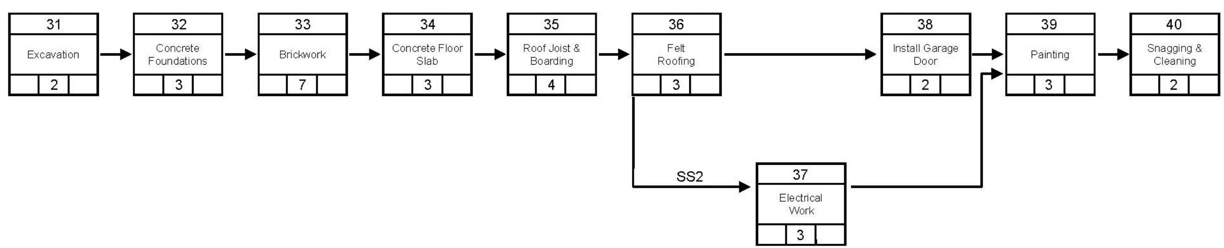

Figure 6.3 Activity-on-Node network.

Nowadays, it is common for the network to be presented as a time-scaled logic-linked programme, as shown in Figure 6.4.

In order to make management decisions and to establish the priority of actions, it is necessary to interrogate the network.

One important attribute relevant to the obligation to complete by a specified date is the critical path. Those activities which can be least delayed without affecting the date for completion are said to be on the critical path. The line, or path, through those activities is the critical path to completion and is usually generated by modern software.

This is shown in Figure 6.5 for the garage construction project, with the activities on the critical path shown.

The activities which are not on the critical path will have 'float'. This is usually shown as the difference between the earliest and latest start dates. There are various types of float, all of which are an expression of the relationship of an activity to other activities and milestones. The term float used here represents the period by which an activity on a programme may be delayed before the programme shows an effect on the date for completion. The activities with the least float are on the critical path to completion.

The emphasis on the programme is important because float is a function of the model represented by the programme, but may not accurately represent the consequences of starting an activity later than it could have been started. The construction logic on many programmes is kept simple in order to produce a workable programme so that management decisions can be taken.

Two other types of programmes are 'line of balance' and 'time chainage'.

Line of balance

The main concept of the line of balance technique is the work continuity of labour gangs, which work with rhythmic production and with no wastes willingly planned into the programme. This planning method fits much more closely to modern construction philosophy.

The line of balance technique is very suitable for repetitive projects like residential buildings; however, it may be adapted for non-repetitive projects as well. Unlike a barchart, which shows the duration of a particular activity, the line of balance chart shows the rate at which the work activity or group of activities have to be undertaken to stay on programme, and it shows the relationship of one activity or group of activities to the subsequent group. More importantly, it shows that, if one group is running behind programme, it will impact on the following group.

The main advantages of this technique are its graphical presentation and the fact that it is easy to understand.

Figure 6.6 is a sample line of balance chart for a residential development of 20 houses. In the above chart, the 'x' axis is the 'time', in this

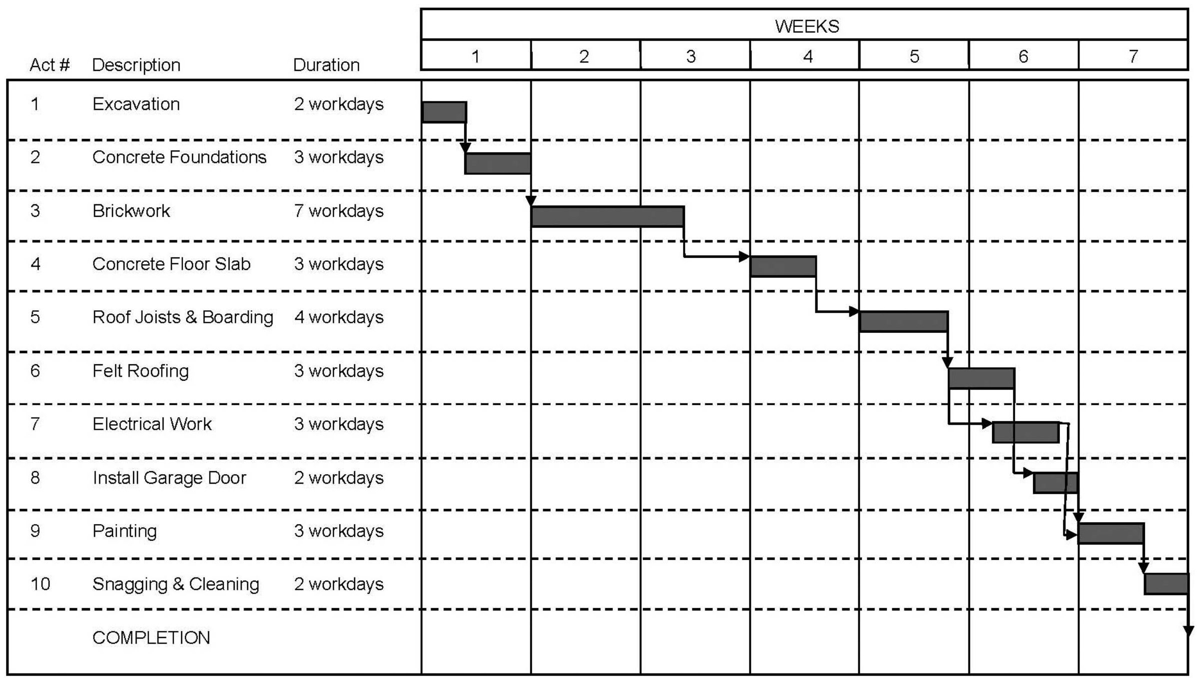

Figure 6.4 Time-scaled logic-linked programme.

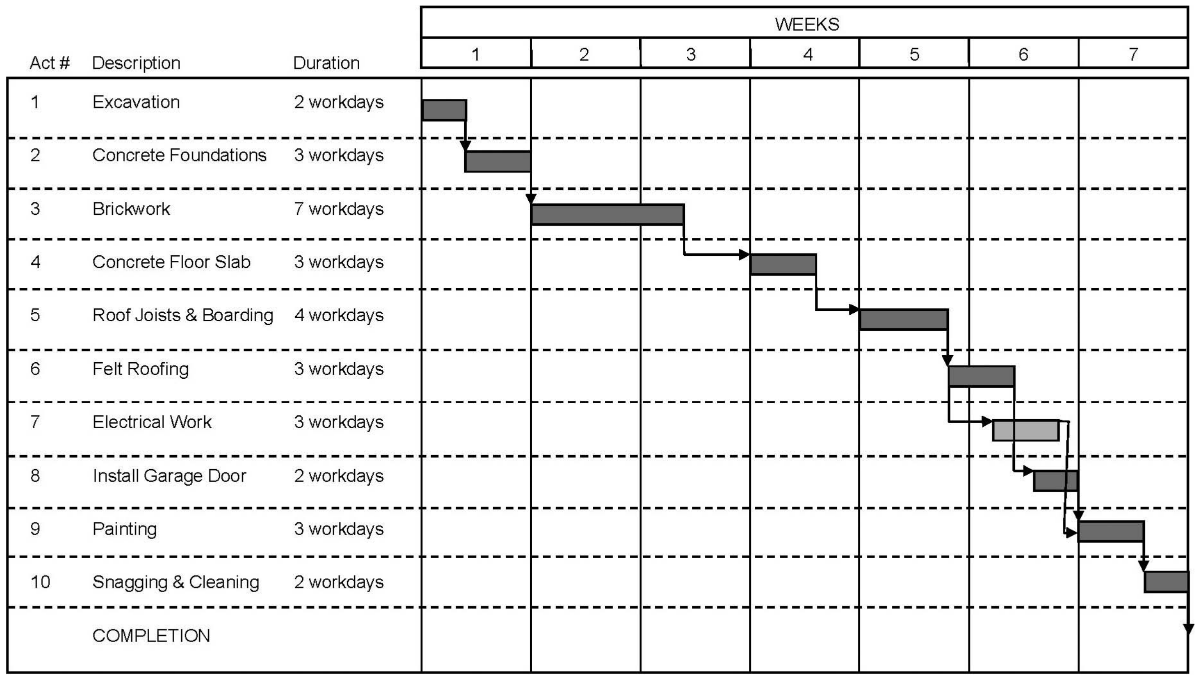

Figure 6.5 Activities on the critical path.

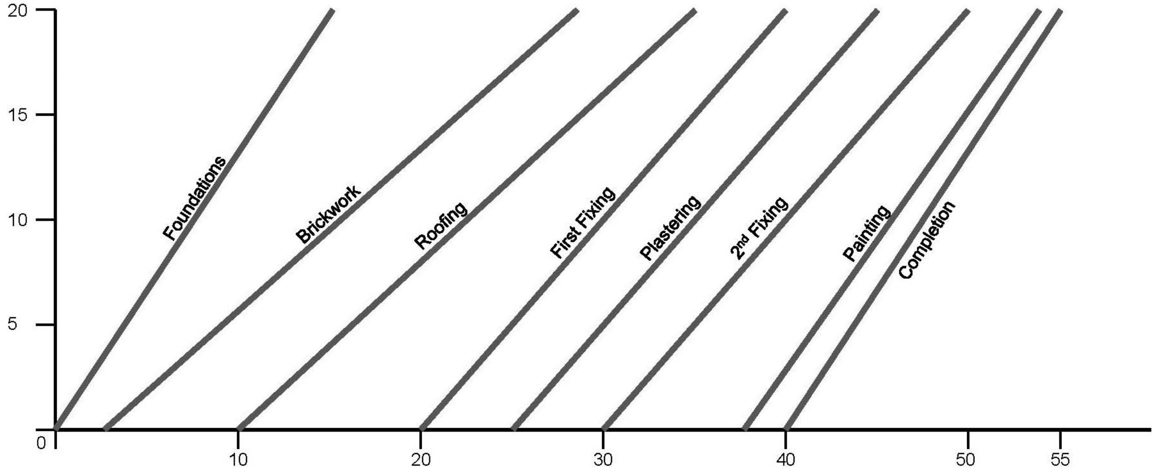

Figure 6.6 A line of balance chart.

example expressed as working weeks, while the ‘y’ axis is the number of houses.

Time chainage

For certain types of projects the time chainage technique can supply a clearer, more easily understood picture of the plan than the traditional barchart because it has a more graphical structure. The types of project that lend themselves to the time chainage programming technique are:

- roads;
- railways;
- pipelines;
- tunnels;
- transmission lines.

Time is displayed on the ‘x’ axis and distance is displayed on the ‘y’ axis. The chart shows the planned start and finish of a work activity against the actual location, or chainage, it is operating within the site as a diagonal line. The chart will also show fixed structures, such as bridges and culverts, as block sections for a fixed period of time (see Figure 6.7).

Levels of programmes

Planners often describe the various types of programmes/schedules that they produce as being of different levels. Each individual person or organisation would set up and use their own system for describing these various levels of programmes, with this inconsistency resulting in confusion.

It is time that the system for describing this hierarchy is standardised in order that some consistency is achieved, so that people can understand what is being referred to by, say, a level 2 programme. Therefore, the Planning Engineers Organisation recently produced a paper to set out standards of description for all planners and schedulers. The purpose was not to determine or set out what programmes/schedules should be produced by whom at which stage. Its use was to be limited to the standardisation of the terminology given to each level of programme/schedule. It is hoped that the recommendations of the Planning Engineers Organisation will be adopted by planners and schedulers as the reference standard against which, in future, programmes/schedules can be described.

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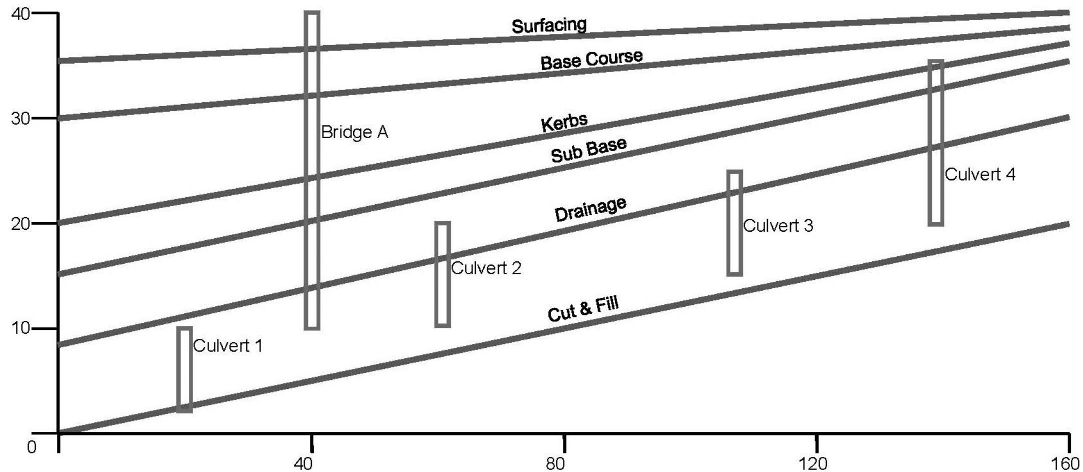


Figure 6.7 A time chainage chart.

7 The importance of a programme

Differences in opinion occur between employers and contractors on many issues. However, both will agree that completing the project as quickly as possible is a common goal, albeit for different reasons. The employer generally wants to have a project completed quickly so that the facility can be put to use as soon as possible. There are circumstances in which an employer may not want to have a project completed earlier than planned for financial or other business reasons; in such a case the employer simply wants the project delivered on time. The contractor, on the other hand, wants to complete the project as quickly as is economical because every day spent on site costs money. Furthermore, cash flow is the lifeblood of the contractor; without it he will not survive. Achieving the scheduled monthly progress helps the contractor to meet his cash flow requirements.

While employers and contractors have similar goals, they have differing needs and expectations from the schedule. Contractors will (or at least should) use the programme primarily as a planning and management tool. The process of planning and programming the project includes determining the overall approach to the job, organising and planning the labour and equipment resources, procuring subcontractors and materials.

However, as well as being used to plan and monitor project performance, a contractor's programme has another key function; that is as a reference and measurement tool for a contractor's entitlement to an extension of time and additional payment for delay and/or disruption.

The programme; as a plan for the works

First, let's look briefly at the programme's role as a plan to manage and monitor the project. Most forms of contract stipulate that the contractor has to submit a programme to the contract administrator. However, many contract forms do not stipulate that the contractor's programme is to be approved or accepted. This, in most cases, leads to distrust of the programme if it is later used by the contractor as a reference and measuring tool for additional time or compensation. It is advisable that the contract administrator should at the very least accept the programme albeit with comments. The programme should then be used by all parties to the project as the means for monitoring and measuring progress and performance.

The degree of detail, form and complexity of the detailed base programme will depend upon the size and nature of the project in question. Except for the simplest minor projects, simple barcharts are not recommended since they do not show the interrelationship between the various activities and in particular the activities' criticality; as a consequence of this it is not possible to demonstrate the effect of events upon the programme without first agreeing an underlying critical path network. In the case of a moderately simple project, it is possible to show links between the activities on a barchart. However, it is strongly recommended that, for any reasonably sized or complex project, whatever its nature, a critical path network programme should be developed from the outset; and indeed this is often a contract requirement. Such programmes are almost invariably produced using proprietary planning software and for presentation purposes, summarised barcharts can easily be produced giving a summary view of the construction sequence.

The level of detail included in a critical path network programme will to some extent depend upon the complexity of a project. In general, as much detail as is reasonably possible should be included in such a programme in order to facilitate the demonstration of the effects of subsequent events upon the programme. It is recommended that all activities in the programme should be coded preferably with a unique activity number and that all other documentation (e.g. correspondence, labour and plant allocations) should be cross-referenced to the programme activities. The actual copy of the programme issued to the other party need not show the wealth of detail underlying the base programme: it is, however, essential for that information to be available in the event of a dispute arising.

The usefulness of a programme can be enhanced by the addition of resource and cost information. This can have considerable benefits in the administration and monitoring of a project. In particular, if these principles are followed through into other documentation it becomes a much easier task to demonstrate the link between cause and effect relative to any single event.

The importance of a comprehensive 'baseline' programme cannot be over-emphasised.

Of the three most common types of construction programmes, i.e. barchart (or Gantt Chart), network, line of balance and time chainage, it is the network format that has become the most popular type for measuring the impact on a project in time-based disputes. Barcharts, although an extremely helpful, visual and graphical medium, are less effective than network programmes in examining time-based construction disputes.

The programme; in a claim situation

Now let's look at the use of the programme in a time-related claim situation. The programme is an essential document in determining the extent of any extension of time and/or compensation for delay. It is the benchmark or measuring tool in these situations. However, to be effective, the programme needs to represent an accurate prediction of future events and model the characteristics of the project with activity relationships, or logic links. This allows the criticality of activities and float cushions to be taken into account when assessing extensions of time or delays.

The roles of a programme as a reference and measuring tool for both contractors and employers in delay situations are:

1 for a *contractor's* entitlement to additional time for completion of the works or for sections of the works, in accordance with the contract;
2 for a *contractor's* entitlement to additional payment for delay and/or disruption, in accordance with the contract;
3 for a *contractor's* entitlement to additional payment for instructed acceleration, in accordance with the contract or on the terms agreed;
4 for the *employer's* right to deduct liquidated damages for the contractor's failure to complete the works on time;
5 for the *employer's* right to terminate the contractor for his failure to comply with the obligation to progress the works.

To establish items 1, 2 and 3 it is recommended that a network, or critical path analysis be carried out. The recommendations and guidelines of the Society of Construction Law's 'Delay and Disruption' Protocol are most useful for this exercise.

For item 4, the employer's right to deduct liquidated damages, it is necessary for the contract administrator to satisfy himself that the contractor is not entitled to an adjustment of the completion date, i.e. an extension of time, due to the occurrence of a relevant or delay event as described in the contract conditions. It is advisable that the contract administrator carries out a critical path analysis to satisfy this condition, otherwise an employer may receive a constructive acceleration claim from a contractor who considers himself entitled to, but did not receive, an extension of time during the project.

In the case of failure to comply with the obligation to progress the works (item 5); this is more difficult to monitor and analyse. Ideally, this requires the actual progress measured in both time and resources to be compared against the standard of progress specified in the contract. However, under most forms of contract the standard required is specified in general terms.

Programme float

A construction or engineering project consists of a series of individual activities which are detailed on a programme and executed over a period of time. If all goes well, the project will be completed on time, but if some activities are delayed will the project be finished late?

Some activities must be completed by their planned date if they are not to delay later activities and the completion of the project. These activities are said to be on the critical path. However, for other activities, the start, or completion, can be delayed to some extent without affecting later activities and completion of the project. This allowable period of delay is called 'float' and, provided that the delay does not exceed it, the project should still be completed on time.

Do all programmes have float? The short answer is yes, but float is only properly identifiable and quantifiable in a programme which is a logic network, more commonly known as a CPM (critical path method). A bar-chart, unless it is generated from a CPM, will not properly define the extent of float and may not even show any.

Float is an essential and inevitable part of every programme and is used by contractors in the efficient management of manpower and equipment resources. It is also vital in quantifying impact and delay in extension of time submissions and delay claims, where a contractor or subcontractor alleges a particular event caused delay and the effect of the delay may entitle them to an extension of time and ultimately a loss and expense claim.

8 Programme submission, review and acceptance

There is a clear need for a 'baseline' programme to be developed after the award of contract, reflecting the intentions of the contractor.

Contract administrators need front-line skills to review a contractor's baseline programme. Accordingly, contract administrators increasingly have to decide if, and to what extent, they are going to trust, approve or accept a contractor's programme submissions. In today's planning software paradise, CA's should be able to detect common techniques or mistakes when reviewing programmes that attempt to or increase the likelihood of extension of time awards. These techniques mean that a programme will not function as a proper predictive tool for measuring progress or quantifying the impact of delays and changes.

Contract requirements: JCT 2005

The *Joint Contracts Tribunal Standard Building Contract, with Quantities, 2005*, includes in Section 2 Clause 2.9, the following:

Construction information and Contractor's master programme

2.9 .1 As soon as possible after the execution of this Contract, if not previously provided:

.1 the Architect/Contract Administrator, without charge to the Contractor, shall provide him with 2 copies of any descriptive schedules or similar documents necessary for use for carrying out the Works (excluding any CDP Works); and

.2 the Contractor shall without charge provide the Architect/Contract Administrator with 2 copies of his master programme for the execution of the Works and, within 14 days of any decision by the Architect/Contract Administrator under clause 28.1 or of any agreement of any Pre-agreed Adjustment, with 2 copies of an amendment or revision of that programme to take account of that decision or agreement.

But nothing in the descriptive schedules or similar documents (or *in that master programme or in any amendment or revision of it) shall impose any obligation beyond those imposed by the Contract Documents.*

Commentary on the JCT 2005 requirements

JCT 2005 has a very basic requirement for submittal of the contractor's programme, the only requirement being a 'master programme for the execution of the Works'. Unlike the NEC3 contract, there are no requirements on the content of the programme and supporting information.

Contract requirements: NEC3

The Engineering and Construction Contract, 'NEC3', includes in core clause 3, 'Time', the following clauses:

The programme 31

31.1 *If a programme is not identified in the Contract Data, the Contractor submits a first programme to the Project Manager for acceptance within the period stated in the Contract Data.*

31.2 *The Contractor shows on each programme he submits for acceptance*

- *the starting date, access dates, Key Dates and Completion Date,*
- *planned Completion,*
- *the order and timing of the operations which the Contractor plans to do in order to Provide the Works,*
- *the order and timing of the work of the Employer and Others as last agreed with them by the Contractor or, if not so agreed, as stated in the Works Information,*
- *the dates when the Contractor plans to meet each Condition stated for the Key Dates and to complete other work needed to allow the Employer and Others to do their work,*
- *provisions for*
  - *float,*
  - *time risk allowances,*
  - *health and safety requirements and*
  - *the procedures set out in this contract,*
- *the dates when, in order to Provide the Works in accordance with the programme, the Contractor will need*
  - *access to a part of the Site if later than the access date,*
  - *acceptances,*
  - *Plant and Materials and other things to be provided by the Employer and*
  - *information from Others,*

- *for each operation, a statement of how the Contractor plans to do the work identifying the principal Equipment and other resources which he plans to use and*
- *other information which the Works Information requires the Contractor to show on a programme submitted for acceptance.*

The next sub-clause, 31.3, concerns acceptance of the contractor's programme by the project manager, while clause 32 is titled 'Revising the programme'. Both clause 31.3 and 32 are referred to in chapter 9 of this book.

Commentary on the NEC3 requirements

The NEC3 contract recognises that the programme is an important tool for use by both the contractor and project manager. The programme is valuable not only as a scheduling tool but also as a project management and change control tool.

NEC3 has distinctive features on the content of the contractor's programme. Indeed, the programme is the contractor's programme and he owns the terminal float. The programme is not only used to portray how the contractor intends to carry out the works, but can also be used for forensic analysis to determine the effect of compensation events for both time and money.

One of the key features of the programme under NEC3 is that upon its acceptance the contractor's programme becomes the 'accepted programme'. Any subsequent programmes submitted by the contractor and accepted by the project manager in turn become the 'accepted programme', superseding the previous programme.

With regard to the required content of the contractor's programme, here are some matters to be aware of:

1. *'planned Completion'* is the date when the contractor plans to complete the works. The requirement is to show on the submitted programme both the 'planned Completion' and the 'Completion Date'. At the start of the contract the contractor's 'planned Completion' may be a date earlier than the contractual 'Completion Date'.
2. *'the order and timing of the operations which the Contractor plans to do in order to Provide the Works'*. This should be clear from the programme, i.e. network logic and listing of activities with start and finish dates. However, incompatibility in this document and with other contractor documents is sufficient reason for the project manager not to accept a programme. The requested information will also facilitate the assessment of compensation events. This item can also include off-site manufacturing of components such as bathroom pods and the like. It is advisable that the procurement chain of these items, e.g. design, approvals, manufacture, etc., be included.

3 *'a statement of how the Contractor intends to do the work'*. In effect this is a resource statement, a list of resources that are intended to be used for each activity. Clearly this list will be based on the scope of the work at the time of submittal of the programme. The resource statement will also facilitate the assessment of compensation events.
4 *'the order and timing of the work of the Employer and Other'*. The employer and project manager need to ensure that any constraints on how the contractor is to 'provide the works' are stated in the 'works information'. The contractor needs to show these constraints in his planning and programme submittal. To introduce constraints at a later date, after commencement of the works, would be a change to the 'works information' and probably a compensation event.
5 *'provisions for float'*. This is an important aspect of NEC3, in that it recognises float in a programme. There are three types of float that should be addressed here:
   i terminal float, which is the period of time between the planned Completion and the Completion Date;
   ii total float, the amount of time a programme activity can be delayed without affecting the planned Completion and reducing the terminal float;
   iii free float, the amount of time a programme activity can be delayed before affecting a successor programme activity and thereby possibly reducing the total float.
6 *'provisions for time risk allowances'*. Another important aspect of NEC3, an example is the amount of down-time allowed for an earthworks activity being carried out during winter. Time risk allowances are owned by the contractor and will be included in the accepted programme.
7 *'acceptances'*. An example here is where the contractor is designing part of the works. If so, he should show on his programme the date(s) by which he requires acceptance of his design.
8 *'Plant and Materials and other things to be provided by the Employer'*. The contractor's programme should show the dates by which he requires plant and materials supplied by the employer.

What to look for in a programme review

When the programme is submitted, the CA should ask the following questions:

1 Does it comply with contractual obligations, milestones or restraints on working hours or methods?
2 Is the entire scope of the work represented?
3 Are any activity durations questionably too long, or too short for the scope of work they represent?

4 Are there any obvious errors in the programme related to the sequence or timing of the works?
5 Are any requirements of the employer's professional team too onerous, e.g. early completion programmes, unrealistic time allowances for approvals or supply of information, which constitute employer's risks?

Review of a CPM programme submittal

A very dangerous misunderstanding exists with a CPM programme submittal; many contract administrators and other professionals are still of the mistaken opinion that a CPM submittal should consist of several pages of activity listings and/or a barchart plot or two. A CPM submission for review should in fact comprise a full copy of the computer files necessary to recreate the programme; everything else is just frills.

A CPM submission, both for the baseline for review and subsequent updates, should consist of three discrete items:

1 The activity details, including description, original and remaining durations, and percentage complete. In conjunction with this, you should see, for each activity, other computed information such as early and late start and finish times, and total float.
2 The logical relationships that connect the various activities together to form a network which makes the CPM work. Full details of any lags and leads, i.e. imposed time durations between activities, is a must in the submittal.
3 Lastly and certainly not least is 'constraints'. The true logic of a network can be overridden by the programme containing various time constraints on an activity or activities. These will artificially reduce total float and could create an invisible delay, or even lead to the activity just expanding to take all the available time. This will never show up on a barchart plot and is only found in a 'constraint' listing and/or a copy of the computer files.

Having been satisfied that the information in the contractor's submittal is sufficient for a proper review, here are five basic checks or tests that should be carried out using the computer files provided by the contractor:

Test 1: Does the 'longest path' filter identify a reasonable critical path for the project?

Make sure the longest path is reasonable, and then check the reasonableness of near critical paths.

Test 2: Are there any open-ended activities in the programme?

In general, there should be only two open-ended activities in the entire network: one beginning activity with no predecessors, and one completion activity with no successors. Every other activity should be logically tied into the network. Furthermore, every activity should have its finish constrained with at least one FS (finish-to-start) or FF (finish-to-finish) successor relationship to another activity. Likewise, every activity should have at least one SS (start-to-start) or FS (finish-to-start) predecessor relationship to another activity.

Test 3: Do any of the activities have too much float?

Activities with too much float may indicate missing logic links, or logic links that have been overridden in a subsequent progress update. Identify any such activities.

Test 4: Are there any unnecessarily long gaps in workflow when grouping activities by work area and sorting by early start dates?

In most cases once work begins in a particular area or phase of the project then the programme should allow work to continue uninterrupted in that area or phase. Long calendar gaps in a work area or phase may indicate less than ideal workflow and suggest an adjustment of preferential logic links to create a better plan.

Test 5: Are there activities with unnecessary contractor-assigned constraints?

As constraints override the network logic in calculating activity start/finish dates and total float they should be used sparingly, if at all. A better approach is to use activity durations and network logic to model the project, and thereby eliminate constraints.

Acceptance of the programme

If the contract administrator fails to comment, it may be implied as acceptance that the contractor's programme is contract-compliant/satisfactory. When 'accepting' a programme, the contract administrator could be merely acknowledging receipt of the contractor's intentions. In 'approving' the programme, the contract administrator is more often seen to have performed some level of due diligence on the programme, such as asking the questions above, and is therefore acknowledging that the submission complies with the terms of the contract. However, it is important that a realistic baseline is established for the management of the works and the assessment of potential and actual effects of changes, unforeseen events or other circumstances that could delay the works.

Programmes are key documents in extension of time and delay claims disputes; therefore their significance in potential dispute resolution forums cannot be underestimated. At the same time, the perspective must be maintained that the programme is a management tool to assist in managing the work. A balance should be struck between keeping the contractor on an accurate progress path and the emphasis on the programme as a claims document. If approval is granted, this should not in any way relieve the contractor from complying with the contract, or in any way increase the employer's liability.

9 Programme updates and revisions

Notwithstanding the acceptance and popularity of detailed programmes, progress updates and their analyses in the dispute resolution arena, they are not held in the same esteem by many of the personnel on the project actually executing the work.

Criticisms that one hears on a construction project regarding programmes are either founded on the detailed use of the tool or the very output. Some typical criticisms of programmes and progress updates by site-based personnel include:

- programme activities and CPM network is too detailed or too condensed;
- no feedback/dialogue between planner and site;
- programme difficult for users to read or understand;
- activity durations haphazard and often changed in subsequent progress updates without rationale;
- programme updated schedules out of date by the time issued.

Contract requirements: JCT 2005

The *Joint Contracts Tribunal Standard Building Contract, with Quantities, 2005*, contains no specific requirements for programme revisions, other than the following reference in Section 2 Clause 2.9:

2.9 *.1.2 the Contractor shall without charge provide the Architect/Contract Administrator with 2 copies of his master programme for the execution of the Works and, within 14 days of any decision by the Architect/Contract Administrator under clause 2.28.1 or of any agreement of any Pre-agreed Adjustment, with 2 copies of an amendment or revision of that programme to take account of that decision or agreement.*

Commentary on the JCT 2005 requirements

JCT 2005 only has a reference in clause 2.9, stipulating that the contractor submit a revised programme after a clause 2.28.1 decision or agreement of a 'Pre-agreed Adjustment'. Clause 2.28 is titled 'Fixing Completion Date', and sub-clause .1 concerns the granting of an extension of time for a delay caused by a relevant event which is likely to cause delay in completion of the works or a section.

Contract requirements: NEC3

The Engineering and Construction Contract 'NEC3', includes in core clause 3, 'Time', the clauses concerning the content, submission and acceptance of the contractor's programme. Sub-clauses 31.1 and .2 refer to the submission and content of the programme, while sub-clause 31.3 concerns approval of the programme as follows:

The programme 31

31.3 Within two weeks of the Contractor submitting a programme to him for acceptance, the Project Manager either accepts the programme or notifies the Contractor of his reasons for not accepting it. A reason for not accepting a programme is that

- *the Contractor's plans which it shows are not practicable,*
- *it does not show the information which this contract requires,*
- *it does not represent the Contractor's plans realistically or*
- *it does not comply with the Works Information.*

Clause 32 concerns revising the programme, and reads as follows:

Revising the programme 32

32.1 The Contractor shows on each revised programme

- *the actual progress achieved on each operation and its effect upon the timing of the remaining work,*
- *the effects of implemented compensation events,*
- *how the Contractor plans to deal with any delays and to correct notified Defects and*
- *any other changes which the Contractor proposes to make to the Accepted Programme.*

32.2 The Contractor submits a revised programme to the Project Manager for acceptance

- *within the period for reply after the Project Manager has instructed him to,*
- *when the Contractor chooses to, and in any case,*
- *at no longer interval than the interval stated in the Contract Data from the starting date until Completion of the whole of the works.*

Commentary on the NEC3 requirements

The contractor submits his programme and upon acceptance of the programme by the project manager it becomes the accepted programme. Subsequent programme submissions by the contractor become the accepted programme when accepted by the project manager.

The first programme is submitted with the tender or within a stipulated time, e.g. four weeks, after contract award. If the contractor does not submit his first programme within the time required, the project manager retains 25 per cent of the value of the work done to date by the contractor until the first programme is submitted. This emphasises the importance placed on the programme by NEC3.

The contract gives only four reasons for which the project manager can refuse acceptance of the contractor's programme:

1 *'the Contractor's plans which it shows are not practicable'*. This refers to the contractor's plans alone. As an example, the contractor's original plan and programme for plasterwork shows an output of 100 sq.m. per gang per day, and his subsequent programme and plan shows 180 sq.m. per gang per day; while his actual production is currently showing 70 sq.m. per gang per day. His plans are therefore not realistic or *practicable*.
2 *'it does not show the information which this contract requires'*. This reason refers to the contract, and it should be remembered that this also includes the works information and whatever else has been incorporated into the contract. An example of this condition not being fulfilled is where the contractor's programme does not show key dates or access dates.
3 *'it does not represent the Contractor's plans realistically'*. For example, the contractor's programme is based on bored piles being used, whereas the project manager knows that driven piles have been procured by the contractor to be used.
4 *'it does not comply with the Works Information'*. An example may be that the contractor's programme has not taken into account a design constraint as shown on the works information.

If the project manager does not accept the programme then the contractor is obliged to resubmit the programme within the period allowed for reply.

The contract gives the following reasons for which the contractor is to submit a revised programme to the project manager for acceptance:

1 *'within the period for reply after the Project Manager has instructed him to'*. If the project manager instructs the contractor to provide a revised programme for his acceptance then the contractor must do so.
2 *'when the Contractor chooses to'*. The contractor may choose to

submit a revised programme to the project manager for acceptance. An example of this may be after deciding to change the sequence or method of working as stated on his then current accepted programme.

3 *'at no longer interval than the interval stated in the Contract Data from the starting date until Completion of the whole of the works'*. The contract data state the time period within which the programme has to be revised by the contractor. This may be every four weeks, two months or even longer, and is usually dependent on the complexity and overall duration of the project.

However, there is a fourth reason for a contractor to submit a revised programme for acceptance, namely,

> *'if a compensation event has affected the Accepted Programme'*. The contractual procedure is that where a compensation event has, or will have, the effect of changing the accepted programme, then the contractor has to submit a revised programme with his quotation for the compensation event, showing the effect of the event on the planned completion and completion date. However, if the contractor does not submit a revised programme with his compensation event quotation, then the project manager will make his own assessment of the effect on the accepted programme of the said event. It is suggested that upon a compensation event being implemented, then the contractor should submit a revised programme, based on the assessment of the event, to the project manager for acceptance as the accepted programme.

Progress updating

Lack of a formal progress updating procedure can cause failure because, without it, problems and delays may not be recognised until too late.

Even a 'perfect' programme becomes outdated unless it is updated on a regular basis. On most projects, programmes are updated monthly, but it is not uncommon to update weekly or even daily.

Some of the most significant purposes to update a project programme are to:

- record progress;
- provide a plan for remaining work to be completed;
- provide a forecast for completion of the project and contract milestones;
- provide progress status for the project team;
- comply with contract requirements.

Maintaining accurate project records through a project control system is an important aspect of updating the programme. Information for the 'update' can come from recording progress data while walking the job-site, site diaries and the like kept by project supervisory staff, and status reports from subcontractors.

An important part of a progress update submission is a narrative. As well as saying what delayed progress during the reporting period, a good narrative should also explain any revisions that have been made to the programme. If a contractor states the revisions contemporaneously then the contract administrator cannot complain at a later date that he was not aware of changes to the contractor's plan.

From a contract administrator's perspective, it is important to obtain a copy of the updated planning software files on disk. Important because, not only are you saving a tree, but how do you know the contractor hasn't made a mistake and accidentally forgot to include in the 'paper' reports some of the critical or embarrassing activities? Or, for that matter, are you really going to spot a change in a logic link to an activity in a paper report? If you were an auditor, would you accept handwritten summaries of the month's transactions or would you want to see the real books?

Programme revisions

Regular revisions of a programme are important because the initial baseline programme is merely a plan with regards to what needs to be accomplished in order to achieve completion of the project on time. How the project actually reaches completion will most likely vary greatly from the original baseline programme, which is why regular programme revisions are crucial.

A revised programme not only records progress at the time of the revision, but should also review and introduce, if necessary, activity logic revisions to reflect current intent. These logic revisions may result in changes to the original baseline critical path.

Detailed review of a progress update or revised programme

A progress update or revised programme submission for review should consist of a full copy of the computer files necessary to recreate the programme, and not just the paper printouts and listings.

In addition to the five basic tests for a programme submittal listed in chapter 8, the following checks should also be carried out on a progress update or revised programme submittal:

> Check 1: *System checks*. Most of the recognised planning software packages allow the user to determine the CPM calculation rules. For example, total float in Primavera software can be set to be computed using one of three different formulae; and mismatched dual-activity

predecessor links can automatically stretch out activity durations and the project completion date.

Check 2: *Activity checks*. This involves four sub-checks,

i Missing 'status' information. Most planning software packages allow you to status an activity without supplying actual start and finish dates. While the lack of actual dates will not affect the progress update calculations as long as the percentage progress achieved is correctly recorded against the activity, actual start and finish dates provide a good record of work already accomplished.

ii Deleted activities. In progress update submissions, activities that are finished should not be deleted as they form a record of when the work was achieved. However, in a revised programme submission it is acceptable that the programme include only works, and their detailed programme activities, still to be carried out on the project.

One last word on deleted activities. You should never re-use the activity ID from the deleted activity as an activity ID for a new, added activity. This not only confuses the 'checker' software, it makes statistic keeping and forensic investigation of the project very difficult. When you delete activities, also retire the activity ID.

iii Added activities. Adding activities is to be encouraged if done in a way to communicate the change in the work plan. It does no good for the contract administrator or employer to insist on 'sticking to the baseline programme', i.e. updating or statusing the activities as they are completed even though the work is no longer being packaged in the manner that was originally planned.

Very little useful information can be obtained from actual start and finish dates if the activity did not describe the way the work was accomplished. Activities by their nature imply that work was being pursued continuously. If the work no longer proceeds in the manner envisioned, the starts and stops of work within an ill-defined work activity will make that activity no more informative than a hammock activity.

iv Modified activities. If an activity was neither deleted nor added, it still may have been modified. It is not 'wrong' that activities are modified. After all, the employer expects progress to be made and that involves modification of activities. The key for the reviewer of the programme is to note those modifications to activities that are other than expected progress. After spotting these types of modifications, the next step is to analyse the modifications.

Check 3: *Actual dates*. Any modification to an existing actual date should be accompanied by an explanation for the change. The obvious reason for this is that there should be only one 'correct' date. The contractor earlier reported that the first actual date was correct. Now he or she is revising that certification. Or are they?

If you fail to unambiguously affirm which is the 'correct' date, the original one or the new one, then in the event of a delay or extension of time submission, the contractor can claim that either of the dates is the correct one. Was the first date correct and a new one inadvertently changed? In other words, which of the two dates works best in the contractor's favour?

In addition to modified actual dates, you should also look for newly added actual dates that do not fall within the update period. You should not accept new dates that just happen to fall in the future. You would think that the planning software programme would prevent this from occurring, but it occurs surprisingly often. Much more subtle are newly added actual dates that fall before the start of the last progress update period. The previously reviewed progress update showed this activity as incomplete. Now you are looking at a progress update that says that you reviewed the wrong programme the previous time. Has the critical path for previous progress update moved?

Check 4: *Network logic and activity links*.

i Where the predecessor and successor activities still exist in both the current update and previous progress update but the activity link is new, it is assumed that the contractor intended to add this relationship. These will have to be reviewed and traced individually.

ii Similarly, for deleted logic links, where the predecessor and successor activities still exist in both the current update and previous progress update, it is assumed that the contractor intended to delete this relationship. These will have to be reviewed and traced individually.

iii Modified logic links: for extensively modified activity links, the ramifications of changing an existing logic relationship from one type to another type is very difficult to predict without looking at each change on a case-by-case basis.

  Where activity link 'lags' have been modified, this usually results in the programme being 'stretched' or 'shortened' in a way that is very difficult to notice. This is especially true if a lot of small changes have been made to several activity link 'lags'. Many small changes can add up to one large change. You will only note this trend if you list all of these changes together in one list.

Check 5: *Activity constraints*. These are invisible on a plotted network, and unless you check the activity database you will not see them at all. They are very powerful and override the logic of the CPM network. Quite simply put, one constraint can completely revise an entire CRM programme.

Constraints are usually start or finish dates imposed on an activity such as 'start no earlier than' or 'start no later than'. These are more acceptable than other date constraints such as 'mandatory start'.

A careful check has to be made of the data associated with each activity to identify the constraints and a more detailed review carried out to identify their purpose.

Remember, good programme reviews don't just happen, they take a lot of work.

10 Progress records and other record keeping

Comparing the health of the project to that of a vehicle reveals some striking similarities. People who neglect the routine maintenance of a vehicle typically experience premature breakdowns and exorbitant repair costs that could be traced directly back to that neglect. Similarly, if a contractor fails to carry out routine maintenance on a project, instead taking the easy approach of updating schedules, the outcome is very likely to be an expensive 'repair' in the form of a claims battle and often a claims loss, or even missed opportunities.

Most construction professionals do not enjoy reporting progress. This task rivals in unpopularity the other bane of keeping minutes of meetings. The fact that the progress-reporting duty is taken on not with relish, but usually because no-one else will touch it with a barge pole, is evident in the tosh that often passes for the monthly client progress report.

These reports concern more than just progress, of course. The usual sections are there – safety, risk, commercial, etc. – but this chapter concerns the programme/progress section. Quite often the programme and/or progress sections fall into one of two approaches:

1. The 'I'm going to prove to everyone, especially my boss, how clever I am, with lots of technical jargon and long words' approach; or
2. The 'Let's take last month's report and just change the figures' approach.

The first approach will be almost impenetrable and unfathomable to anyone reading it, including the boss. The second approach is plain boring and is effectively saying to the client that you can't be bothered and that the monthly report is unimportant.

On most projects, the client is looking for simplicity in the monthly report, and he is primarily interested in one key thing: when will the project be complete. The information in the programme/progress section of the report to the client should be easy to understand and well annotated/explained.

The format of progress reporting should be agreed with the client at the outset of the project. The programme, which will normally be maintained as a critical path network in proprietary planning software, should be capable of being summarised to level 1 barchart format.

The most readily understood graphic is that of the 'staggered-line'. Graphics of the original baseline programme and the current revised or working programme should have a vertical line showing the progress cut-off date. Progress may be indicated either by colouring along the bar or by the vertical line diverting to the actual progress position for each bar. This is a very simplistic 'progress indicator' chart. See the example in Figure 10.1.

Unfortunately, the client is generally left to interpret the chart for himself, and often he will not have the information to do this meaningfully and may easily jump to the wrong conclusion. Therefore, both the chart and the accompanying narrative should contain an explanation of why activities are shown in delay, what the implications are for completion of the project, and how you intend to redress the situation and by when.

The simple 'progress indicator' chart and an accompanying narrative may be enough for many projects, but each project is unique and many will necessitate auxiliary methods, which may even be required under the contract. Details of three such methods are given below.

The first of these is the 'planned progress' chart. This addresses the volume of work, and simply measures the volume of progress in terms of activity weeks, giving no allowance for weighting of activities. Planned progress can be shown in terms of a cumulative S-curve of activity weeks achieved if the early dates are met. Another curve can be generated from the late dates. When plotted on the same chart, the area between the curves represents the zone within which the actual achievement line should lie. See the example in Figure 10.2.

Figures are calculated after each progress update and the actual line plotted. The closer this line is to the early (lefthand) line, then the more comfortable all parties should feel. A drift towards the late (righthand) line means that float is being used up and more activities are becoming critical.

Even though there is no weighting factor, the fact that every programme activity is taken into account means that the law of averages comes into play, and the outcome is virtually identical to one where complex weightings based on earned value or work content have been laboriously applied.

A second method is the 'Progress Tracking' chart. This is a simple but effective way of showing progress in terms of quantity or value of work done at any point. It is basically two charts in one. The 'x' axis is a common time scale. The lefthand 'y' axis shows unit per time unit (week or month) shown in histogram form; whereas the righthand side relates to the cumulative figure and is shown as a simple line. The actual performance is input on a regular basis and compared to the plan. See the example in Figure 10.3.

Because this method relies on the work being measured in the same units throughout, this approach is well suited for package works or

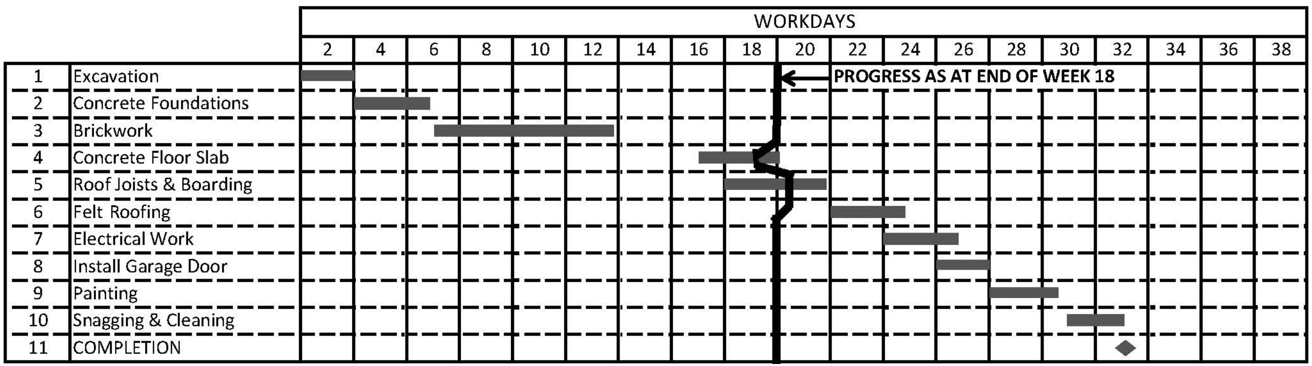


Figure 10.1 A progress indicator chart.

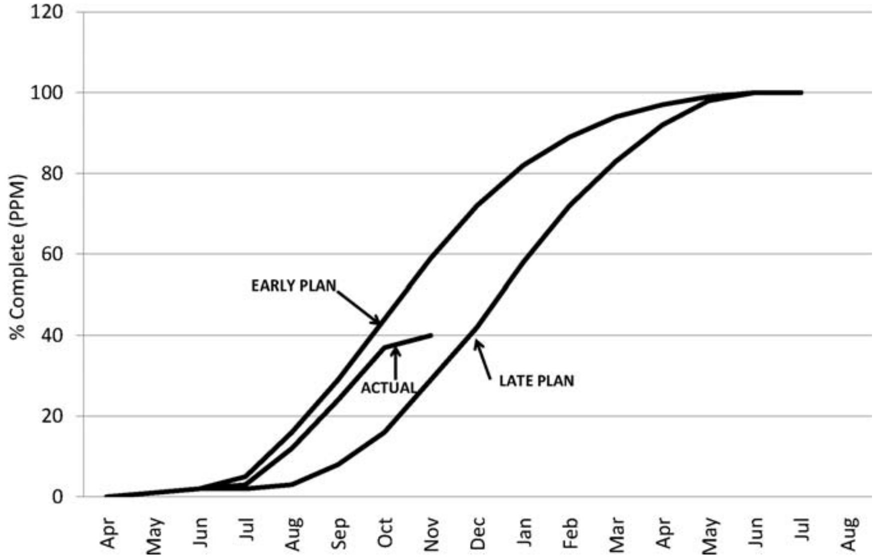


Figure 10.2 A planned progress chart.

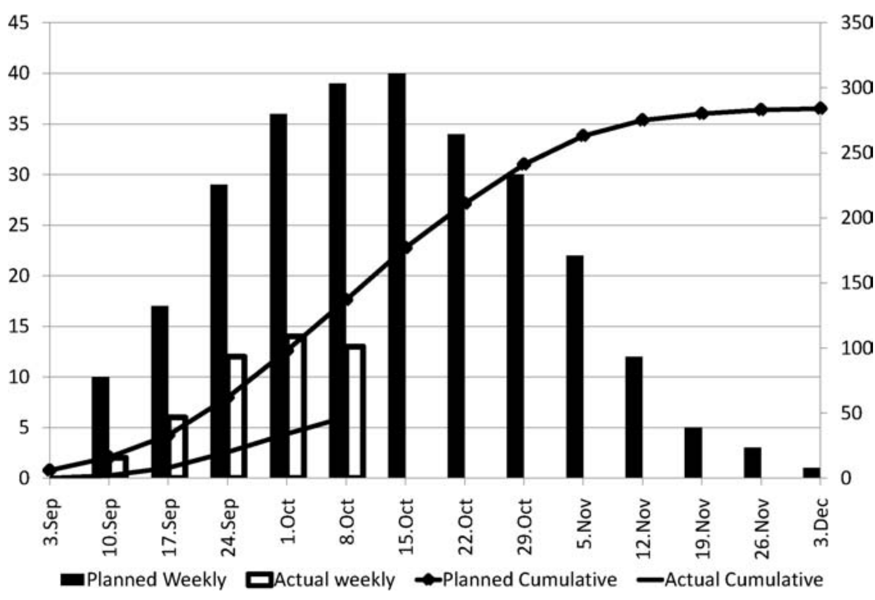


Figure 10.3 A progress tracking chart.

individual operations or trades. It would usually be introduced to show close control of a particular critical or near-critical activity. As the planned figures are likely to be based on early dates, it is important to stress that the plan is target-based and that moderate slippage does not necessarily mean that the programme has been compromised.

The third method is a 'line of balance' chart. This approach comprises a series of cumulative line graphs set against a common time scale. This approach is somewhat specialist in nature and is ideal for situations of repetition, such as housing and high-rise. See the example in Figure 10.4.

The angle of each line represents the rate of output, and the gap between the lines shows the working float between operations or trades. In a situation where the lines represent recorded progress on site, it is easy to see who is delaying whom. This method also allows simple 'what-if' scenarios to be explored.

A further method of recording progress which should be encouraged is that of colouring in drawings as work proceeds. However, the colouring in of drawings is not particularly useful in comparing progress to a plan. But it is an accessible way of showing how the site is proceeding and should not be dismissed on the grounds of crudity. Often it is exactly what is needed to convey a sense of momentum; and this method of recording progress is particularly useful in a claim situation.

However, for progress reports, this method should only cover one or two activities at a time, and one should avoid confusing the message

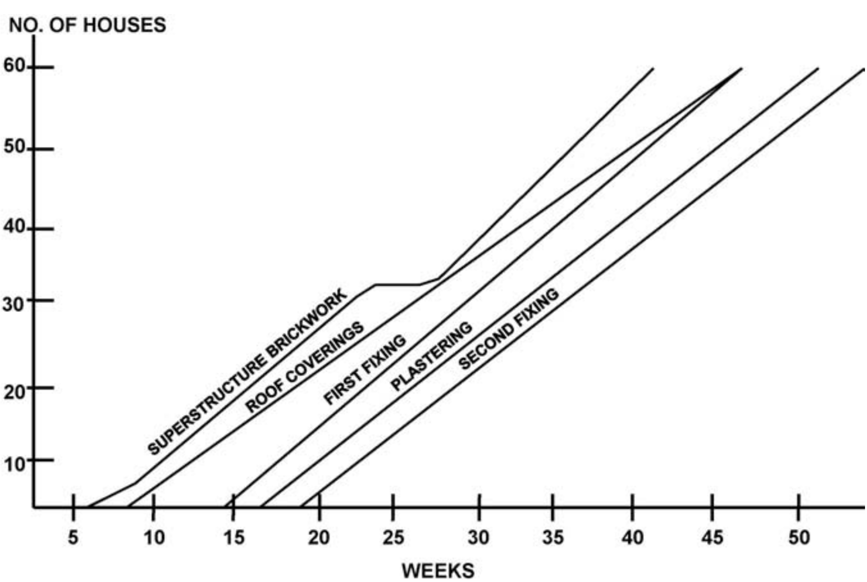


Figure 10.4 A line of balance chart.

through overkill. Types of activities that are particularly suited to this method include piling, pipe caps, slabs, roof coverings and ceilings.

To summarise, simplicity is the watchword. First, the contractor should state when the project is forecast to be complete. Second, give the client a programme with a staggered line and explain the main features; including what is to be done to recoup lost time. Finally, use any of the auxiliary methods, as appropriate, to focus on critical areas or to get key points across.

Progress reporting should not be a complicated progress. Clients do not scrutinise boring or complicated documents to find the hidden message. It is in everyone's interest to present information in as simple a format as possible. The client will never complain of condescension if the message is clear and, if he wants something a little more sophisticated, he will ask for it.

It may be necessary in claim situations to develop a daily, specific, as-built programme to justify a delay claim. An as-built record of the accepted project programme will usually only record the actual start and finish dates for each activity. However, to support a delay and/or disruption claim, it is beneficial to identify and record multiple starts and stops of affected activities.

Site diaries maintained by job-site supervisory staff are important source documents used to develop a daily, specific, as-built programme. The site diaries should record the following information on a daily basis:

- weather;
- manpower by number, trade and subcontractor;
- specific work performed, with reference to the corresponding programme activity number;
- delays/interruptions/issues encountered;
- work stoppages;
- variation, or change in the order work performed;
- repair or rework performed;
- RFIs (requests for information) submitted;
- CVIs (confirmation of verbal instructions) received.

A quality as-built programme can be generated from well-kept site diaries. The as-built data can be maintained in an electronic database, and nowadays can be collected using handheld devices during job-site walkthroughs. Photographs are also a very helpful way of documenting site progress. However, to be useful they should be labelled with the date of the photo and specific description of the subject.

Records in a claim situation

Obtaining a correct extension of time and time-related costs is all to do with the strength of a case, and whether it can be proved with factual records. It is a truism to say that there is no substitute for good record keeping.

For example, can you prove that an entitlement to an extension of time resulted from information being received late? The key element in most cases lies in the contemporaneous project records. Success in a claim is all about keeping them; and then using them to demonstrate cause, effect and entitlement.

First, let's deal with the programme; for if you don't keep details of what was built and when, then there is very little chance of proving cause and effect. Earlier chapters in this section explain the importance of planning and programming.

Now let's consider the contemporaneous project records, and particularly those that relate to the work activities on the programme. Frequently, these records are just a list of percentages for the programme activities as at the date of the site meeting.

Ideally, for each activity the following progress information should be maintained on a fortnightly or monthly basis as a minimum:

1 In addition to recording the percentage of work achieved, record the actual start and finish dates, together with any periods of inactivity or stoppages.
2 Where possible, subdivide the programme activity into smaller elements, e.g. for brickwork and blockwork subdivide into elevations; for suspended ceilings subdivide into floor areas or groups of rooms.
3 Maintain allocation sheets of who did what, where and when.
4 The weather conditions.
5 Any problems encountered together with any steps taken to overcome them including resources used.

In addition all operational supervisory staff should keep meaningful site diaries, supplemented with photographs as these often prove very useful later if a dispute materialises. Photographs must be properly identified and the following information should be recorded on the reverse:

1 the date and time taken;
2 position from where the photograph was taken;
3 full details of the subject matter;
4 a reference number for the photograph;
5 name of the photographer.

Disruption and loss of productivity are difficult to prove as generally very little contemporaneous data are available from site showing the levels of productivity attained before and after the disruptive event. Any data kept that can establish disruption and productivity loss, particularly in respect of subcontractors who carry out the majority of the work, will be invaluable.

Part III

Contracts and case law

11 Introduction

This section of the book deals with two subjects, namely, ‘contracts’ and ‘case law’. Chapter 12 concerns the two most popular forms of contract used in the UK, which are the JCT and NEC. The chapter reviews the clauses relating to time issues, while those clauses dealing with programmes are reviewed in chapters 8 and 9 of this book.

The remaining four chapters in this section review case law regarding disputes and judgments concerning extensions of time and delay claims.

Contracts

All of the standard forms of contract, and subcontract, include clauses for dealing with delays to the project. Most of these standard forms require the contract administrator (architect or engineer) to deal with a contractor’s claim for extension of time when actual delay has occurred to the works or when a likely delay is notified.

For example, JCT 2005 contains the following in clause 2.27:

> *If and whenever it becomes reasonably apparent that the progress of the Works or any Section is being or is likely to be delayed the Contractor shall forthwith give written notice to the Architect/Contract Administrator of the material circumstances, including the cause or causes of delay, and shall identify in the notice any event which in his opinion is a Relevant Event.*

The underlying objective is for extension of time applications to be dealt with as close as possible to the occurrence of events giving rise to the delay. In this way the contractor will be working towards a realistic completion date.

If extensions of time are largely ignored until the completion stages of the project, the contractor may have been forced to plan the works against an unrealistic early completion date. This may give rise to unnecessary acceleration claims.

Furthermore, in the latter stages or post-handover of a project, delay events can be assessed with the benefit of hindsight. In this type of scenario, a 'retrospective analysis' method is likely to be adopted. The analysis results may show that an employer-responsible event that was likely to cause delay according to the evidence that was available at the time when it 'it becomes reasonably apparent', with hindsight did not in fact delay the completion of the project. In such circumstances, a contractor will argue that according to the contract he was entitled to an extension of time at the 'time' of the event. However, as there was no actual delay, he probably has no claim for prolongation costs or loss and expense resulting from the event. On the other hand, the employer will contend that, as no actual delay occurred, there is no entitlement to an extension of time; and an analysis at the 'time' of the event can be construed as an overly theoretical prediction of delay.

In such circumstances there is no 'one-size-fits-all' solution. Many factors have to be taken into account, not least:

1 the contract and wording of the extension of time clause;
2 the facts appertaining at the 'time' of the event;
3 if the parties were aware of a 'likely' delay at the time, and if the contractor provided necessary particulars of the event;
4 the circumstances that resulted in a likely delay becoming no actual delay.

Case law

The four chapters covering 'case law' review 15 disputes that were referred to the Court, initially the Official Referee's Court and now the Technology and Construction Court.

The disputes selected are considered to be the most important concerning extensions of time and delays, primarily due to the Court's comments and advice on the approach and methodology used.

The cases include the 'landmark' ones, such as *Fairweather*, *Glenlion*, *McAlpine Humberoak*, *Chestermount*, *John Barker*, *Ascon*, *Malmaison*, *Royal Brompton*, *Balfour Beatty*, *Skanska* and *Great Eastern Hotel*.

For each dispute, details are given of (i) the project concerned; (ii) the dispute itself; (iii) the judgment; and finally (iv) a commentary on the important comments and advice given by the Court.

The delay analysis subjects that are covered by the judgments included in this section are:

1 Extensions of time awarded retrospectively: *Amalgamated Contractors*, *Balfour Beatty (*v. *Chestermount)*.
2 Time at large: *Peak Construction*, *Balfour Beatty (*v. *Chestermount)*.
3 Inclement weather: *Walter Lawrence*.
4 Dominant cause of delay: *Fairweather*.

5 Programmed early completion: *Glenlion*.
6 Presentation and methodology of delay analysis: *McAlpine Humberoak*, *John Barker*, *Royal Brompton*, *Skanska*, *Great Eastern Hotel*.
7 Programme float: *Ascon*, *Royal Brompton*, *Motherwell Bridge*, *Balfour Beatty (*v. *LB Lambeth)*.
8 Concurrency: *Henry Boot*, *Royal Brompton*.

12 Contracts

JCT and NEC

In 2005, the Joint Contracts Tribunal (JCT) brought out a new suite of contracts, with the Standard Building Contract replacing the 1998 version. The 2005 publication has three main versions, *Standard Building Contract with Quantities*, *Standard Building Contract with Approximate Quantities* and *Standard Building Contract without Quantities*.

The clauses relating to time issues, delays and extensions of time in JCT 2005 are similar, but not identical, to those in JCT 1998. In JCT 2005 the clauses are contained in a section titled 'Adjustment of Completion Date', which contains the following four clauses:

Clause 2.26, *'Related definitions and interpretation';*
Clause 2.27, *'Notice by Contractor of delay to progress';*
Clause 2.28, *'Fixing Completion Date';*
Clause 2.29, *'Relevant Events'.*

Clause 2.26, '*Related definitions and interpretation*', states:

.1 Any reference to delay or extension of time includes any further delay or further extension of time.
.2 'Pre-agreed Adjustment' means the fixing of a revised Completion Date for the Works or a Section in respect of a Variation or other work referred to in clause 5.2.1 by the Confirmed Acceptance of a Schedule 2 Quotation;
.3 'Relevant Omission' means the omission of any work or obligation through an instruction for a Variation under clause 3.14 or through an instruction under clause 3.16 in regard to a Provisional Sum for defined work.

Clause 2.27, '*Notice by Contractor of delay to progress*', states:

.1 If and when it becomes reasonably apparent that the progress of the Works or any Section is being or is likely to be delayed the Contractor shall forthwith give written notice to the Architect/Contract Administrator of the material circumstances, including the cause or causes of

the delay, and shall identify in the notice any event which in his opinion is a Relevant Event.

.2 *In respect of each event identified in the notice the Contractor shall, if practicable in such notice or otherwise in writing as soon as possible thereafter, give particulars of its expected effects, including an estimate of any expected delay in the completion of the Works or any Section beyond the relevant Completion Date.*

.3 *The Contractor shall forthwith notify the Architect/Contract Administrator in writing of any material change in the estimated delay or in any other particulars and supply such further information as the Architect/Contract Administrator may at any time reasonably require.*

Clause 2.28, '*Fixing Completion Date*', states:

.1 *If, in the opinion of the Architect/Contract Administrator, on receiving a notice and particulars under clause 22.7:*

  .1 *any of the events which are stated to be a cause of delay is a Relevant Event; and*

  .2 *completion of the Works or of any Section is likely to be delayed thereby beyond the relevant Completion Date,*

then, save where these Conditions expressly provide otherwise, the Architect/Contract Administrator shall give an extension of time by fixing such later date as the Completion Date for the Works or Section as he then estimates to be fair and reasonable.

.2 *Whether or not an extension is given, the Architect/Contract Administrator shall notify the Contractor in writing of his decision in respect of any notice under clause 2.27 as soon as it is reasonably practicable and in any event within 12 weeks of receipt of the required particulars. Where the period from receipt to the Completion Date is less than 12 weeks, he shall endeavour to do so prior to the Completion Date.*

.3 *The Architect/Contract Administrator shall in his decision state:*

  .1 *the extension of time that he has attributed to each Relevant Event; and*

  .2 *(in the case of a decision under clause 2.28.4 or 2.28.5) the reduction in time that he has attributed to each Relevant Omission.*

.4 *After the first fixing of a later Completion Date in respect of the Works or a Section, either under clause 2.28.1 or by a Pre-agreed Adjustment, but subject to clauses 2.28.6.3 and 2.28.6.4, the Architect/Contract Administrator may by notice in writing to the Contractor, giving the details referred to in clause 2.28.3, fix a Completion Date for the Works or that Section earlier than that previously so fixed if in his opinion the fixing of such earlier Completion Date is fair and reasonable, having regard to any Relevant Omissions for which instructions have been issued after the last occasion on which a new Completion Date was fixed for the Works or for that Section.*

.5 After the Completion Date for the Works or for a Section, if this occurs before the date of practical completion, the Architect/Contract Administrator may, and not later than the expiry of 12 weeks after the date of practical completion shall, by notice in writing to the Contractor, giving the details referred to in clause 2.29.3:
  - *.1 fix a Completion Date for the Works or for the Section later than that previously fixed if in his opinion that is fair and reasonable having regard to any Relevant Events, whether on reviewing a previous decision or otherwise and whether or not the Relevant Event has been specifically notified by the Contractor under clause 2.27.1; or*
  - *.2 subject to clauses 2.28.6.3 and 2.28.6.4, fix a Completion Date earlier than that previously fixed if in his opinion that is fair and reasonable having regard to any instructions for Relevant Events issued after the last occasion on which a new Completion Date was fixed for the Works or Section; or*
  - *.3 confirm the Completion Date previously fixed.*

.6 Provided always that:
  - *.1 the Contractor shall constantly use his best endeavours to prevent delay in the progress of the Works or any Section, however caused, and to prevent the completion of the Works or Section being delayed or further delayed beyond the relevant Completion Date.*
  - *.2 in the event of any delay the Contractor shall do all that may reasonably be required to the satisfaction of the Architect/Contract Administrator to proceed with the Works or Section.*
  - *.3 no decision of the Architect/Contract Administrator under clause 2.28.4 or 2.28.5.2 shall fix a Completion Date for the Works or any Section earlier than the relevant Date for Completion; and*
  - *.4 no decision under clause 2.28.4 or 2.28.5.2 shall alter the length of any Pre-agreed Adjustment unless the relevant Variation or other work referred to in clause 5.2.1 is itself the subject of a Relevant Omission.*

Clause 2.29, '*Relevant Events*', states:

The following are the Relevant Events referred to in clauses 2.27 and 2.28:

.1 Variations and any other matters or instructions which under these Conditions are to be treated as, or as requiring, a Variation;

.2 Instructions of the Architect/Contract Administrator:
  - *.1 under any of clauses 2.15, 3.15, 3.16 (excluding an instruction for expenditure of a Provisional Sum for defined work), 3.23 or 5.3.2; or*
  - *.2 for the opening up for inspection or testing of any work, materials or goods under clause 3.17 or 3.18.4 (including making good), unless the inspection or test shows that the work, materials or goods are not in accordance with this Contract;*

.3 *deferment of the giving of possession of the site or any Section under clause 2.5;*
.4 *the execution of work for which an Approximate Quotation is not a reasonably accurate forecast of the quantity of work required;*
.5 *suspension by the Contractor under clause 4.14 of the performance of his obligations under this Contract;*
.6 *any impediment, prevention or default, whether by act or omission, by the Employer, the Architect/Contract Administrator, the Quantity Surveyor or any of the Employer's Persons, except to the extent caused or contributed to by any default, whether by act or omission, of the Contractor or any of the Contractor's Persons;*
.7 *the carrying out by a Statutory Undertaker of work in the pursuance of its statutory obligations in relation to the Works, or the failure to carry out such work;*
.8 *exceptionally adverse weather conditions;*
.9 *loss or damage occasioned by any of the Specified Perils;*
.10 *civil commotion or the use or threat of terrorism and/or the activities of the relevant authorities in dealing with such event or threat;*
.11 *strike, lock-out or local combination of workmen affecting any of the trades employed upon the Works or any of the trades engaged in the preparation, manufacture or transportation of any of the goods or materials required for the Works or any persons engaged in the preparation of the design for the Contractor's Design Portion;*
.12 *the exercise after the Base Date by the United Kingdom Government of any statutory power which directly affects the execution of the Works;*
.13 *force majeure.*

The main changes in JCT 2005 affecting EOT submissions

The main difference in the wording between the two forms is that JCT 2005 does not include any reference to 'nominated subcontractors'; and introduces two new terms, 'Pre-agreed Adjustment' and 'Relevant Omission'.

The approach taken by the 1998 and 2005 contracts is generally the same; the contractor has to notify the contract administrator of the cause or causes of delay, 'whenever it becomes reasonably apparent that the progress of the Works or any Section is being or is likely to be delayed'. The contract administrator then has 12 weeks to give an extension of time and fix a new completion date with adjustments for relevant events, which are listed in clause 2.29.

The 12-week period was introduced in the 1980 version of the JCT contracts in order to set a limit to the amount of time the contract administrator, or architect, could take for an extension of time decision. Many observers were of the opinion that one of the principal reasons for the slow take-up of the 1980 contract was that it was considered unreasonable to set a time limit on the architect's decision-making process. However, there has always existed a 'get-out' condition in that the contract administrator had only to deal with EOT submissions once 'reasonably sufficient particulars' had been received.

JCT 2005 has tightened the rules on how contractors and contract administrators must approach extensions of time. For example, the qualification that the contract administrator has to have 'reasonably sufficient information' in order to be able to make a decision has been deleted. This appears to mean that the contract administrator must make a decision even on insufficient information. However, the contract administrator needs to make his decision, and fix a new date which he considers fair and reasonable, based on the information received.

Another example is that the contractor has to give a wider picture of all the delays and the reasons for them, and the contract administrator has to respond to all of the events and say in detail why extra time is being given.

Other changes affecting extensions of time are:

1 The contractor has to give notice of a relevant event and estimate 'the expected delay in the completion of the works'. JCT 1998 went on to say 'whether or not concurrently with delay resulting from any other relevant event'. This has been omitted from JCT 2005. However, although that wording has been left out, the contractor's obligation is still to provide an estimate of the delay in relation to any relevant event, regardless of whether they are concurrent with other events.
2 The contract administrator has to 'decide' on extensions of time, rather than, as under JCT 1998, where he had to 'in writing to the contractor give an extension of time'. This change in words indicates a more active approach.
3 The contract administrator's decision has to state the extension that has been attributed to each relevant event. Previously, in JCT 1998, the decision was only obliged to state which of the relevant events had been taken into account.
4 If the contract administrator's decision is that no extension of time is due, then there is an obligation to notify the contractor of this, in writing. In JCT 1998 there appeared to be no obligation for the contract administrator to respond to the contractor if an extension of time had not been granted.
5 Clause 25.4.10 in JCT 1998; concerning the unavailability of labour and materials has been deleted from JCT 2005. As this was invariably deleted in the previous version, the omission may not make much difference.
6 Where the period of time between the particulars being received and

the completion date is less than 12 weeks, then the contract administrator has only to 'endeavour' to provide its decision prior to the completion date. Previously, in JCT 1998, the obligation was to make a decision 'if reasonably practicable'.

The New Engineering and Construction Contract, 'NEC3'

In June 2005, the third edition of the New Engineering and Construction Contract, NEC3, was published. This contract is endorsed by the Office of Government Commerce (OGC) as complying fully with the principles of the *Achieving Excellence in Construction* report, and the OGC recommends the use of NEC3 by public-sector construction procurers on their construction projects. Furthermore, in 2006 the Olympic Delivery Authority indicated that NEC3 was likely to be the contract of choice for the design and construction elements of the 2012 London Olympics projects.

Despite these auspicious endorsements, together with the NEC team's efforts to promote the use of the contract, the take-up in the industry has not been as widespread as hoped; the private sector in particular remains to be convinced. However, a point in its favour is that the NEC has been remarkably litigation-free since it was introduced.

One of the key aspects of the NEC is the early warning of matters that are likely to impede progress and cause delay, and the contract requires the parties to notify each other as soon as they become aware of any matter which could delay completion.

The NEC also takes a distinctive approach to delay by way of compensation events in that it requires ascertainment of additional time and cost in advance and the present provisions are deliberately worded to avoid uncertainty on these issues.

The notification period of compensation events is one of the most controversial changes in NEC3. Most of the other forms of contract require 'events' which are causing or likely to cause delay to be notified within a reasonable time of their becoming apparent to the contractor. Under NEC3, clause 61, the contractor must notify the project manager within eight weeks of 'becoming aware of the event' which he believes to be a compensation event 'which has happened or which he expects to happen'. Should the contractor not give notice within this period of time, he is not entitled to a change in the completion date or key dates unless the project manager should have notified the event to him but did not.

Clause 63.3 of NEC3 deals with the assessment of compensation events and stipulates the following:

> *A delay to the Completion Date is assessed as the length of time that, due to the compensation event, planned Completion is later than planned Completion shown on the Accepted Programme.*

This in effect protects a period of float built into the programme by the contractor. In other words, if the contractor plans to complete the project earlier than the completion date and this is shown in the accepted programme, then the period of time between the planned completion and the completion date is the contractor's float, or risk allowance. This period of float is sometimes called 'terminal float', though this phrase is not used specifically in NEC3. Therefore, if a compensation event assessment is a delay of, say four weeks to the planned completion then the 'terminal float' period in the accepted programme is maintained and the completion date is extended by the same four weeks.

However, a few words of warning on 'terminal float'. The fact that the contractor's programme shows a period of 'terminal float', or apparently unused time, at the end gives some doubt as to the credibility of the activity durations he has assessed for the project's scope of work.

In my view it is better to distribute the contractor's risk allowance by adding a specific activity, or activities, after a risky activity in the programme. For example, if the contractor considers that, due to the current market situation, the delivery of external façade-cladding materials may be late, then it would be more prudent to add an activity, for contractor's risk allowance, after the external façade-cladding activity.

In summation, NEC3 requires that the programme is:

- a critical path network;
- updated monthly with progress achieved;
- used in determining the actions following a compensation event.

Furthermore, the content of the contractor's programme is clearly defined in NEC3. Further details and observations on programmes, acceptance, updating and revisions can be found in chapters 8 and 9.

13 Case law

Pre-1993

The cases reviewed in this chapter are:

- *Amalgamated Contractors* v. *Waltham Holy Cross UDC* (1952);
- *Peak Construction (Liverpool) Ltd* v. *McKinney Foundation Ltd* (1970);
- *Walter Lawrence & Sons Ltd* v. *Commercial Union Properties Ltd* (1984);
- *H. Fairweather & Co. Ltd* v. *London Borough of Wandsworth* (1987);
- *Glenlion Construction Ltd* v. *The Guinness Trust* (1987);
- *McAlpine Humberoak* v. *McDermott International* (1992).

Amalgamated Contractors v. *Waltham Holy Cross UDC* (1952)

The facts

Waltham Holy Cross UDC employed Amalgamated Contractors to construct 202 houses in Princesfield, Essex. The form of contract was the Royal Institute of British Architects (RIBA)/National Federation of Building Trades Employers (NFBTE) standard. The commencement date was 7 November 1946 and completion was fixed for 7 February 1949. However, the last house was not handed over until 28 August 1950.

The contractor requested an extension of time due to difficulties in obtaining labour and materials and the architect granted an extension of time in December 1950, some four months after completion, revising the completion date to 23 May 1949. The employer deducted liquidated damages for 66 weeks, being the balance of the overrun.

The dispute

Clause 18 of the RIBA/NFBTE contract stated:

> *If in the opinion of the architect the works be delayed....*
> *(ix) by reason of labour or material not being available as required...*
> *Then in any such case the architect shall make a fair and reasonable extension of time for completion of the works.*

The contractor's argument was that the extension of time was invalid as it was issued some four months after the project was completed, whereas in their view the purpose of clause 18 was to grant extensions of time as and when a delay event occurred to enable a contractor to re-plan for a future date and organise its works accordingly.

The Court decided that the extension of time awarded by the architect was valid. The contractor, Amalgamated Contractors, appealed.

The judgment on appeal

The Court of Appeal agreed that the extension of time awarded was valid.

Lord Denning, one of the appeal judges, did not agree that an architect could not give an extension of time to a date that had passed. He noted that, in this case where a delay was continuous until the works were complete, then the architect was only in a position to grant a fair and reasonable extension of time on completion. In other words, an architect could grant an extension of time retrospectively.

Commentary

In the judgment, Lord Denning gave a hypothetical situation where a contractor was in delay for which he was responsible, which was followed by a labour strike for which he was entitled to an extension of time under the contract. In that situation, according to Lord Denning, the delay period caused by the strike should be added to the contract completion date to give a new completion date; and one that had already passed. The hypothetical situation given by Lord Denning is similar to the situation in *Balfour Beatty Building Ltd* v. *Chestermount Properties Ltd*, which came before the Court some 40 years later.

***Peak Construction (Liverpool) Ltd* v. *McKinney Foundation Ltd* (1970)**

The facts

Peak Construction Ltd was contracted to Liverpool Corporation to construct a 14-storey block of apartments on the East Lancashire Road in

Liverpool. Under this contract McKinney Foundation Ltd was the nominated subcontractor for the design and construction of piling works. The piling works were started in May 1964 and completed within six weeks. Subsequently, in October 1964, it was discovered that some piling works were defective and all works on site were stopped until a full inspection of all piling works was carried out. However, the inspection was not carried out until May 1965; remedial works were carried out and construction works recommenced on site in November 1965. Effectively, the problem with the piling works had caused a 58-week delay to the project.

The dispute

The employer, Liverpool Corporation, deducted liquidated damages from the contractor, Peak Construction, who in turn passed this on to McKinney Foundation. McKinney disputed the deduction of liquidated damages, and the case came before the Official Referee, who upheld the deduction. McKinney took the dispute to the Court of Appeal.

The judgment on appeal

The Court of Appeal overturned the Official Referee's judgment on the basis that the 58 weeks' delay did not flow naturally and in the ordinary course of things from McKinney's breach and that the deduction of liquidated damages was 'beyond all reason'. The Court of Appeal decided that part of the 58-week delay was the fault of the employer, Liverpool Corporation, in that it was dilatory in agreeing to the investigation and remedial works.

Commentary

An issue in this case concerned 'time at large', and it was held that, as delays on the part of the employer in approving remedial works to the piling were not catered for in the extension of time provisions, the right to liquidated and ascertained damages was lost and time became at large. Therefore, the employer was left with an entitlement to claim such common law damages as a result of the contractor failing to complete within a reasonable time as it was able to prove.

Walter Lawrence & Sons Ltd v. *Commercial Union Properties Ltd* (1984)

The facts

In 1982 Commercial Union Properties Ltd contracted with Walter Lawrence & Sons Ltd for certain construction works. The contract between the parties was the JCT Standard Form of Contract, 1963 edition.

During the course of the work, severe weather conditions were encountered and the project was delayed. Clause 23 of the contract concerned extensions of time and sub-clause b gave entitlement to an extension of time if the weather was 'exceptionally inclement'.

The dispute

The contractor, Walter Lawrence applied for an extension of time under clause 23 (b); and upon receipt of the contractor's claim, the architect obtained the relevant weather records from the Meteorological Office to assist him in his assessment.

In assessing the claim, the architect compared the weather records with the contractor's planned programme and his conclusion was that the contractor was entitled to an extension of time of two weeks. His reasoning was that he compared the weather conditions current when the works were planned to be done not when they were actually carried out.

The dispute was referred to the Official Referee's Court.

The judgment

In the Official Referee's Court, Judge Lewis Hawser decided in favour of the contractor, Walter Lawrence.

In his judgment, he held that the correct test was whether the weather was 'exceptionally inclement' so as to delay the works actually being carried out at the time; and not whether the amount of time lost was exceptional.

Commentary

It is common for extension of time submission to include the impact of inclement weather on the progress of the works. This case provided some useful guidance on the correct approach to this issue.

H. Fairweather & Co. Ltd v. *London Borough of Wandsworth* (1987)

The facts

H. Fairweather & Co. Ltd was contracted by the London Borough of Wandsworth to build 478 dwellings. The contract between the parties was the JCT *Standard Form, Local Authorities with Quantities*, 1963 edition. The contract commencement date was 15 December 1975 and the completion date was 5 August 1979.

Major delays occurred, including general strikes in 1978–1979. As a result, the architect awarded an extension of time of 81 weeks, under clause 23 (d), by reason of strikes and combination of workmen. The quantum of the extension of time was not challenged by Fairweather, but the allocation of the award under clause 23 (d) was. The parties could not agree and the dispute was referred to arbitration.

The dispute

Fairweather contended, before the arbitrator, that 18 of the 81 weeks should be reallocated under sub-clauses (e) or (f) of clause 23; the reasoning being that only if there was reallocation could Fairweather recover direct loss and expense.

The arbitrator rejected Fairweather's reasoning, agreeing with the architect and in sections 6.11, 6.12 and 6.14 of his interim award stated:

> *It is possible to envisage circumstances where an event occurs on site which causes delay to the completion of the works and which could be ascribed to more than one of the eleven specified reasons but there is no mechanism in the conditions for allocating an extension between different heads so the extension must be granted in respect of the dominant reason.*
>
> *I accept the respondent's contention that, faced with events of this contract, nobody would say that the delays which occurred in 1978 and 1979 were caused by reasons of the Architect's instructions given in 1975 to 1997. I hold that the dominant cause of the delay was the strikes and combination of workmen and accordingly the Architect was correct in granting his extension under condition 23 (d).*
>
> *For the sake of clarity I declare that this extension does not carry with it any right to claim direct loss and/or expense.*

The arbitrator's award was the subject of an appeal by Fairweather. Judge Fox-Andrews heard the appeal in the Official Referee's Court.

The judgment

The judge in the case disagreed with the arbitrator's ruling that the extension of time should relate to the dominant cause of delay, and said in his judgment:

> *'Dominant' has a number of meanings: 'ruling, prevailing, most influential'. On the assumption that condition 23 is not solely concerned with liquidated or ascertained damages but also triggers and conditions a right for a contractor to recover direct loss and expense where applicable under condition 24 then an architect and in his turn an arbitrator has the task of allocating, when the facts require it, the extension of time to the various heads. I do not consider that the dominant test is correct.*

Judge Fox-Andrews also made it clear that there was no connection, explicit or implied, between clause 23, 'Extension of Time, and clause 24, 'Loss and Expense'. His judgment said, 'An extension of time under clause 23 (e) is neither expressly nor I find impliedly made a condition precedent to a right to payment.'

Commentary

In this case the dominant cause of delay theory was rejected by the court.

Glenlion Construction Ltd v. *The Guinness Trust* (1987)

The facts

The project concerned was a residential development in Bromley, Kent. Glenlion, the contractor, entered into a contract with the Guinness Trust under a JCT 1963 *Standard Form of Contract with Quantities*. The date for possession was 29 June 1981 and the period for completion was 114 weeks.

One of the contract obligations was for the contractor to provide 'a programme or chart for the whole of the works', showing a completion date within the 114-week period for completion. Glenlion duly obliged. However, the programme showed completion only 101 weeks after the date for possession.

The dispute

The project was delayed and the contractor alleged the delay was due to the employer's professional team not providing information to allow the contractor to complete by the early completion date shown on their programme. The dispute was referred to arbitration.

The arbitrator issued an award in favour of the employer, the Guinness Trust.

The contractor, Glenlion Construction Ltd, referred the dispute to the Official Referee's Court.

The judgment

In the Official Referee's Court, before Judge Fox-Andrews, the Court was asked

> *Whether there was an implied term of the Contract between the applicant and the respondent that, if and so far as the programme showed a completion date before the date for completion the Employer by himself, his servants or agents should so perform the said agreement as*

> *to enable the Contractor to carry out the Works in accordance with the Programme and to complete the Works on the said completion date.*

The Judge's conclusion was:

> *The answer to the question must be 'no'. It is not suggested by Glenlion that they were entitled and obliged to finish by the earlier completion date. If there is such an implied term, it imposed an obligation on the Trust but none on Glenlion.*
>
> *It is not immediately apparent why it is reasonable or equitable that a unilateral absolute obligation should be placed on an employer.*

Judge Fox-Andrews also said, 'The unilateral imposition [by a contractor] of a different completion date would result in the whole balance of the contract being lost.'

Commentary

This case concerned a contractor programming the works to complete earlier than the contract completion date; and if there was an obligation on the employer and his professional team to provide information to allow the contractor to complete the works in accordance with his 'shortened programme'.

The Court's ruling was that a contractor is entitled to complete the works earlier than the contract completion date and has a right to do so. However, there is no corresponding duty on the part of the employer to permit him to do so, and in particular to provide him with information or otherwise positively co-operate so as to enable him to do so. The contractor is merely free from any contractual restraint and may complete earlier. The employer must not prevent him from doing so, but this does not mean that the employer is bound to facilitate in a positive way the implementation of the contractor's privilege or liberty.

McAlpine Humberoak v. *McDermott International* (1992)

The facts

In June 1981 Conoco contracted with McDermott for the construction of the deck structure for a tension leg platform for use in the Hutton oil field. The design of the tension leg platform was a prototype. The deck structure was a complex steel frame comprising nine pallets which had to be fabricated to within small dimensional tolerances to ensure an accurate fit when all nine were bolted together.

In October 1981 McAlpine was invited to tender for the construction of seven of the nine pallets which when joined together would form the weather deck. The pallets were to be fabricated and assembled in McAlpine's yard in Great Yarmouth and delivered by barge to McDermott's base in the Moray of Firth, Scotland. On 18 November 1981, McDermott issued a letter of intent to McAlpine for construction of four of the nine pallets; based on 22 number drawings and a period of completion of 18 weeks.

In early December 1981, new drawings and revised drawings were issued to McAlpine and, by the end of the work, McDermott had issued 191 number additional drawings to McAlpine. In addition, 45 number technical queries (TQs) were issued by McAlpine, and McDermott changed the delivery dates for two of the four pallets.

On 24 March 1982, the parties formally entered into a contract which was expressed as being effective from 18 November 1981. Also on 24 March 1981, McDermott omitted two of the pallets from the contract, citing as the reasons 'serious failure without good cause to make reasonable progress and serious substantial failure by McAlpine to properly perform its obligations under the contract'.

The two pallets remaining in the contract were finally delivered on 15 July 1982 and 7 September 1982. These were delivered some 21 weeks and 31 weeks later respectively than the contract completion dates.

The dispute

McAlpine sued, claiming £2.849 million for delay caused by the large number of revised drawings, technical queries and variation. McDermott counterclaimed for the additional cost it incurred through alleged delay and defective fabrication by McAlpine.

Following a trial lasting some 92 working days between November 1987 and June 1989 and deliberating for a further year, Judge Davies gave his judgment in July 1990.

The judgment

Judge Davies described the defendant's delay claim format as a 'retrospective and dissectional re-creation' of the project. He further stated that this method was unhelpful, artificial and of no particular use in deciding how delays had actually been caused.

Judge Davies found for McAlpine, and ruled that McAlpine was entitled to an additional £1.839 million.

However, in finding that the contract was frustrated, the judge held that, since the contract was agreed to take effect from 18 November 1981, it must be construed in the light of circumstances then existing and what the parties then knew. The judge's decision that the contract had been frustrated surprised both parties since frustration had neither been pleaded nor argued.

McDermott appealed.

The judgment on appeal

The Court of Appeal found for McDermott. In giving judgment the Court of Appeal found that

> *The revised drawings did not transform the contract into a different contract or distort its identity. It remained a contract for the construction of four pallets until 24 March 1982 when W5 and W6 were withdrawn. Thereafter it was a contract for the construction of two pallets.*

The Court went on to say:

> *If we were to uphold the Judge's finding of frustration this would be the first contract to have been frustrated by reason of matters well known to the parties which had not only occurred before the contract was signed, but has also been expressly provided for in the contract itself.*

Having found that the contract had not been frustrated, the Court then turned to the assessment of indirect costs claimed by, and previously awarded to, McAlpine. The Court of Appeal held that the effect of the changes on the overall performance of the contract was just what the defendant had attempted to assess. Judge Davies's findings, 'hardly did justice to the painstaking analyses by the defendant's experts of what actually happened'.

The Court of Appeal held that McAlpine's approach was simply theoretical and unsupportable. Several important points can be extracted from the Court of Appeal's judgment.

First, the claim for an extension of time was presented by considering each variation, identifying how long it would take to do that variation and then simply adding up the number of days to produce an overall delay. The Court of Appeal said that this approach was insufficient. The major defect was that it was assumed that, for each day spent working on a variation, the completion date of the contract was also delayed for that particular day. This was entirely incorrect.

Second, in respect of additional costs, the claimant calculated the additional labour costs by reference to the tender. The claimant calculated the number of man-hours allowed for in the tender. They then divided that by the number of days for each activity as originally planned. The claimant next identified the number of man-hours per day for the whole of the delayed period. The Court of Appeal did not accept this approach, which assumed that the workforce for any planned activity was continuously engaged in that activity from the commencement of the activity until it was complete. It considered this approach entirely unrealistic.

The Court of Appeal stated that a retrospective and dissectional reconstruction of what actually happened on site was the only real acceptable approach to the proof of delay. The Court of Appeal stated: 'No attempt was made by the parties to assess the effect of the changes on the overall performance of the contract by way of delay, disruption and interruption.'

While the original planned intent was important, it was the blow-by-blow deconstruction of the actual sequence of works on site that was required in order to identify actual periods of delay that could then be assigned to the liability of each of the parties.

Finally, the Court of Appeal considered late instructions. This is sometimes referred to as the 'colour of the front door' argument. In other words, if the building was completed very late by the contractor (with this delay being the contractor's fault), but then the employer asked for the colour of the front door to be changed, then in that scenario is the contractor entitled to an extension of time up to the point where the work is finished? The Court of Appeal dismissed the approach by stating:

> *If a contractor is already a year late through his culpable fault, it would be absurd that the Employer should lose his claim for unliquidated damages just because, at the last moment, he orders an extra coat of paint.*

Commentary

In reviewing the facts the Court of Appeal reverted to the maxim 'he who asserts must prove', and quickly concluded that McAlpine had not proven their case.

What appears surprising about this judgment is that, after sitting for only three and a half weeks out of an allotted nine weeks and without hearing evidence firsthand from witnesses, the Court of Appeal came to an opposite conclusion on virtually every finding on matters of fact and law from Judge Davies, who had listened to the evidence firsthand over a period of 92 days and had deliberated for a further year.

The Court of Appeal made two important observations on the standard of proof required for contractors' delay and disruption claims:

1 The claim must be particularised addressing the crucial issue of causation in respect of individual disrupting events and their impact on the programme. It is not proven by generalities concerning impact on the programme such as 'vast amount of disruption', 'utter confusion', 'impossible situation'. The allegations of fact must be sustainable.
2 Proof of the claim is achieved through expert evidence by reconstruct-

ing events so as to show the delaying and disrupting effects of the causal events, e.g. late information, revised drawings, instructions, etc.

This case demonstrates that on complex disputes there is no fast and simple method of defending claims. It is not unusual for those on the receiving end of complex and substantial claims to baulk at committing the resources, whether in terms of finance, staff or time or a combination of all three, to carry out the detailed work necessary to mount an adequate defence. More often than not there is no real alternative. For McDermott such an approach eventually paid handsome dividends.

A final observation is that this case supports the use of retrospective analysis as a technique for demonstrating delay claims. The procedure in this case, involving the comparison of planned and as-built programmes, and thereby tracing the actual critical path through the project from what was planned to what it actually became. This technique allows the effect on the project completion date to be shown and demonstrated for each delaying event.

14 Case law
1993 to 1999

The cases reviewed in this chapter are:

- *Balfour Beatty Building Ltd* v. *Chestermount Properties Ltd* (1993);
- *John Barker Construction Ltd* v. *London Portland Hotel Ltd* (1996);
- *Ascon Contracting Ltd* v. *Alfred McAlpine Construction* (1999);
- *Henry Boot Construction Ltd* v. *Malmaison Hotel (Manchester) Ltd* (1999).

Balfour Beatty Building Ltd v. *Chestermount Properties Ltd* (1993)

The facts

Chestermount employed Balfour Beatty to construct an office building in the City; and the works concerned the shell, core and certain elements of the fit-out works. The form of contract between the parties was JCT 1980. By clause 2.2 of the contract, Chestermount could elect by a stated date to confine the contract to the shell and core works only. This option was duly exercised but the fit-out works were reinstated into the contract by variation order.

The contract commencement date was 18 September 1987 and the contract completion date was 17 April 1989. In March 1998 Chestermount confined the works to shell and core only. In October 1988, the architect granted an extension of time which made the completion date 9 May 1989. The project was not completed by this date and a Certificate of Non-Completion was issued by the architect under clause 24.1 of the contract. By February 1990, some nine months later, the project had still not been completed.

Between 12 February 1990 and 12 July 1990, the architect issued instructions to the contractor for the carrying out of fit-out works, as a variation to the contract. The instructions and variation for the fit-out works were issued after the revised contract completion date but before practical completion.

Practical completion of the shell and core work was achieved on 12 October 1990, some 22 weeks later than the revised contract completion date; while practical completion of the fit-out work was achieved on 25 February 1991, some 19 weeks later.

The dispute

The contractor's argument was that the effect of variations issued after the contract completion date in a period of contractor-culpable delay was to cause time to be at large, meaning that the contractor had to complete within a reasonable time; and that the employer would lose his rights to levy LADs. The contractor's alternative argument was that, in the circumstances, the architect should have fixed as a new completion date the date upon which the works could fairly and reasonably have been expected to be completed having regard to the date when the variation was ordered. The architect should, they said, have ignored the previous completion date and start his assessment from the date when the variation instruction occurred and then cast the appropriate extension of time forward. On this basis the contractor, although in culpable delay, would get an automatic extension of time for the period between the completion date previously fixed and the date the variation was ordered.

The employer's argument was that any extension of time for the fit-out works should be on a 'net' basis. That is to say, adding to the revised completion date of 9 May 1989 the period that the architect considered to be fair and reasonable for the fit-out works, which was 18 weeks.

The judgment

This case was heard before Mr Justice Coleman in the Commercial Court, and arose from an appeal against an arbitration award of Mr Christopher Willis.

The following preliminary question was put before the Court,

> *In granting an extension of time in respect of the Relevant Event occurring during a period of culpable delay, ought the Architect to award a 'gross' extension (that is one that re-fixes the Completion Date at the calendar date upon which the work would reasonably be expected to be completed, having regard to the calendar date upon which it is instructed), ought it to be a 'net' extension (that is one which calculates the revised Completion Date by taking the date currently fixed and adding the number of days which the Architect regards as fair and reasonable).*

The Court confirmed that the correct approach was that the architect should start with the existing completion date and extend it to the date that he considers 'fair and reasonable', having regard to the delay caused by the requirement to execute the variation instructions. The Court confirmed that it was the 'net' method that was appropriate.

Mr Justice Coleman found in favour of the employer for the following reasons:

1 The objective of clause 25.3.1 is for the architect to assess whether any of the relevant events have caused delay to completion, and if so by how much. He then applies the result of his assessment to give a revised completion date.
2 With regard to the architect's review of extensions of time under clause 25.3.3.2 following practical completion, Mr Justice Coleman said:

   he (the architect) *looks back after the most recently-fixed completion date and under clause 25.3.3, perhaps even after practical completion, and assesses the extent to which the period of contract time available for completion ought to be extended or reduced having regard to the incidence of relevant events.*

3 Mr Justice Coleman also gave his yardstick on criticality and concurrency:

   His yardstick is what is fair and reasonable. For this purpose he ought to take into account, amongst other factors the effect that the relevant event had on the progress of the works. Did it bring the progress of the works to a standstill? Or did it merely slow down the progress of the works?

With the objective being, 'to assess whether any of the relevant events has caused delay to the progress of the works as a whole and, if so, how much'. And:

> *If the variation works can reasonably be conducted simultaneously with the original works without interfering with their progress and are unlikely to prolong practical completion, the architect might properly conclude that no extension of time was justified.*

Mr Justice Coleman examined the purposes of the completion date, extension of time and liquidated damages regime and stated:

> *At the foundation of this code is the obligation of the contractor within the contractual period terminating with the completion date and on failure to do so pay liquidated damages for the period of time by which practical completion exceeds the completion date.*

If events occur which are non-contractor's risk events and cause the works to be delayed, the contract provides for the completion date to be adjusted in order to reflect the delay caused.

In essence the architect is concerned to arrive at an aggregate period for completion of the contractual works, having regard to the occurrence of non-contractor's risk events and to calculate the extent to which the completion of the works has exceeded that period.

Obviously there is nothing to stop the architect in an appropriate case from re-fixing the completion date at a point of time which is not only before the date on which he exercises the power but is also before the date on which he issued the instruction.

He further said:

The remarkable consequences of the application of the principle could therefore be that if, as in the present case, the contractor fell well behind the clock and overshot the completion date and was unlikely to achieve practical completion until far into the future, if the architect then gave an instruction for the most trivial variation, representing perhaps only a day's extra work, the employer would thereby lose all right to liquidated damages for the entire period of culpable delay up to the practical completion or, at best, on the respondents' submission, the employer's right to liquidated damages would be confined to the period up to the act of prevention. For the rest of the delay he would have to establish unliquidated damages. What might be a trivial variation instruction would on this argument destroy the whole liquidated damages regime for all subsequent purposes. Such extreme a consequence … could hardly reflect the common intention.

The means by which that period is adjusted is by advancing or postponing the completion date, which can be done prospectively or retrospectively. If it is advanced by reason of an omission instruction, the consequence may well be that the adjustment required by way of reduction of time for completion is sufficiently substantial to justify re-fixing the completion date before the issue of the instruction… (In) *the case of a variation which increases the works, the fair and reasonable adjustment required to be made to the period for completion may involve movement of this completion date to a point in time which may fall before the issue of the variation instruction.*

The completion date as adjusted retrospectively is thus not the date by which the contractor ought to have achieved, or ought in future to achieve, practical completion but the date which marks the end of the total number of working days starting from the Date of Possession within which the contractor ought fairly and reasonably to have completed the works.

The judge considered the 'gross' method of assessing extensions of time, and stated:

> *if the architect were to assess the length of time to carry out the variation works and to re-fix the completion date at the end of such period starting from the date of the variation instruction, he would produce a result that would be unfair to the employer.*

His conclusion was:

> *The underlying objective is to arrive at the aggregate period of time within which the contract works as ultimately defined ought to have been completed having regard to the incidence of main contractor's risk events and to calculate the excess time, if any, over that period which the contractor took to complete the works. In essence the architect is concerned to arrive at an aggregate period for completion.*
>
> *The completion date as adjusted was not a date which the contractor ought to have achieved practical completion but the end of the total number of working days starting from the date of possession within which the contractor ought fairly and reasonably to have completed the works.*

Commentary

Of special interest in this case were two matters concerning extensions of time:

1. Was the issue of a variation after the extended completion date but before practical completion, and, therefore, can an extension of time be granted or will LADs become unenforceable, and was 'time at large'?
2. If an extension of time could be granted to the contractor, should a 'gross' extension of time be awarded, or simply a 'net' extension of time?

The 'net' basis is simply the amount of delay occasioned by the relevant event added onto the last revised completion date. This is often referred to as the 'dot-on' principle.

The 'gross' approach is the amount of delay occasioned by the relevant event but calculated from the calendar date on which the variation is instructed. This is, of course, the interpretation contended for by contractors because they could then get an extension of time for the period between the completion date previously fixed and the date on which the variation is instructed; and they are often in culpable delay for this period.

To summarise, where a contract administrator, architect/engineer, issues an instruction or variation after the contract completion date but before practical completion, it is appropriate where resultant delays occur for an extension of time to be granted. The starting point for consideration is the completion date currently fixed and such extension of time will be calculated by extending the completion date by the 'net' period of delay caused to completion. The 'gross' method is, as both judge and arbitrator found, 'wholly inconsistent with the distribution of risk'.

Moreover, if the varied works can reasonably be carried out simultaneously with the original works without interfering with their progress and are unlikely to prolong practical completion, the architect might properly conclude that no extension of time is justified.

Furthermore, it is now clear that the issue of a variation in a period of culpable delay and after the current completion date does not set time at large. The chances of establishing such a claim are now very slim indeed because of case law development.

John Barker Construction Ltd v. *London Portland Hotel Ltd* (1996)

The facts

The project concerned alterations and refurbishment of the London Portman Hotel, the contractor being John Barker Construction Ltd. The contract between the parties was JCT 1980 *Standard Form of Contract with Quantities*, incorporating the sectional completion supplement. The works were to be completed by 14 August 1994.

The contractor commenced in April 1994 and practical completion was certified on 23 September 1994.

The dispute

On 1 December 2004, Barker applied for an extension of time for the full period of delay which was six weeks. An extension was awarded by the architect, but not for the full period of delay.

The judgment

The dispute was referred to the Official Referee's Court, and was heard before Mr Justice Toulmin.

The judge was not persuaded that the architect's assessment of a fair and reasonable extension of time was methodical and logical. His conclusion was that the architect's assessment was irrational, illogical and fundamentally flawed, and he mentioned in his judgment that the architect

> *did not carry out a logical analysis in a methodical way of the impact which the relevant matters had or were likely to have on the planned programme. He made an impressionistic, rather than a calculated, assessment of the time which he thought was reasonable for the various items individually and overall.*

Commentary

Two important observations in this case are:

1 Mr Recorder Toulson QC held that a fair extension of time called for a logical analysis of the impact of relevant matters in a methodical way.
2 An analysis using CPM techniques was held to be a fair way of assessing a reasonable extension of time. However, it was not suggested that such techniques constituted the only way of assessment.

Ascon Contracting Ltd v. *Alfred McAlpine Construction* (1999)

The facts

Alfred McAlpine was the main contractor for the construction of a five-storey building, known as the Villiers Building along the seafront in Douglas, Isle of Man, and Ascon was appointed as subcontractor for the concrete works. The subcontract period was 27 weeks, commencing on 28 August 1996, with completion by 5 March 1997. Completion of Ascon's works was not achieved until 16 May 1997, some ten weeks late.

Ascon submitted claims for extension of time for 39 days for delays caused by water percolating into the foundations of the building prior to tanking, and the fact that the lift pit was not available. Ascon also claimed loss and expense for both causes of delay and acceleration costs to overcome the delay.

The dispute

McAlpine denied Ascon's claims, arguing that the delays were Ascon's responsibility, caused by Ascon's failure to work in accordance with the detail of the main contract programme. McAlpine also counterclaimed for liquidated damages imposed on it by the employer under the main contract, and for its own loss and expense.

Ascon denied that it was obliged to follow in detail the main contract programme or that it was liable for liquidated damages imposed on McAlpine. McAlpine's argument was that, had all subcontractors started and finished on time and McAlpine executed its own work on time, practical completion of the project would have been five weeks earlier than the contract completion date. McAlpine argued that the five weeks' float was for its benefit in order to absorb its own delays. As the five weeks' float had been used by Ascon and other subcontractors, McAlpine claimed it was entitled to recover its lost benefit.

As the parties were unable to resolve their differences, the dispute was heard in the Technology and Construction Court before Judge Hicks.

The judgment

The first part of Ascon's claim was for an extension of time of 22 days for water percolating into the foundations of the building prior to tanking. Ascon's case was that it was McAlpine's responsibility to keep the works free from water ingress; McAlpine's position was that Ascon's failure to provide sufficient steel fixers was the real cause of this delay.

While Judge Hicks was persuaded that there were insufficient steel fixers, but that Ascon was probably disrupted by the water-percolating matter, he was not persuaded that the water-percolating matter caused the 22-day delay, and only allowed a six-day extension of time for this matter.

The second part of Ascon's claim was for an extension of time of 17 days for the lift pit not working.

On this matter, the judge ruled that Ascon could and should have made more progress on the lift pit, and therefore only allowed an extension time of eight days for this matter. Judge Hicks's view was that Ascon did not do enough to mitigate the effects of the delay and was therefore partly culpable.

On the matter of Ascon's acceleration claim to overcome the delays, Judge Hicks said:

> *'Acceleration' tends to be bandied about as if it were a term of art with a precise technical meaning, but I have found nothing to persuade me that this is the case. The root concept behind the metaphor is no doubt that of increasing speed and therefore, in the context of a construction contract, of finishing earlier.*

The judge, in wholeheartedly rejecting Ascon's approach on acceleration, observed:

> *It is difficult to see how there can be any room for the doctrine of mitigation in relation to damage suffered by reason of the employer's culpable delay in the face of express contractual machinery for dealing with the situation by extensions of time and reimbursement of loss and expense. However that may be as a matter of principle, what is plain is that there cannot be both an extension of time to the full extent of the employer's culpable delay, with damages on that basis,*

> *and also damages in the form of expense incurred by way of mitigation, unless it is alleged and established that the attempt at mitigation, although reasonable, was wholly ineffective.*

McAlpine had argued in support of its counterclaim that float in the main contract programme belonged to it. The judge rejected this argument; he considered the float to be of value in the sense that delays could be accommodated in the float time. This would avoid an overrun to the contract period and hence any liability to pay liquidated damages to the employer. The judge went on to say that McAlpine, while accepting the benefit against the employer, could not claim against the subcontractors. The judgment included the following:

> *The float is certainly of value to the main contractor in the sense that delays of up to that total amount, however caused, can be accommodated without involving him in liability for liquidated damages to the employer or, if he calculates his own prolongation costs from the contractual completion date rather than from the earlier date which might have been achieved, in any such costs. He cannot, however, while accepting that benefit as against the employer, claim against sub-contractors as if it did not exist. That is self-evident if total delays against sub programmes do not exceed the float. The main contractor, not having suffered any loss of the above kinds, cannot recover from sub-contractors the hypothetical loss he would have suffered had the float not existed, and that will be so whether the delay is wholly the fault of one subcontractor, or wholly that of the main contractor himself, or spread in varying degrees between several subcontractors and the main contractor. No doubt those different situations can be described, in a sense, as ones in which the 'benefit' of the float has accrued to the defaulting party or parties, but one could suppose that the main contractor has, or should have, any power to alter the result so as to shift the 'benefit'. The issues in any claim against a subcontractor remain simply breach, loss and causation.*

Judge Hicks's decision on whether Ascon caused delay to the main contract works was:

> *The date of practical completion will also govern liability for liquidated damages. Here no subcontract liquidated damages clause is relied upon and Ascon was not a finishing trade; the question whether a delay on its part caused loss of the kind claimed by McAlpine turns not on any nice question of how practical completion is to be understood or its date identified but on the factual issue whether, and if so by how much, delayed working affected the progress of the following trades and thereby completion of the main contract.*

> *This brings me back to the factual issues of causation. The first is whether it is proper, in the absence of other evidence, to infer that the causes of delay at one stage have a continuing effect so as to produce the same delay at a later stage. I believe that in principle it is a proper inference, but that the probability that it will be drawn, or drawn to its full extent, is likely to diminish with the passage of time and the complexity of intervening events. My reasons for regarding it as proper, with those qualifications, are first that such an inference, at least over short periods, is tacitly assumed in all negotiation, arbitration and litigation of delay claims, and secondly that it represents the 'neutral' position, in the sense that if all other activities proceeded according to programme … that would be the result.*

Commentary

With regard to float, although he did not expressly state so, the judge seems to have favoured the argument that the float belongs to the first person to use it, be they employers, contractors or subcontractors. The main contractor has no power to shift the benefit which would effectively result in him having his cake and eating it.

It is noteworthy that the expert appointed by Ascon's to give opinion on the extent of delays claimed was a 'quantity surveying expert', and it is surprising that the judge did not query the relevance of the witness's expertise in planning and programming matters. Litigants should be careful to ensure that evidence is given by independent experts on matters within their expertise.

***Henry Boot Construction Ltd* v. *Malmaison Hotel (Manchester) Ltd* (1999)**

The facts

Malmaison engaged Henry Boot to construct a new hotel in Piccadilly, Manchester. Completion was fixed for 21 November 1997 but was not achieved until 13 March 1998. However, extensions of time were issued by the architect revising the date for completion to 6 January 1998. The employer, Malmaison, deducted liquidated damages from the contractor. Henry Boot claimed further extensions of time in respect of a number of alleged relevant events; no further extensions of time were awarded.

The dispute

Henry Boot gave notice of arbitration in respect of only two relevant events, which it used to claim extensions of time through to practical completion. If it succeeded in the arbitration, the liquidated damages would be repaid and it would also be in the position to claim time-related costs for the overrun.

Malmaison denied that the two alleged relevant events caused delay and further pleaded many other matters which if proved would demonstrate that the contractor was the cause of the overrun.

Henry Boot argued before the arbitrator that Malmaison should not be permitted to introduce into the arbitration their positive case as this was outside matters defined by its original notice. The arbitrator rejected Henry Boot's argument; Boot appealed, and the matter came before Mr Justice Dyson for his decision.

The judgment

In his judgment, His Honour Judge (HHJ) Dyson confirmed that, when an architect was considering awarding an extension of time in respect of a relevant event, then he should consider the impact of 'other events' in order to see the interaction of those events and in particular whether the delay for a particular relevant event was on the critical path. The architect could then determine whether the contractor was entitled to an extension of time in respect of any particular relevant event. Judge Dyson described the certifier's duty under clause 25 in the following terms:

> *But in both cases his objective must be the same: to assess whether any of the relevant events has caused delay to the progress of the works and, if so, how much. He must then apply the result of his assessment to the amount of delay caused by the relevant event by extending the contract period for completion of the works by a like amount and this he does by postponing the completion date.*

This case also concerned concurrent delays. In his judgment, HHJ Dyson considers how two concurrent causes of delay should be determined; one being a relevant event such that a contractor was entitled to an EOT and the other having no entitlement to an EOT. He clarified this as follows:

> *It is agreed that if there are two concurrent causes of delay, one of which is a relevant event and the other is not, then the contractor is entitled to an extension of time for the period of delay caused by the relevant event, notwithstanding the concurrent effect of the other event. Thus to take a simple example, if no work is possible on site for a week, not only because of exceptionally inclement weather (a relevant event), but also because the contractor has a shortage of labour (not a relevant event), and if the failure to work during that week is likely to delay the works beyond the completion date by one week, then if he considers it fair and reasonable to do so, the architect is required to grant an extension of time of one week.*

HHJ Dyson went on to say that an architect is not precluded from considering the effect of other events when determining whether a relevant event is likely to cause delay to the works beyond completion.

Commentary

The central issue in this case was clause 25, its construction and use. The judge considered the key words in clause 25 were:

> *If, in the opinion of the architect, upon receipt of any notice … the completion of the works is likely to be delayed thereby beyond the completion date.… The architect shall in writing to the contractor give an extension of time.*

HHJ Dyson acknowledged that while the decision in *Balfour Beatty* v. *Chestermount* was of some assistance, that case involved the retrospective use of clause 25, whereas in this case an opinion had to be formed before practical completion.

This case is also relevant to the function of granting extensions. Should the investigation be limited to looking only at the impact of the 'relevant event' in respect of which the contractor is seeking an extension of time? Or should the certifier also consider the impact of other events? At stake, from the employer's aspect the proper exercise of this function will dictate the extent to which the contractor can be charged liquidated damages. For the contractor, there is the question of its entitlement to recover time-related costs.

This case is also important with regard to concurrency. If it can be shown that there are two equal concurrent causes of delay, for which the employer and contractor were respectively responsible, then the contractor is still entitled to an extension of time.

Judge Dyson illustrated his views on concurrency with an example of the start of a project being held up for one week by exceptionally inclement weather, a 'relevant event', and at the same time the contractor suffered a shortage of labour, not a 'relevant event'. In effect the two delays and causes were concurrent. In this situation, Judge Dyson said that the contractor should be awarded an extension of time of one week, and an architect should not deny the contractor an extension on the grounds that the project would have been delayed by the labour shortage.

Judge Dyson's approach to concurrency is considered to be fair and reasonable, the implications being that the employer cannot levy liquidated damages against the contractor for delay, while the contractor should not be allowed to recover its prolongation costs for the delay.

15 Case law
2000 to 2003

The cases reviewed in this chapter are:

- *Royal Brompton Hospital NHS Trust* v. *Frederick Alexander Hammond and Others* (2000);
- *Motherwell Bridge Construction Ltd* v. *Micafil Vakuumtechnik* (2002);
- *Balfour Beatty Construction Ltd* v. *The Mayor and Burgesses of the London Borough of Lambeth* (2002).

Royal Brompton Hospital NHS Trust v. *Frederick Alexander Hammond and Others* (2000)

The facts

The project concerned the construction of a six-storey hospital, known as the National Heart and Chest Centre Phase 1, in Chelsea, London for the Royal Brompton Hospital (RBH) NHS Trust. Taylor Woodrow was the main contractor, and practical completion was certified as being achieved on 23 May 1990, some 43 weeks and two days later than the original completion date for the project. In total, the architect awarded an extension of time of 43 weeks and two days, thereby revising the date for completion to 23 May 1990.

The contractor claimed loss and expense from the hospital for delays. Some money was paid by the hospital, and in 1992 the contractor commenced arbitration proceedings against the RBH Trust for the remainder of its claim.

In 1995, prior to a hearing, the arbitration was settled with the employer making a payment of £6 million to the contractor.

The dispute

In 1997 the RBH Trust served a statement of claim with allegations of negligence against members of the professional team involved with the project, i.e. architect, project manager, etc. seeking to recover the settlement amount paid to the contractor plus their own arbitration costs.

The action resulted in a series of trials taking place in the Technology and Construction Court between 1999 and 2002.

The judgment

The hospital's main case against the architect was that the contractor was responsible for the delays but the breaches and negligence of the architect had so weakened the hand of the hospital in the arbitration that, instead of recovering from the contractor liquidated and ascertained damages and the loss and expense already paid to the contractor, it paid out further sums to the contractor plus costs of £15 million.

One of the key points in the Trust's case was that, in determining a fair and reasonable extension of time, the architect failed to determine the actual critical path of the contractor's works and that extension of time awards had been given for non-critical path works.

Further, the Trust alleged that the architect had failed to determine the contractor's actual progress against its programme and had not examined the reasons for delay against that programme and the actual progress of the works in assessing the applications for extensions of time.

A key issue in this case was 'concurrency'. On this issue, Judge Seymour distinguished between sequential causes of delay and true concurrency, stating:

> *However, it is, I think, necessary to be clear what one means by events operating concurrently. It does not mean, in my judgment, a situation in which, work already being delayed, let it be supposed, because the contractor has had difficulty in obtaining sufficient labour, an event occurs which is a Relevant Event and which, had the contractor not been delayed, would have caused him to be delayed, but which in fact, by reason of the existing delay, made no difference. In such a situation although there is a Relevant Event, 'the completion of the Works is [not] likely to be delayed thereby beyond the Completion Date'. The Relevant Event simply has no effect on the completion date. This situation obviously needs to be distinguished from a situation in which, as it were, the works are proceeding in a regular fashion and on programme, when two things happen, either of which had it happened on its own would have caused delay, and one is a Relevant Event, while the other is not. In such circumstances there is real concurrency of causes of delay.*

Judge Seymour also gave his view on the analysis that is required to demonstrate delay and the available float:

> *All activities have potential or theoretical float (even if the period is negative). What is required is to track the actual execution of the works. On a factual basis this case requires no further discussion. In addition clause 25 refers to 'expected delay in the completion of the Works' and for the need for the Architect to form an opinion as to whether because of a Relevant Event 'the completion of the Works is likely to be delayed thereby beyond the Completion Date'. Under the JCT conditions, as used here, there can be no doubt that if an architect is required to form an opinion then, if there is unused float for the benefit of the contractor (and not for another reason such as to deal with p.c. or provisional sums or items), then the architect is bound to take it into account since an extension is only to be granted if completion would otherwise be delayed beyond the then current completion date.*

Commentary

The important matters that are gleaned from this case and judgment are:

1. In determining a fair and reasonable extension of time as a consequence of a delay event, an examination of the actual critical path of the contractor's works should be carried out to establish that the delay event affected, or was likely to affect, the completion of the works. Furthermore, the work activities that were critical to the forward progress of the works at the time the delay event occurred should be taken into account.
2. The matter of concurrency should be looked at closely to determine those events that are sequential and those that are truly concurrent.

Judge Seymour also noted that, in order to make an assessment of whether a particular delay event affected the completion of the works and not just a work activity, he considered it correct to take into account what work activities were critical to the forward progress of the works, at the time the delay event occurred.

Motherwell Bridge Construction Ltd v. *Micafil Vakuumtechnik* (2002)

The facts

Micafil was engaged by BICC as main contractor for the construction of an autoclave, which is a large steel vessel with an internal volume of some 650 m^3. The vessel was to be used in the manufacture of high-quality power cables. Micafil undertook the responsibility for the design work and subcontracted its construction to Motherwell Bridge. During construction

Motherwell Bridge raised many technical queries and a number of significant design changes were issued by Micafil. There were two formal amendments to the contract.

The dispute

Delays occurred and Micafil deducted liquidated damages. Motherwell Bridge in turn claimed extensions of time to extinguish the claim for liquidated damages.

The judgment

His Honour Judge Toulmin first dealt with the matter of concurrent causes of delay. He was satisfied that his approach must be outlined from the judgment in the *Henry Boot* case. He said in his judgment:

> *Crucial questions are, (a) is the delay in the critical path? and, if so, (b) is it caused by Motherwell Bridge? If the answer to the first question is yes and the second question is no, then I must assess how many additional working days should be included.*

HHJ Toulmin then departed slightly from the guidance in *Henry Boot,* by going on to comment:

> *other delays caused by Motherwell Bridge* (if proved) *are not relevant, since the overall time allowed for under the contract may well include the need to carry out remedial works or other contingencies. These are not relevant events, since the court is concerned with considering extensions of time within which the contract must be completed.*

Judge Toulmin went on to add that the approach must always be tested against an overall requirement that the result accords with commonsense and fairness. With regard to the questions raised in the *Balfour Beatty* case, Judge Toulmin concluded that an extension of time for completion of the works may be granted in respect of a relevant event occurring during the period of culpable delay. However, he refused to follow precisely the guidance in *Balfour Beatty* to determine the 'net' effect of delays occurring after the date for completion. By fixing the extended period of time available for completion of the work, having regard to the incidences of the causes of delay and measured by the standard of what is fair and reasonable, Motherwell Bridge became entitled to an extension of time for the full period of delay.

Commentary

The judgment in this case emphasised that a delay must be on the critical path, confirming again what was stated in the *Henry Boot* and *Royal Brompton* judgments.

Judge Toulmin also concluded that an extension of time for completion of the works may be granted in respect of a relevant event occurring during the period of culpable delay; an endorsement of the approach in *Balfour Beatty*.

Balfour Beatty Construction Ltd v. *The Mayor and Burgesses of the London Borough of Lambeth* (2002)

The facts

The project involved the refurbishment of Falmouth House, Kennington Park Road in London. The project value was £3.8 million and the contract between the parties was JCT 1988 *Local Authorities Edition without Quantities*. The works commenced on 1 November 1999.

As a consequence of delays to the project, the contractor was awarded extensions of time which revised the date for completion to 23 October 2000. However, practical completion was not achieved until 24 May 2001, some 41 weeks and three days later than the revised date for completion. As a result, liquidated damages for this delay of £355,831.00 were deducted from the contractor.

The dispute

Balfour Beatty maintained that it was entitled to further extensions of time and referred the dispute to adjudication. The adjudicator's decision was that Balfour Beatty was entitled to an extension of time of 35 weeks and one day, thereby reducing the liquidated damages levied to some £80,600.

The employer, the London Borough of Lambeth, challenged the decision on the grounds that the adjudicator did not act impartially and that the decision was reached in breach of contract and without jurisdiction.

The judgment

The case was heard before Judge Humphrey Lloyd, who found in favour of the defendant, Lambeth, and Balfour Beatty's application for enforcement was dismissed. Judge Lloyd was persuaded that the adjudicator 'had not acted impartially and that he failed to comply with the rules of natural justice in significant respects'.

Judge Lloyd made the following comments on the importance of establishing a critical path and on extension of time presentations:

> *This is yet another case in which adjudication has been launched after completion of the works and in which the dispute attracts a simple description but comprises a highly complex set of facts and issues relating to the performance of a contract carried out over many months. It may well be doubted whether adjudication was intended for such a situation. If it is to be utilised effectively it is essential that the referring party gives the adjudicator all that is needed in a highly manageable form. From the material available to me it is clear that BB did little or nothing to present its case in a logical or methodical way. Despite the fact that the dispute concerned a multi-million pound refurbishment contract no attempt was made to provide any critical path. The work itself was no more complex than many other projects where a CPN is routinely established and maintained. It seems that BB had not prepared or maintained a proper programme during the execution of the works. By now one would have thought that it was well understood that, on a contract of this kind, in order to attack, on the facts, a clause 24 certificate for non-completion (or an extension of time determined under clause 25), the foundation must be the original programme (if capable of justification and substantiation to show its validity and reliability as a contractual starting point) and its success will similarly depend on the soundness of its revisions on the occurrence of every event, so as to be able to provide a satisfactory and convincing demonstration of cause and effect. A valid critical path (or paths) has to be established both initially and at every later material point since it (or they) will almost certainly change. Some means has also to be established for demonstrating the effect of concurrent or parallel delays or other matters for which the employer will not be responsible under the contract. BB and its claims consultants, whilst recognising that the critical path would constantly fluctuate (see the referral notice), nevertheless decided that not only was it not practicable but that it was unnecessary to determine a constantly changing critical path.*

The judge also made the following observations regarding progress recording and the presentation delay to areas of the works:

> *BB programmed the works on a flat type basis (albeit without identifying the critical path for same) and at the very least BB should have measured progress against these same flat types. That way it would have been possible to compare the planned progress with the actual progress in a meaningful way. Instead all that BB have provided is an aggregate of all the planned time and compared with all the actual*

time on a trade by trade basis. No attempt has even been made by BB to demonstrate any link between the trades.

Commentary

There are some important issues to be taken out of this judgment, such as:

1 A proper programme should be maintained during the execution of the works.
2 In determining an extension of time, the 'foundation' should be the original programme, subject to justification and substantiation of its validity and reliability.
3 A valid critical path, or paths, should be established as it, or they, will almost certainly change.
4 Concurrent, or parallel, delays should be demonstrated where necessary.

Another key aspect in which the Court gave its opinion was that, in granting an extension of time, the purpose was to fix the period of time by which the period available for completion was to be extended. In other words, the date for completion, as adjusted, was not the revised or new date by which the contractor was to have achieved practical completion, but the end of the total number of days.

16 Case law

2004 to 2005

The cases reviewed in this chapter are:

- *Skanska Construction UK Ltd* v. *Egger (Barony) Ltd* (2004);
- *Great Eastern Hotel Company Ltd* v. *John Laing Construction Ltd & Anor.* (2005).

Skanska Construction UK Ltd v. *Egger (Barony) Ltd* (2004)

The facts

The project was the design and construction by Skanska of a timber-processing facility in Scotland for Egger, an Austrian company, on a former colliery site in Ayrshire. The contract price for Skanska's work was £12 million, under a guaranteed maximum price agreement. Overall, in a period of less than a year, a redundant colliery site with varying levels was transformed into a state-of-the-art, fully automated factory where virgin timber was fed in at one end and a sophisticated chipboard product emerged at the other.

However, during the course of Skanska's works there were delays and disruption; a major issue being the warehouse floor slab which cracked and broke up.

The dispute

Skanska valued the final account as £24.5 million; while Egger's value was £13 million, from which there was a deduction of £4.1 million for defective work and liquidated damages.

The matter was referred to the Technology and Construction Court and was heard before Judge Wilcox.

The judgment

The quantum issues of this case concerned the much greater part of the trial and the subsequent judgment. However, one of the issues was that of loss and expense and, in considering this, the Court was presented with expert evidence relating to delays suffered by several of Skanska's subcontractors.

This judgment considers a technique of delay analysis, which HHJ Wilcox describes as an 'impact analysis'. In this case, the original planned construction programme in barchart form was converted into a network form, i.e. a logically linked critical path analysis.

The judge observed that, if an original programme was converted into a network, then it was essential that the reconstruction was accurate and supported by the evidence; otherwise the Court might decide that the critical path analysis is 'not reliable as a base line'.

During the project there was agreement of the master programme; however, a further three sub-zone programmes were issued by Skanska. Their relevance was stated in the judgment as follows:

> *in order to carry out its impact analysis the master programme prepared by Skanska on 23rd May which for reasons extensively set out in the liability judgment became virtually redundant, almost from the outset because of the late provision of vital information relating to design and layout and changes made on the instructions of Egger. I am satisfied that the sub-zone programmes dealing with each zone separated in planning and programme terms provide a more accurate basis for detailed delay analysis rather than the flawed planned programme....*

Judge Wilcox also commented that 'The reliability of (a) sophisticated impact analysis is only as good as the data put in.'

Commentary

This case emphasises the reliability of a programme used as a baseline for analysis. In establishing a reliable baseline for analysis, the objective is to remove flaws in the original master programme. Furthermore, if more detailed sub-programmes are available, they should be considered in any reconstruction of the master programme, in order to provide a reliable baseline programme for the assessment of delays.

Observations in this judgment were made with regard to the approach of the experts.

1 It is not advisable to overpower the Court with information and numerous delay charts which are difficult to understand. While planning software nowadays is capable of producing a wide variety of reports and charts, careful consideration should be given in selecting the outputs to be incorporated in a report. In his judgment HHJ Wilcox was not impressed with the complexity of a report running to

'some hundreds of pages supported by 240 charts'. There is a lot to recommend the 'keep-it-simple' philosophy. Ensuring the accessibility of a report will always be a problem with delay analysis on large and complex projects as criticism could also be levelled if the report lacks the detailed supporting programmes, hammocks, sub-nets and analysis of alternative critical paths that could be required.

2 Another observation in the judgment is that it is fundamental that the delay analyst is 'objective, meticulous as to detail, and not hide bound by theory as when demonstrable facts collide with computer programme logic'. This applies to all methods and techniques of delay analysis, time impact analysis or other methods. For example, the conversion of the master programme from barchart to network format; if evidence contradicts or conflicts with the output of the computer programme, then adjustment of the input is required to ensure consistency with the facts, i.e. follow the facts, not the computer output. Further, if there are more detailed programmes available, then these should be considered in the development of the reconstructed baseline programme. It will, however, be for the delay analyst to adopt 'intellectual independence and objectivity' in applying his judgment to the weight he attaches to such programmes.

Finally, if a report is to be presented to Court or a tribunal, the expert should be fully conversant with his report. While this may seem self-evident, it is common practice on large and complex projects for an expert to engage assistants to carry out aspects of the investigation. However, an expert's opinion becomes less compelling if he gives the impression that he is not entirely familiar with the details of his own report.

Great Eastern Hotel Company Ltd v. *John Laing Construction Ltd & Anor.* (2005)

The facts

The Great Eastern Hotel (GEH) appointed John Laing as construction manager for the extension and refurbishment of the existing Great Eastern Hotel next to Liverpool Street Station in London. The works included a complete refurbishment and extension of the existing buildings to produce a first-class hotel. This included major demolition work and then re-building, to create a large central atrium and two and a half additional floors within a newly created mansard roof. GEH's budget for the project was £34.8 million; and Laing was appointed under a Construction Management Agreement (CMA). The employer's Indicative Design and Construction Programme for the works was for a period of 113 weeks, but Laing proposed and issued a programme showing a 109-week overall period.

A Letter of Intent was issued to Laing on 19 June 1997, and the works commenced on 30 June 1997, which gave a planned completion date of 2 August 1999. Delays occurred and practical completion was not achieved until 13 July 2000, some 346 days later than the planned completion date. The final cost of the project was £61 million which was some £26 million more than the employer's original budget.

The dispute

The employer, the Great Eastern Hotel Company, sought to recover losses of £17 million from the construction manager, Laing, by way of damages in respect of Laing's various breaches of contract. The matter came before Judge Wilcox in the Technology and Construction Court.

The judgment

The major issue that the Court had to decide was responsibility for the delay. Both the claimant and defendants accepted that there was significant delay. The defendants denied liability, pointing the finger at both other parties and other concurrent causes of delay.

The procurement and erection of the temporary roof was one of the first items on Laing's programme. The judgment describes this situation as follows:

> *Unhappily both the procurement of the Temporary Roof Trade Package and erection of the roof itself went badly wrong. The procurement took three weeks longer than the time programmed by Laing. In consequence the scaffold and Temporary roof contractors TRAD commenced on site on 11th September 1997, three weeks later than programmed. There was thus an immediate three-week delay caused to the Project. The erection of the roof itself took 35 weeks rather than the 10 weeks programmed by Laing. It was completed on 1st May 1998 instead of late October of 1997 as planned. That was a delay in excess of six months. The reasons for these delays had been canvassed a great deal in the evidence.*
>
> *The parties accept that the temporary roof was critical to the whole Project and agree that the delays to the procurement and erection of the temporary roof caused a substantial delay to the project. GEH say that the critical delay caused was 19 weeks and Laing's expert accepts that the critical delay was even more substantial, 26.9 weeks. In either case, the effect on the project was significant. It never recovered from this first fundamental setback, and the delays sadly became worse.*

Judge Wilcox's conclusion on this issue was:

> *In my judgment, in relation to this phase of the project, the defendants are clearly in breach of clauses 2.8, 2.9, 3.1 3.2 (D) and 3.4 of the*

> *CMA and in consequence by their acts and omissions are proved to have significantly caused the delay during these periods.*

The Judge was looking for an objective evaluation from the experts. The two experts approached their analyses of project delay in two different ways.

> *Both experts approached their analyses for the principal part of the project differently. Mr* xxx *for the main part proceeding retrospectively from an as built programme to determine the critical path and respective periods of delay and causes. Mr* yyy *used an impacted as planned programme analysis by which the project is analysed on a monthly basis to measure the impact of events as the project proceeded. The principal critical path determined by each expert was broadly similar. The total extent of delay periods found by each expert broadly coincided. Mr* xxx*'s assessment was several weeks longer than Mr* yyy*, but I am satisfied that by applying an adjustment for public holidays and not taken account of by Mr* xxx*, there is no significant overall difference. It was 49.5 weeks. The vital differences relate to some differences as to the route of the critical path and the causes of delay advanced by each expert.*

However, there was some agreement between the experts before the matter reached the trial stage:

> *The experts in their joint statement that Court agreed as built dates for construction activities up to April of 1999. Thereafter, due to lack of information, Mr* yyy *was unable to confirm the dates relied upon by Mr* xxx *in his as-built programme. They both agreed that MP/1 demonstrated Laing's programme intentions at the time it was drawn in August of 1997 and at the time the periods allocated to the activities were reasonable. Mr* yyy *made certain improvement and refinements to MP/1. Not all of these were agreed by Mr* xxx *but none are particularly significant.*
>
> *The experts dealt with the delay issues with reference to identified periods of time. In reviewing the evidence I would do so relating to each of these periods.*
>
> *I accept Mr* yyy*'s careful evidence as to the impact of the flow of design information throughout the Project. It was based on thorough research and objective analysis.*
>
> *Furthermore, Mr* xxx *in his report compares the timing of the actual design releases against an original programme which was superseded by later versions of the procurement programme on which Laing showed later dates for the provision of the information required.*

> *Mr yyy took account of the actual events in his researches and exhibited in his researches and conclusions the clear-sighted objectivity that informs the whole of his report.*

One of the issues that came up during the trial was progress monitoring and reporting. On this issue Judge Wilcox said:

> *It is evident in my judgment that Laing consistently underplayed mention of the true causes of critical delay and assert other reasons for delay that would not reflect upon them. They consistently misreported the delays actually occurring and manipulating the data in the programme update to obscure the accurate position.*

Another issue that received comment in the judgment was that of alterations to the programme logic. An example of this issue in the judgment was:

> *The deletion of the logic link between the demolition of the Mansard and demolition of the Infill Block obscured from GEH and the design team that the Infill Block was as critical as it was. Had Laing's manipulation not taken place the criticality of the Infill Block from the delays it was causing would have become more readily apparent to everyone. In that event is it more likely than not that under inevitable pressure from the hotel and design team Laing would have taken steps to commence demolition of the Infill Block after protecting the Rail Track services at a much earlier stage. The misreporting of progress had further serious effects on the following Trade Contractors. Because of the misreporting of progress, some of the following Trade Contractors commenced work on site before the works were ready for them, and this led to claims for extensive extensions of time together with prolongation and disruption costs. Had the true state of progress been declared, whilst it would have been necessary for Laing to have renegotiated with Trade Contractors in order to postpone their commencement on site, the cost consequences of such renegotiation would have been relatively minor, and it would have avoided the subsequent claims for extensions of time and loss and expense.*

Commentary

The two party-appointed experts approached their task with different approaches. One expert used a retrospective analysis approach from an as-built programme to determine both the critical path, the periods of critical delay and their causes. This was based on the 'collapsed as-built' technique. The other expert analysed the project on a monthly basis in order to measure the impact of events as the project proceeded. This was based on the 'windows' technique.

Despite the different approaches used by the experts, their results showed that the principal critical path and the extent of the critical delay periods were broadly the same.

The judge had some comments about the potential difficulties with the 'collapsed as-built delay analysis'. His view was that, unless this takes account of the actual events which occurred on the project, it can only give rise to hypothetical answers. One of the key issues in this dispute involved the timing of design release. The judge commented that it was necessary to do more than compare actual release against the original construction programme, stating that if you only do this, the analysis will not take account of the fact that the design team would have been aware of the significance of any delays which may have occurred to the original master programme. In other words, the design team may have been able to prioritise design and construction to fit actual progress.

The judge preferred the 'as-planned impacted delay analysis'; which is a form of 'windows' analysis in that the delays are determined and assessed by analysing the updated planned programme on a monthly basis to measure the impact of events as they occurred.

In summation, the judge preferred the forward-looking 'impacted as-planned' to the retrospective 'collapsed as-built' approach. In particular he considered it very important that it had been based on a careful analysis of what had actually happened.

Furthermore, while ensuring that his own delay analysis could be supported, the expert had dealt with the question of concurrency by considering all other activities which might have caused delay to the completion date of the project, if the identified critical activities had been completed within the originally programmed period. The expert's conclusion was that none were in fact critical thereby demonstrating to the Court that the case in relation to the alleged concurrent causes to the delay could not be established.

Part IV

The ‘thorny issues’

17 Introduction

This section of the book looks at four of the ‘thorny issues’ which are prevalent in many extension of time submissions:

1 float; ownership and utilisation;
2 concurrency;
3 mitigation and acceleration;
4 time at large.

The first of these issues to be reviewed is ‘float’; this is the amount by which individual construction activities can be delayed without affecting completion of the project.

In most standard forms of contract, it is unclear whether it is the employer or contractor who owns the programme float. The view of the Society of Construction Law in their ‘Delay and Disruption Protocol’ is that the project owns the float, which means that either party can use it. Chapter 18 reviews the issue in detail, discussing the concept of float, the importance of it, and who owns it. Simple diagrams are used to illustrate these aspects of ‘float’.

The next issue, ‘concurrency’, is probably the most prevalent of the four issues. This issue is reviewed in chapter 19, looking first at the usual methods of assessment, such as the ‘Devlin approach’, the ‘Dominant Cause Approach’ and the ‘Burden of Proof Approach’. This is followed by a sub-section titled, ‘A practical approach to concurrency’, which discusses how to establish whether delays are truly concurrent, with the help of worked examples. The final part of the chapter presents various scenarios of delays involving concurrency portrayed with some helpful graphics.

The third issue is ‘mitigation and acceleration’. Strictly speaking, these are two separate issues, but they are being considered in the book as one. Most forms of contract contain an obligation for the contractor to mitigate delays. However, none of the standard forms define the difference between mitigation and acceleration; the difference is usually from the standpoint of an employer or a contractor.

In the chapter on mitigation and acceleration, the reasons for acceleration are discussed, and in particular the concept of constructive acceleration. On this matter, the American doctrine on constructive acceleration is explained.

The final thorny issue being reviewed is 'time at large'. This argument is often put forward by contractors to defeat the application of liquidated damages. The expression 'time at large' is used to indicate that the contractor believes that there is no enforceable date for completion of the works. Therefore, as there is then no date from which they can be calculated, the employer's right to liquidated damages is defeated. If the contractor's argument succeeds, then his obligation is to complete within a reasonable time.

The chapter on 'time at large' also reviews 'what is a reasonable time to complete', and 'determining a reasonable time to complete'.

18 Float; ownership and utilisation

'Float' is the amount by which individual construction activities can be delayed without affecting completion of the project; it should be properly defined if this vital ingredient is to play its part in both the construction process and the resolution of disputes.

Do all programmes have float?

The short answer is yes. Float is a function of the programme network, and the amount and position of float within a programme is dependent upon the manner in which the network has been constructed. Float provides a contingency or buffer which may be used to absorb the effects of delays to activities not on the critical path. For example, float is used by contractors in the optimisation of manpower and equipment resources, or to absorb the effects of contractor-responsible delays to activities not on the critical path.

In most standard forms of contract, it is unclear whether it is the employer or contractor who owns the programme float. However, the view of the Society of Construction Law in their 'Delay and Disruption Protocol' is that the project owns the float; this means that either party can use the float. In effect, whichever party, employer or contractor, gets to it first can use it.

What is 'float?'

In project-planning terms there are a number of different types of 'float', such as free float, independent float and interfering float, but the most important type, particularly in terms of the project completion date, is 'total float'.

The British Standard BS 4335:1987, defines total float as

> *The time by which an activity may be delayed or extended without affecting the total project duration.*

Take for example a programme for construction of a new garage. If the programme activity 'ground floor slab' has a total float ('TF') of '12', then this activity can be delayed by 12 workdays before completion of the project will be delayed. See Figure 18.1 below.

In the above example, the programme activity 'ground floor slab' has a total float ('TF') of '4', which means that this activity can be delayed by up to four workdays before completion of the project will be delayed.

So where does 'float' come from? It is often talked about as though it is an entity or object that exists, whereas it is a product of the time analysis process of a logic-linked network. In other words, a logically linked programme, or CPM network. Therefore, float is the difference between the earliest and latest start, or finish, dates for each activity.

The time analysis process consists of three parts:

1 a forward pass, which calculates the early start and finish dates based on predecessor activity restraints and activity durations;
2 a backward pass, which calculates the latest start and finish dates based on successor activity restraints and activity durations;
3 a float calculation, which establishes the difference between the earliest and latest dates for each activity.

Figure 18.2 below shows the programme for construction of a garage portrayed in network format.

The above chart shows for each activity:

From the 'forward pass':

i its earliest start date;
ii its earliest finish date.

From the 'backward pass':

i its latest start date;
ii its latest finish date.

The float calculation; the difference between an activity's early and late dates:

- its total float.

Effectively, float is the spare time available for an activity and the amount of float is the number of working days the activity can be prolonged or delayed without impacting on the project completion date.

In a path of activities where the float is '0', or the lowest in the programme, the chain of activities is referred to as the critical path. Therefore, the critical path through a project is the sequence of activities that represents the shortest possible time to complete the project (see Figure 18.3).

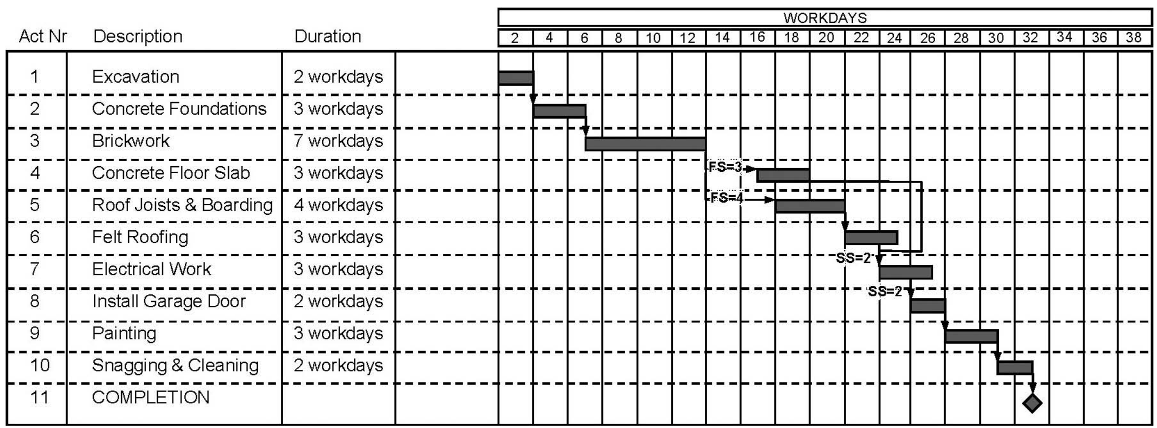


Figure 18.1 Planned programme.

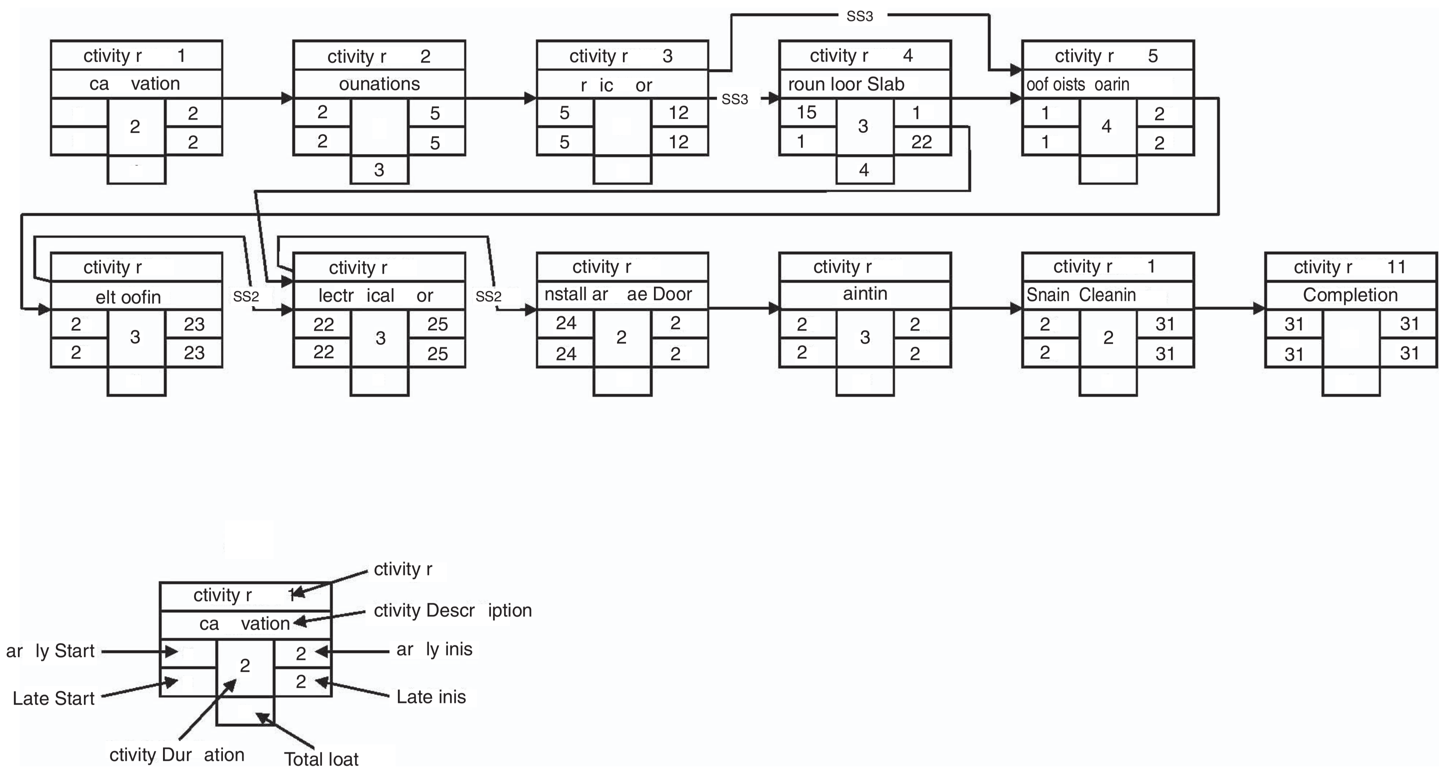


Figure 18.2 Network diagram.

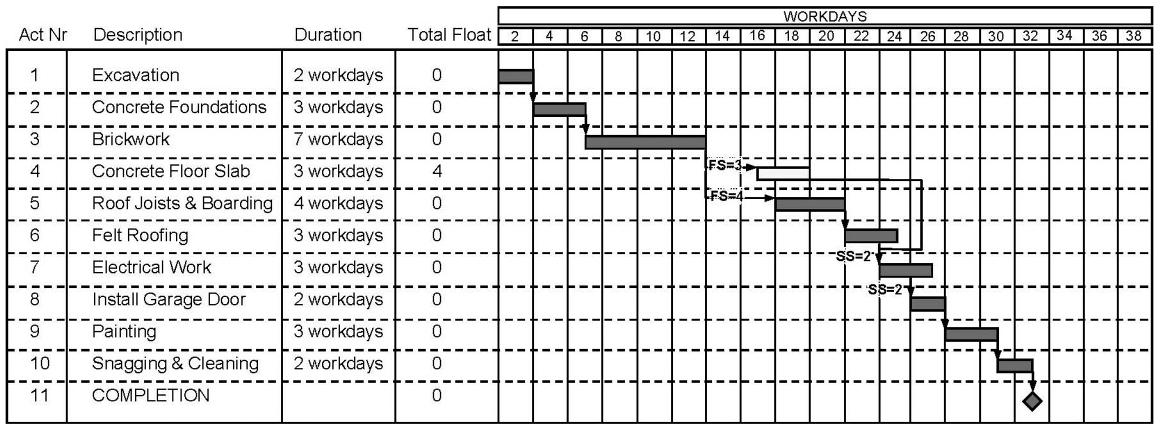


Figure 18.3 The critical path in the planned programme.

The importance of 'float'

If an activity containing float is delayed, then the amount of float will be reduced. When the delayed activity's float has been reduced to zero, then that activity will be critical to the completion date of the project. If the delay to that activity continues, then the activity's float will become negative, and there will be a critical delay to the completion of the project. Using the programme for construction of a garage, and updating it based on actual progress as at workday 26, the updated programme and new forecast now look like this, see Figure 18.4 below.

As can be seen, almost all the remaining work activities are critical, i.e. TF = 0; the only activity that is not on the critical path is 'ground floor slab'. Furthermore, as a consequence of delay to the 'ground floor slab' activity, there has been a critical delay to the project and completion of the project is now forecast to be six workdays late.

Who owns the 'float'?

There are different approaches to the 'ownership' of float, i.e. whether the contractor or employer is entitled to make use of programme float. Propositions and arguments that have been advanced for the 'ownership' of float follow,

Scenario one: the contractor owns the float

The reasoning is that as the contractor created the work programme, he is entitled to use the float to re-programme the work. Float is included in the programme for the contractor's own benefit and helps to plan works and allows the contractor a contingency for any unforeseeable events that occur during the project.

Float enables the contractor to complete on time and, if all goes well and delaying events do not occur, he may complete the works early.

The amount of float that the contractor includes in the programme does not include any allowance for employer-caused delays. The float is in the programme solely as one of the contractor's management tools. As a result, if employer-caused events affect this float, then it is only fair that the contractor should be given an extension of time to maintain that level of contingency.

Scenario two: float belongs to the project

Employers argue that the float is contingency time programmed by the contractor into the programme as insurance against delaying, caused by either party.

If such events do occur, and their only effect is to reduce the float time,

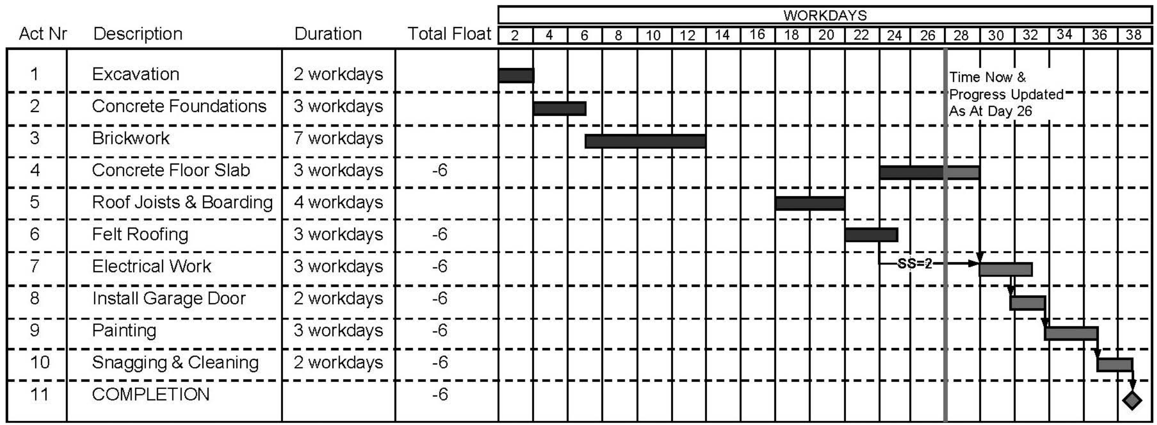


Figure 18.4 The updated planned programme.

the contractor should not be entitled to an extension of time. Employers further argue that this is because the completion date of the project has not been delayed by the event at all.

For example, if only part of the float was used up by delaying events and the contractor was entitled to an extension of time because of these events, then the contractor would still be able to complete the works early, because all of the float had not been used up by the delaying events; but at the same time be entitled to an extension of time beyond the contract completion date.

So employers argue that they own the float, or alternatively that the float 'belongs to the project'.

Disputed liability: an example

On an office-block refurbishment project, because of restricted craneage facilities, the new ventilation equipment has to be hoisted up to the flat roof and then winched across it to the plant room. In order not to damage the new roof waterproofing, the roofing is left off until all equipment is in position.

The contractor's plan is to start internal finishes immediately after the roofing is completed and the building is weather-tight. The contractor's programme shows three weeks' float on the series of activities linking the 'ventilation equipment', 'roofing' and 'internal finishes', i.e. the start of the 'internal finishes' activity can be delayed by up to three weeks without delay to the project completion date. The extract from the contractor's programme is shown in Figure 18.5.

Four weeks before the equipment is due to be delivered the services consultant decides to make an important change to the ventilation equipment which requires a modification in the factory and results in a three-week delay to delivery of some of the equipment. The final installation of the ventilation equipment and the start and finish of roofing will be delayed by three weeks and, as a consequence, the float is used up.

No problem, you might say: the contractor reschedules the works and the project should still finish on time. See Figure 18.6.

In that situation the contractor would not be entitled to an extension of time, as it was not anticipated, or likely, to be 'any expected delay in the completion of the Works or any Section beyond the relevant Completion Date'.

After the start of internal finishes, however, the suspended ceiling subcontractor sets out his work incorrectly and has to redo much of his ceiling grid work. As a consequence, the whole of the internal finishes takes longer than programmed and the project finishes two weeks late. The as-built programme would look like Figure 18.7.

The question is likely to arise as to who pays for the consequences of the delay in completion of the project.

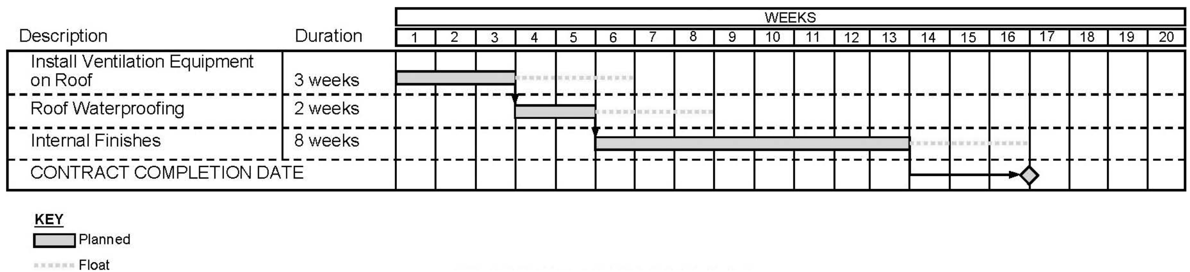


Figure 18.5 Extracts from the contractor's planned programme.

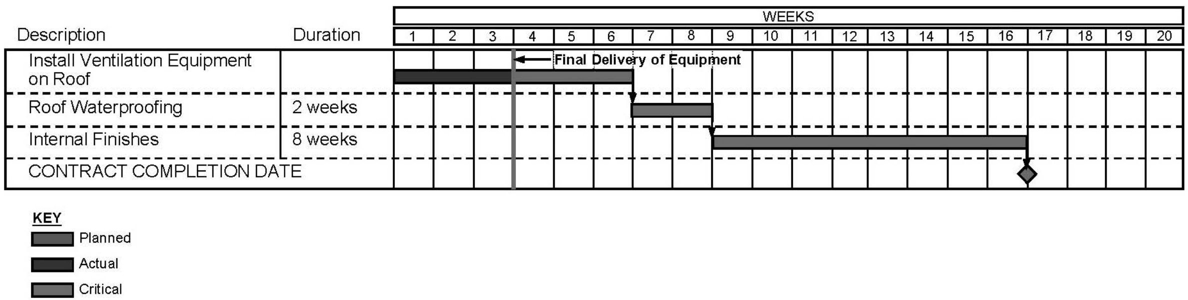


Figure 18.6 As-built programme – after delivery of equipment.

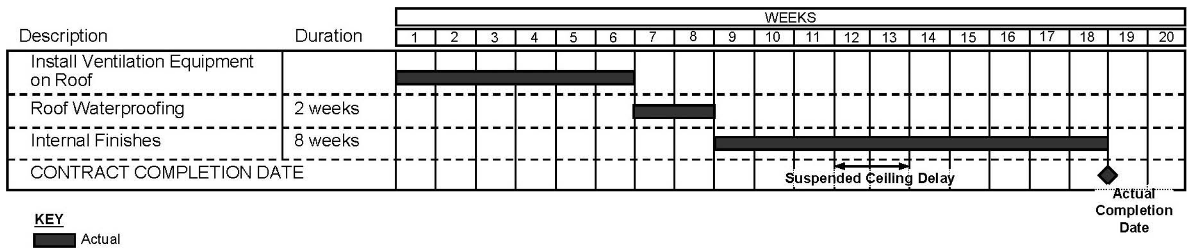


Figure 18.7 Final as-built programme.

The contractor will probably argue that he built float into his programme to cater for his own delays, e.g. the delay in internal finishes, and the cause of the delay in completion was the modification to the ventilation equipment. The architect may argue that the delay in completion was caused by the suspended ceiling subcontractor's default and as such the contractor is not entitled to an extension of time.

Who is right? Most contracts, including the JCT contract, do not address the subject of float and consequently it is a constant source of dispute in time-related claims. Float means flexibility; and both contractor's and employer's representatives argue their need to be able to adjust their programmes as they respond to events that unfold as the project progresses.

The above illustration is a simplified example of problems which can, and do, occur on construction projects. As stated earlier, the standard forms of contract do not address the issue of float. In view of the importance of float, it is essential for employers and contractors alike that it is properly identified in a structured programme, i.e. a critical path network, with any necessary adjustments made to that programme.

Conclusion

Finally, there are five basic tenets that need to be understood regarding delay, disruption and extension of time entitlement. Namely:

1. The programme is dynamic.
2. Float, also being dynamic, is best evaluated, measured and considered at the time of the delay.
3. A critical path analysis is essential to determine the cause and effect nexus required for extension of time entitlement.
4. Contractor-responsible concurrent delays do not reduce the contractor's entitlement to an extension of time.
5. However, contractor-responsible concurrent delays do reduce the contractor's entitlement to prolongation costs.

19 Concurrency

A question that frequently arises is the method of dealing with extensions of time which may be due to either or both of two causes, i.e. concurrency. The more complex the project the more likely that this issue will arise.

Concurrent delays refer to delay situations when two or more delays, regardless of the type, occur at the same time or overlap to some degree – either of which occurring alone would have affected the project completion date.

It is important to differentiate between the delaying event or cause and the delay itself. It is generally recognised that there are times when there are delays which may result from different causes, but that sometimes the causes will run at the same time or overlap. This makes it difficult to decide how to treat the delay, particularly if the causes originate from different parties or the delays are of different kinds. For example, under most forms of contract, some causes may give the contractor entitlement to an extension of time; some causes may give the contractor entitlement to an extension of time and also loss and expense, while other causes may not entitle the contractor to any extension of time or loss and expense whatsoever.

In analysing concurrent delays, each delay should be assessed separately and its impact on other activities and the project date for completion calculated. Much will turn on the quality of planning and programming, and record keeping. Not only will there often be several delay events running in parallel, but there may be parallel critical paths to contend with and periods of acceleration and/or mitigation to take into account. The contract conditions will also have to be taken into account on the analysis technique used.

Methods of assessment

Keating on Building Contracts looks at a number of propositions as follows:

1 *The Devlin Approach*. This contends that if there are two causes operating together and one is a breach of contract, then the party responsible for the breach will be liable for the loss.

2 *The Dominant Cause Approach.* This contends that if there are two causes, the effective, dominant cause is to be the deciding factor.
3 *The Burden of Proof Approach.* This contends that if there are two causes and the claimant is in breach of contract, it is for the claimant to show that the loss was caused otherwise than by his breach.

A further method to consider is the *Malmaison* approach, which is often considered to be the leading modern decision on concurrent delay. Disputes occurred on a hotel project in Manchester which culminated in arbitration and subsequently ended in Court before Mr Justice Dyson.

An agreement on concurrency was reached between the parties and this was ratified in Court by Judge Dyson thus:

> *It is agreed that if there are two concurrent causes of delay, one of which is a relevant event and the other is not, then the contractor is entitled to an extension of time for the period of delay caused by the relevant event, notwithstanding the concurrent effect of the other event. Thus to take a simple example, if no work is possible on site for a week, not only because of exceptionally inclement weather (a relevant event), but also because the contractor has a shortage of labour (not a relevant event), and if the failure to work during that week is likely to delay the works beyond the completion date by one week, then if he considers it fair and reasonable to do so, the architect is required to grant an extension of time of one week.*

Therefore, by using a simple example, Judge Dyson demonstrated that, if a contractor suffered a delay of one week due to exceptionally inclement weather, a relevant event, and in the same period there was a delay due to the contractor's shortage of labour, not a relevant event, then, if the architect considers it fair and reasonable to do so, he should grant an extension of time of one week; and he cannot refuse to grant one on the grounds that the delay would have occurred anyway because of the contractor's shortage of labour.

A simplistic approach sometimes adopted is the 'first-past-the-post' method. This is based on the logic that, where delays are running in parallel, the cause of delay that occurs first in terms of time will be used first to evaluate the impact on delay to the date for completion.

A practical approach to concurrency

When faced with the problem of concurrent delays, it is always worthwhile pausing and asking whether the delays really are concurrent as most delays are in fact consecutive. The test is to look at the project's critical path. Delays will generally be consecutive unless there are two or more critical paths. On some projects, several critical paths running in parallel is not uncommon, but even in such cases, true concurrency is rare. Usually, after investigation it can be established that one delay occurred after the other. Or, for example, only one delay was affecting the critical path and the other delay was using up only available float, so that the non-critical delay is not delaying completion of the project.

Therefore, before the question of concurrency arises at all, it must be established that there are two competing causes of delay operating at the same time and affecting the critical path or paths of the project.

Complications are introduced when, for example, one delaying event is soon followed by another during the delay caused by the first event itself, and it may be unclear as to whether the second event was triggered by the first; or if the contractor's obligation to mitigate delays has to be reassessed.

Worked examples

The project is a new school, consisting of two blocks, a classroom block and a science block. Figure 19.1 shows the planned programme for the project.

Assuming that the criteria for concurrency have been satisfied and assuming further that there are the same two causes in each case; one the fault of the contractor, i.e. equipment breakdown; the other the fault of the employer, i.e. an architect's instruction, then there are three likely scenarios.

Scenario one

This scenario looks at entitlement to an extension of time as a consequence of a relevant event, followed shortly by a contractor-responsible delay; the effect of both delays acting independently but concurrently.

Ten weeks after commencement of the project, the following event occurs (see Figure 19.2):

> *The contractor is due to start facing brickwork to the classroom block on Monday morning (start of week 11) when on the Friday before he receives an Architect's Instruction to change the colour of the facing bricks from red to blue. He orders the new blue facing bricks immediately, but they are on 4 weeks delivery and will not arrive until the end of week 14, which means that the start of facing brickwork will be delayed until the beginning of week 15. This will cause a delay of 4 weeks to the progress of the works and this delay will cause a likely delay of 4 weeks to the date for Completion.*

Shortly afterwards a further event occurs.

> *The contractor is due to start erecting precast floor units to the science block at the start of week 13. Therefore, he carries out preparatory work and organises his labour and lifting crane ready to commence*

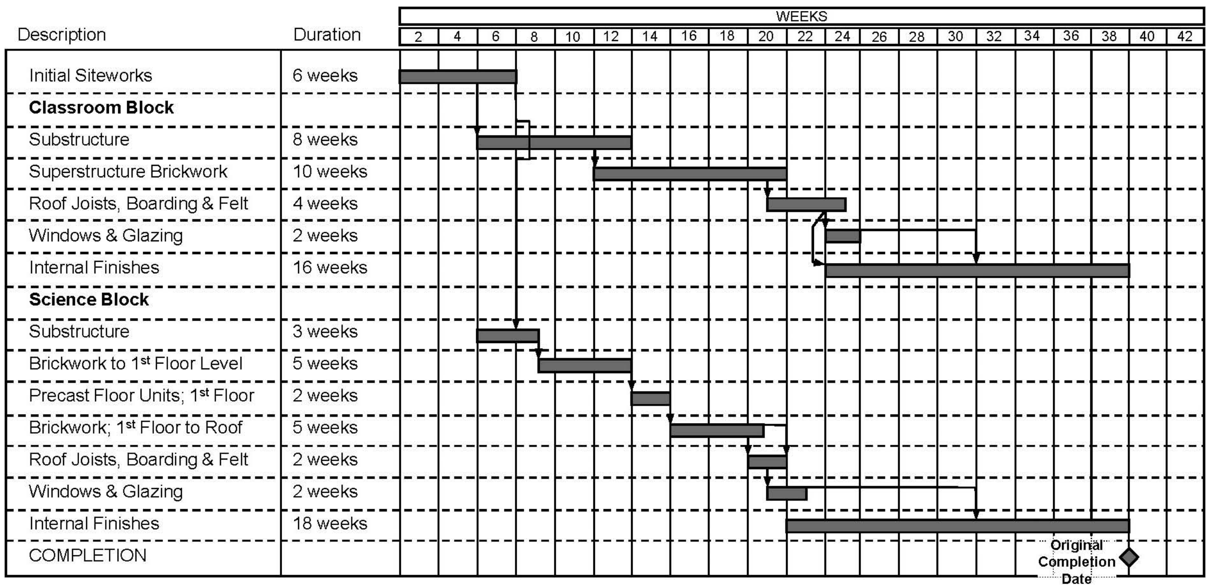


Figure 19.1 Planned programme.

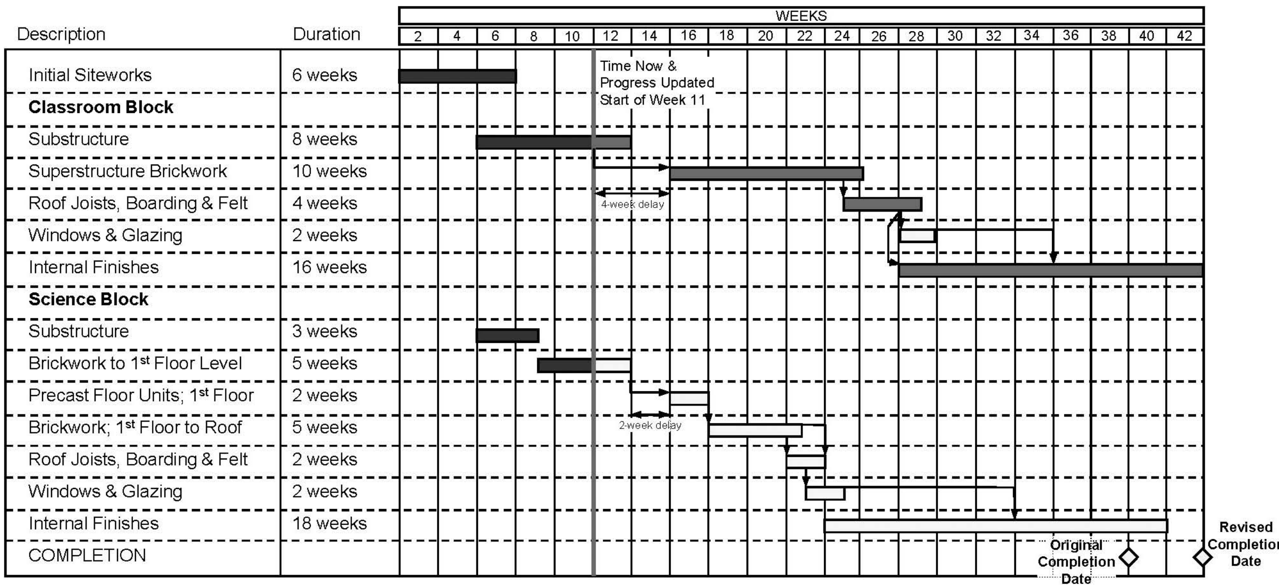


Figure 19.2 As-built situation: as at start of week 11.

Notes

1 4-week delay to progress due to late delivery of changed facing bricks

2 2-week delay to progress due to contractor's craneage breakdown

Extension of Time Entitlement: 4 weeks

> *lifting the precast units at the start of week 13. On the Monday morning of week 13, his crane breaks down at the start of this operation and it will take 2 weeks to obtain the necessary replacement parts and carry out the repairs. He therefore re-schedules the installation of the precast floor units to start at the beginning of week 15. This will cause a delay of 2 weeks to the progress of the works and this delay will cause a likely delay of 2 weeks to the original date for completion.*

However, while the crane breakdown was delaying progress on the science block it had no effect on the forecast date for completion, because this was already being delayed by the architect's instruction revising the facing bricks for the classroom block.

Therefore, in scenario one, the contractor is entitled to a four-week extension of time to the date for completion as a consequence of the instruction to change the facing bricks, which should not be reduced because of his own culpable delay of mechanical breakdown.

However, for prolongation costs/loss and expense, the contractor's two-week concurrent culpable delay should be taken into account.

Scenario two

This scenario looks at entitlement to an extension of time as a consequence of a relevant event, when a contractor-responsible delay occurs at the same time; the effect of both delays acting independently but concurrently.

Using the same events as for scenario one, except that in the early part of week 11 the facing brick manufacturer receives an order cancellation from another contractor and is able to deliver the new blue facing bricks at the end of week 11. We now have the following situation:

1 The new blue facing bricks are delivered to site at the end of week 11 and facing brickwork to the classroom block starts at the beginning of week 12. This causes a delay of one week to the progress of the works and this delay will cause a likely delay of one week to the date for completion.
2 The situation on the new science block is still the same as for scenario one. At the beginning of week 13, the contractor was due to start erecting precast floor units to the science block. His crane breaks down at the start of this operation and it will take two weeks to obtain the necessary replacement parts and carry out the repairs. He therefore reschedules the installation of the precast floor units to start at the beginning of week 15. This will cause a delay of two weeks to the progress of the works and as the science block is on the second critical path, this delay will cause a likely delay of two weeks to the date for completion.

Figure 19.3 below shows the situation for scenario two.

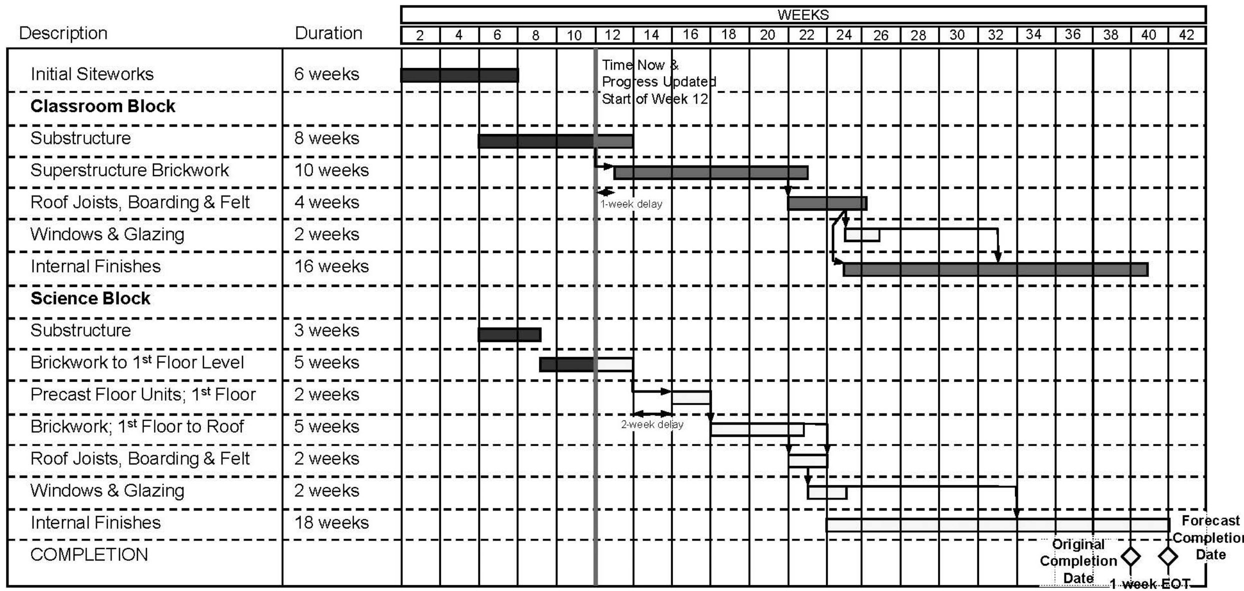


Figure 19.3 As-built situation: as at start of week 12.

Notes
1 1-week delay to progress due to late delivery of changed facing bricks
2 2-week delay to progress due to contractor's craneage breakdown
Extension of Time Entitlement: 1 week

Therefore, in scenario two, the contractor is entitled to a one-week extension of time to the date for completion as a consequence of the instruction to change the facing bricks, which should not be negated because of his own culpable delay of mechanical breakdown.

However, for prolongation costs/loss and expense, the contractor's two-week concurrent culpable delay should be taken into account.

Scenario three

This scenario looks at entitlement to an extension of time as a consequence of a relevant event, when a contractor-responsible delay has occurred just prior to the relevant event; and the effect of both delays are acting independently but concurrently.

Using the same events as for scenario one, except that the facing brick manufacturer can commence delivery immediately of the new blue facing bricks and brickwork to the classroom block commenced on programme at the start of week 11. However, shortly afterwards, the following situation develops.

1 In the early part of week 16 the facing brick manufacturer has a problem with the quality of the changed blue facing bricks which results in a two-week period where no blue facing bricks are delivered to site. This results in completion of the classroom block brickwork being delayed by two weeks until the end of week 22.
2 Meanwhile, the situation on the new science block is still the same as for scenario one. At the beginning of week 13, the contractor was due to start erecting precast floor units to the science block. His crane breaks down at the start of this operation and it will take two weeks to obtain the necessary replacement parts and carry out the repairs. He therefore reschedules the installation of the precast floor units to start at the beginning of week 15. This will cause a delay of two weeks to the progress of the works and, as the science block is on the second critical path, this delay will cause a likely delay of two weeks to the date for completion.

Figure 19.4 shows the situation for scenario three.

Therefore, in scenario three, at week 13 there is a delay to 'the progress of the works' as a consequence of the contractor's equipment breakdown on the science block. At the time, this is likely to cause a two-week delay to the current date completion.

A few weeks later, there is a separate delay on the classroom block, as a consequence of a relevant event. As a result there is a delay to the progress of the works on the classroom block only but no likely delay to the date for completion, as the current forecast completion date has not been delayed further.

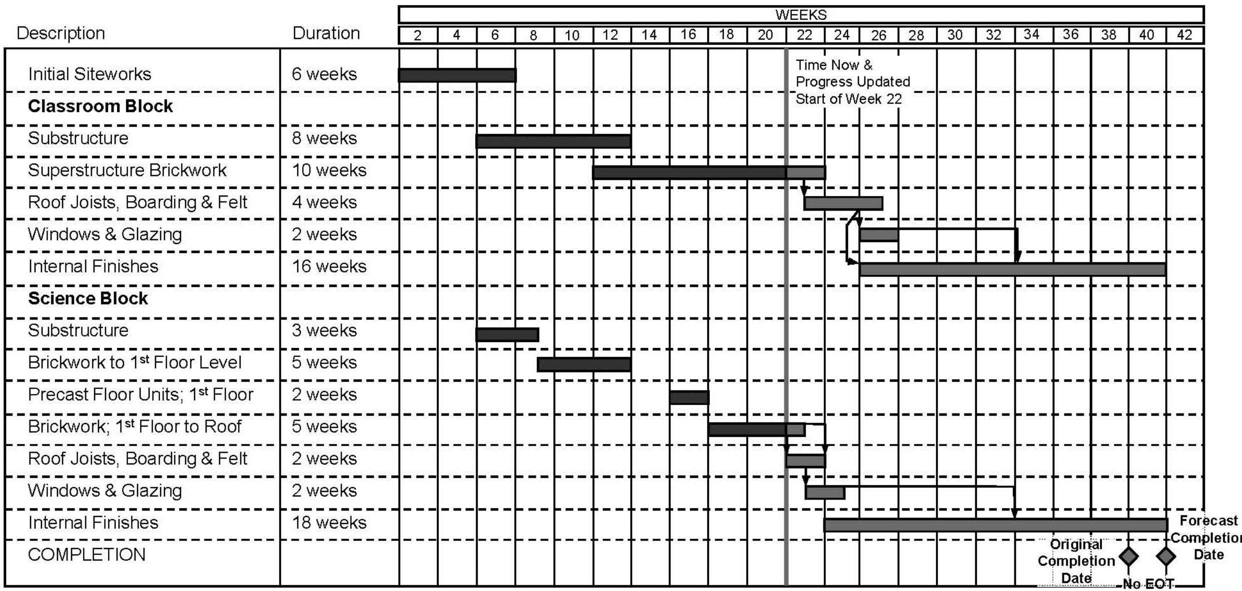


Figure 19.4 As-built situation: as at start of week 22.

Notes
1 2-week delay to progress due to late delivery of changed facing bricks
2 2-week delay to progress due to contractor's craneage breakdown
Extension of Time Entitlement: nil

Therefore, the contractor is not entitled to an extension of time to the date for completion as a consequence of the instruction to change the facing bricks and the resulting delay in delivery of the bricks.

However, an important issue here is that the situation on the science block should be kept under close review for, if the contractor subsequently mitigates his own two-week delay caused by his equipment breakdown, then he will probably be entitled to a two-week extension of time for the relevant event of the changed facing bricks.

For prolongation and time-related costs, unless the circumstances change, as explained above, it is unlikely that the contractor will be reimbursed.

Useful guidelines

Where there are overlapping or concurrent delays, the most popular guidelines are:

1 No extension of time is granted when an employer-responsible delay event is within a non-critical path while a contractor-responsible delay (e.g. poor progress through lack of resources) is on a critical path.
2 An extension of time is awarded when both an employer-responsible delay event and a contractor-responsible delay event occur concurrently on parallel critical paths, on the basis that either delay by itself could have prolonged the project by the same period.

However, where the delays are unequal, or where an employer-responsible delay is followed by a contractor-responsible delay (or vice versa) on the same or parallel critical paths, and it is unclear as to whether the second was triggered by the first, the 'dominant cause' approach could help to allocate liabilities.

Clearly, more explicit guidelines are needed based on sound principles to improve fairness, consistency and certainty in practice, which would in turn lead to better planning and control of potential project risks and less resource wastage on acrimonious disputes where these risks materialise.

20 Mitigation and acceleration

Most forms of contract contain reference to a contractor's obligation to mitigate delays, including the effects of employer-responsible delays.

JCT 2005 contains the following at clause 2.28.6.1:

> *the Contractor shall constantly use his best endeavours to prevent delay in the progress of the Works or any Section, however caused, and to prevent the completion of the Works or Section being delayed or further delayed beyond the relevant Completion Date.*

However, in many instances this leads to conflicting interpretations, for example, as to what extent of 'best endeavours', or mitigation, is required. Beyond a certain level, e.g. if substantially more resources are mobilised, it could be interpreted as 'acceleration' to catch up for delays by others, rather than mere 'mitigation', which could lead to further claims for compensation.

'Acceleration' tends to be bandied about as if it were a term of art with a precise meaning, but this is not the case.

The reasons for acceleration usually fall into one of the following categories:

1. *By agreement or instruction*. By agreement between the parties or, if the contract so provides, on the instruction of the architect.
2. *Unilateral acceleration*. Unilaterally on the initiative of the contractor, often categorised as 'mitigation' by the contractor or as 'using best endeavours' by the employer.
3. *Constructive acceleration*. Constructive acceleration is where the contractor argues that he has no real alternative in the circumstances.

By agreement or instruction

There should be no difficulty in obtaining payment where the architect, in exercise of his powers under a contract, orders acceleration of the work or the employer and the contractor agree acceleration and a claim under the direct loss and expense clause is unnecessary.

However, few standard forms of contract give the architect the power to order the contractor to accelerate.

Unilateral acceleration

This is the situation where a contractor accelerates without any agreement with the employer or instruction from the architect. No pressure has been placed on him by the refusal of an extension of time; indeed in this situation it may be that the contractor is reasonably confident of getting an extension of time. The reason for doing so may be in order to find work for operatives from another site where construction is drawing to a close. The result may be that some time is recovered and an extension of time is not required. In most such cases, the contractor will find it difficult to contend that he was doing other than 'using his best endeavours' to reduce delay.

Constructive acceleration

This is an argument advanced by a contractor and is based on the architect's failure to give an extension of time to which the contractor believes he is entitled. A contractor will put more resources into a project than originally envisaged and then attempt to recover the value on the basis that he was obliged to do so in order to complete on time, because the architect failed to make an extension of time of the contract period. The problem faced by the contractor is that, in the absence of an extension of time, he may have liquidated damages being levied against him. He has a stark choice: he can continue to work as planned and efficiently in the hope that he can later successfully demonstrate that he is entitled to an extension of time and that this will be granted. Alternatively, he can accept, temporarily at least, that he is in default and take steps to mitigate the consequences of this temporary default by putting more resources into the project, and/or reorganising the works, so as to finish by the date for completion.

An important question to be asked before this kind of argument can be entertained is the extent to which pressure is put on the contractor; the contractor's problem is one of causation. Where the architect fails to make an extension of time, either at all or of sufficient length, the contractor's route under the contract is adjudication or arbitration. If, as a matter of fact and law, the contractor is entitled to an extension of time, it may be said that he can confidently continue the work, without increasing resources, secure in the knowledge that he will be able to recover his prolongation loss and/or expense and any liquidated damages wrongfully deducted, at adjudication or arbitration. If he increases his resources, that is not a direct result of the architect's breach, but of the contractor's decision.

In practice, it must be acknowledged that a contractor in this position may not be entirely confident; the facts may be complex and the liquidated damages high. Faith in the wisdom of an adjudicator or arbitrator may not be total. It may be cheaper, even without recovering acceleration costs, for the contractor to accelerate rather than face liquidated damages with no guarantee that an extension of time will ultimately be made. As a matter of plain commercial realism, the contractor may have no other sensible choice than to accelerate and take a chance as to recovery. Unless the contractor can show that the architect has given him no real expectation that the contract period will ever be extended and in those circumstances the amount of liquidated damages would effectively bring about insolvency, this kind of claim has little chance of success.

However, under the Housing Grants, Construction and Regeneration Act, a contractor now has the option to address the uncertainty at an early stage and not wait until after completion of the project. He can refer the architect's/contract administrator's refusal of his extension of time claim to an adjudicator during the course of the contract, rather than to arbitration or litigation after completion.

In the United States, a 'constructive acceleration' doctrine has been established to permit a contractor to claim his acceleration costs. The US doctrine, modified for the British construction scene, comprises a six-stage test:

1 Is there a delay, resulting from a relevant event, that would entitle the contractor to an extension of time?
2 Has the architect/contract administrator been given notice of the delay in accordance with the contract?
3 Has the architect/contract administrator refused or failed to grant an extension of time?
4 Has the architect/contract administrator or employer acted in some manner that can be construed as an instruction to complete by the original or revised date for completion?
5 Has the contractor accelerated its performance?
6 Has the contractor incurred additional costs as a result?

Recovery of acceleration costs

Usually, if it can be shown that the acceleration has been caused by an event for which there should have been compensation, then there is no reason why the costs should not be recoverable as loss and expense and valued in the usual way under the contract. However, if they cannot be so valued, then it is possible that the claim can proceed on a quantum merit basis of the reasonable costs of the accelerated works.

21 Time at large

In the absence of any contractual mechanism for fixing a new date for completion, then no such date can be fixed and the contractor's duty then will be to complete the works within a reasonable time. Provided the contractor has not acted unreasonably or negligently, he will complete within a reasonable time despite a protracted delay due to causes outside his control. In such circumstances, time is said to be 'at large'.

The expression 'time at large' is used to indicate that the contractor believes that there is no enforceable date for completion of the works. Therefore, as there is then no date from which they can be calculated, the employer's right to liquidated damages is annulled. If the contractor's argument succeeds, then his obligation is to complete within a reasonable time. If the argument does not succeed, then the employer may recover his losses as general damages at common law.

Whether time has become at large is a matter for the contract, and the facts and circumstances that are alleged to defeat the application of liquidated damages.

The most common allegation supporting a claim for 'time at large' is that the contract administrator has either failed to grant an extension of time at all, or that the extension of time that has been awarded is very unreasonable.

However, in most standard forms of contract a refusal or unappealing extension of time award by the architect/contract administrator will not set 'time at large'. Under the Housing Grants, Construction and Regeneration Act, a contractor now has the option to refer the architect's/contract administrator's unappealing response to his extension of time claim to an adjudicator during the course of the contract.

All standard forms of contract have clauses permitting an extension of time thereby enabling the architect or contract administrator to fix a new completion date where the employer is responsible for delay to the progress of the works. However, even where a contract contains terms providing for an extension to the contract period, time may yet become 'at large', either because the terms do not properly provide for the delaying event or because the architect/contract administrator has not correctly operated the terms. For example, the JCT 2005 series of contracts list, under clause 28, events giving grounds for extension of time. Because the power of the architect/contract administrator to award an extension of time is restricted to the listed events, there is a danger that the employer may delay the works in a way which does not fall under one of the listed events. In such a case, time would be 'at large'.

Again, with reference to the JCT suite of contracts, where the architect/contract administrator operates the extension of time clause incorrectly, time may become 'at large'. An example would be where the architect was late in issuing drawings or information to the contractor, a fact causing or likely to cause delay to completion of the works, but he failed to give any extension of time.

It is common to find the allegation in a contractor's claim that the employer is not entitled to any liquidated damages and that 'time is at large'. The contractor's position is usually that, for reasons within the employer's control, the contractor was prevented from completing by the date for completion and the date was not properly extended by the contract administrator. The employer can no longer insist upon the completion date, original or revised, and therefore there is no firm date from which liquidated damages can be calculated. Time is then said to be 'at large', as a result of the effect of the 'prevention principle'; a rule of law that 'a man should not be allowed to recover damages for what he himself has caused'.

Determining a reasonable time to complete once time is 'at large'

This is dependent upon the circumstances that led to time becoming at large and, based upon the date when time became at large, the information available from which such a calculation can be made.

There is some case law support for the view that, provided that the contract contained a completion date, or a completion date could be construed from the conduct of the parties, then that is the position from which to commence identifying a reasonable time to complete.

In the case of *Astea* v. *Time Group*, HHJ Seymour considers that the contractor's contract period was the appropriate starting point, by saying that consideration of a reasonable time for performance 'is likely to include taking into account any estimate given by the performing party of how long it would take him to perform…'.

In a further case, *J & J Fee* v. *Express Lift,* there had been correspondence between the parties on the dates of commencement and completion. The last correspondence from the contractor stated that it could see little possibility of improvement on the dates previously given, but suggested that it would try to improve upon it. HHJ Bowsher gave a provisional view (without deciding) that it would be impossible for the contractor to contend that a reasonable time for completion of the works would be any later than the date consistently put forward in contract negotiations.

Determining a reasonable time to complete

Where a contract period is established, it should be possible to take as a baseline the contractor's planned programme for the contract scope and add to this the effect of the employer's delay events or breach. This approach and methodology is known 'as planned impacted'.

Provided the necessary materials are available, a reasonable time to complete can also be calculated by the 'time impact' method. This method is recommended by the Society of Construction Law in their 'Delay and Disruption Protocol'. By taking into account the contractor's culpable delay, if any, and identifying the net effect of the employer-responsible delay events on the contractor's programme, the contractor does not benefit from additional time other than that caused by the employer's delay events or breach.

A further technique, and one that is often used in the absence of a contract period from which to start, is the 'collapsed as-built' method. Provided the materials are available from which to establish an as-built programme, this method uses as the baseline the programme of work that was actually carried out, i.e. the as-built programme for the project. From this programme, the actual periods of time for which the contractor is liable are subtracted from the actual critical path. This shortens the actual critical path and the resultant completion date can be said to be the completion date that reasonably could have been achieved, save for the contractor's culpable delay.

Summary

It is common to see in a contractor's claim the contention that 'time is at large'.

Time being 'at large' does not mean that the contractor has no obligation to complete the work. He has to complete in a 'reasonable time'. What is reasonable depends on the facts and circumstances at the time.

Part V

Extensions of time

22 Introduction

The standard forms of contract set out a number of possible contingencies, the risk of which is to be borne not by the contractor but by the employer. For example, the JCT form, under clause 25, details relevant events which are beyond the control of the contractor. If the occurrence of any of those contingencies occur so as to cause the works to take longer to complete then, because those contingencies are not at the contractor's risk, that much more time must be added to the contract period. Without provisions for more time to be granted, for example for the effect on the contract period for late issue of information, time would become at large. This means that the contractor would have to complete not within the contract period but within a reasonable time, whatever that was determined to be. Furthermore, the employer would not be able to recover liquidated damages for any overrun of the contract period. This is why there are provisions for time to be extended in the event that the contract period is adversely affected by those risks that are borne by the employer.

The amount of time to be added to the contract period for employer-responsible delaying events which have caused delay to the completion date should be calculated logically and methodically by the contract administrator, or architect, and he must form his judgement impartially and objectively. This means that, if it comes to a dispute as to whether a fair and reasonable extension of time has been granted and the contract administrator has determined the period of that extension of time instinctively, intuitively or under the instructions of one of the parties, his decision is likely to be overturned.

Unfortunately, none of the standard forms provide any indication of the sort of information or technique upon which such a logical and methodical appreciation of the factual matrix upon which an extension of time should be calculated.

For example, JCT 1980 requires the contractor to identify any cause of delay or likely delay to progress, and requires the contractor to estimate the effect on the date for completion for each delay event and to provide all the necessary particulars demonstrating how such an effect has been calculated. However, it does not say how, i.e. which EOT assessment technique should be used to demonstrate any such delay to the date for completion.

It is important to recognise that, generally, it is only a delay or likely delay to the progress of the works that the contractor has to notify, but it is the extent, or knock-on effect of such event to the date for completion that the contract administrator has to certify. One of the major difficulties is that the delay in the planned timing of an activity alone gives no clue as to whether it is likely to have an effect on the date for completion. Neither is it of any importance that an activity took longer to achieve than that shown on the contractor's as-planned programme. In the end, the deciding factor to the contract administrator is whether the employer-responsible delay event has adversely affected the date for completion.

Except in the most obvious of circumstances, proving a chain of causation in an environment in which many ongoing activities are being carried out concurrently is by no means a simple exercise. Therefore, even if the contractor provides what is required under the contract, the contract administrator will necessarily have to do an awful amount of work to sort out the wheat from the chaff.

Arising out of its role as an aid to the planning of a project and as a monitor of current performance, it was a short step to the programme being used to provide a quick and simple means for appraising delays and showing entitlement for extensions of time. By the early 1970s the use of computers and project-planning software meant that the critical path method (CPM) was developed as a tool for assessing responsibility in delay and disruption construction disputes.

Since then there has been a proliferation of techniques, which have evolved with increasing sophistication and ingenuity, but most of these suffer from weaknesses in adequately addressing a number of issues relating to the use of CPM for extension of time submissions and delay claims, such as programme float and concurrency.

Delay analysis

'Delay analysis' in respect of a construction dispute is the process in a claim or claim defence that the contractor or employer has to practise in order to be able to:

- establish lines of research and investigation;
- demonstrate the contractor's (or employer's) entitlement to claim (or to reject a claim against it or to counterclaim);
- present the claim (or claim defence) effectively.

The initial research and review stage will help to ascertain whether the delay claim to be pursued involves 'critical' delays or 'non-critical' delays. Critical delays are those that delay the project completion date, whereas non-critical delays are those which affect progress at any given time but which have no ultimate effect upon the completion date of the project.

The next stage is that of investigation, when all the factors relating to the areas of claim made known during the initial research and review stage are analysed. The aim is to establish the specific causes of the delay, in which area or section of the work it took place, and when it began to affect the rate of progress. It is often helpful at this stage to use specific databases to record this information.

Once recorded in a database, these records would then have to be analysed and put into a format that can be used to demonstrate how the particular events led to the delays. After compiling the databases regarding the delay claims, the results may be shown in the form of charts, graphs, histograms, etc.; basically adopting the best format to make the most presentable and convincing argument when presenting the claim.

EOT assessment techniques

Due to the dynamic and often complex nature of a construction project, the simple 'short-cut' method of delay analysis has proved to be inappropriate for anything other than providing a relatively informed feel for what happened. However, this can be useful for the purpose of providing an element of support for positions adopted in the context of normal final account negotiation, but it falls considerably short of the burden of proof in the context of legal proceedings.

Previous experiences of various authors and observations by other investigators indicate the wide spectrum of EOT assessment and analysis approaches/techniques adopted or adapted by various contractors and consultants at different times; but also the lack of consensus on any suitable approach.

A closer examination of the various techniques widely employed for EOT submissions shows that none of the commonly recognised methods allows for the assessment of three important issues at the same time, namely:

1 the progress of the project at the time the event occurred;
2 the changing nature of the critical path at the time the delay occurred;
3 the effects of action taken, or that should have been taken, to minimise likely delays.

It is thus not surprising that the consequential inconsistencies and clashes have fuelled many prolonged disputes on EOT analysis and assessments.

Problems often arise in unravelling 'cause' and 'effect' patterns, given that many EOT causes and entitlement are interrelated and may also be concurrent. Concurrent delays are said to arise when two or more delays occur at the same time or overlap to some degree. Examples of scenarios needing careful consideration and evaluation include those where:

1 a contractor-responsible event on a non-critical path makes a subsequent activity critical and this activity is then subjected to an employer-responsible event;
2 an employer-responsible event is followed by a contractor-responsible event;
3 an employer-responsible event and a contractor-responsible event are concurrent and on parallel critical paths.

The following chapter describes most of the recognised EOT assessment techniques, categorised into the following groups:

A *Impressionistic*. Visually impressive, these are only suitable for simple projects.
B *Simplistic*. These are static models and do not provide the insights into impacts and relationships afforded by critical path analysis methods.
C *Prospective analysis*. These techniques use as-planned programmes and essentially project the likely delay an event will cause.
D *Retrospective analysis*. These techniques use as-built programmes and establish the actual delay an event caused.

However, the critical importance of reliable documentation and records in establishing EOT entitlements cannot be over-emphasised, whichever technique is ultimately adopted.

Extension of time submissions

Major obstacles to prompt settlement of submissions for extensions of time include:

1 The erroneous assumption that an extension of time automatically grants entitlement to monetary compensation.
2 Late, insufficient or total lack of notice of delay or likely delay on the part of the contractor.
3 Failure to maintain contemporary records.
4 Failure to regularly update the programme so that the effects of delay can be monitored.
5 Poor presentation of the claim to show how the progress of the work has been, or is likely to be, impacted.
6 The probability that the cause of delay will reflect on the performance, or lack of it, on the part of the employer's professional team.
7 Pressure, on the part of the employer, to complete the project by the original completion date, irrespective of delays which occur.

The first obstacle, (1) which assumes that delay means money, is understandable. Nevertheless, it should not be a consideration when reviewing and resolving extensions of time. It should be clearly understood that an extension of time merely gives the contractor more time to complete the works and allows the employer to preserve his rights to liquidated damages. An extension of time awarded for a cause of delay which appears to have financial implications does not necessarily lead to additional payment. If the contractor is himself also in delay, then the financial compensation arising out of the extended period to execute the works may, in total or in part, have to be borne by the contractor.

The next three obstacles, (2) notice, (3) contemporary records and (4) programme, are all practical matters which can only be addressed by ensuring that adequate contract administration procedures are followed from the start of the project.

The fifth obstacle concerns presentation of the claim. While the contract administrator must do his best to estimate the length of any extension of time which may be due, irrespective of lack of notice and particulars given by the contractor, contractors cannot complain if the extension made on the basis of inadequate information does not live up to their expectations.

Good practice

It is recommended that for an EOT submission, the contractor should state:

1. the material circumstances giving rise to an extension of time;
2. the event or cause of entitlement;
3. whether the cause is a relevant event under the contract;
4. the delay, or likely delay, to the progress of the works;
5. the likely effect of the event on the completion date of the contract and any contractual sectional completion dates.

Which technique to use sometimes depends on the reason for preparing the delay analysis. For example, a contractor who makes a submission to the employer, or his representative, for an extension of time as part of the final account settlement, may not have the time for an extensive delay analysis and so will lean towards one of the simplistic techniques. Going to the other extreme, if the dispute is in arbitration or litigation, one of the prospective analysis or retrospective analysis techniques should be exploited as the level of sophistication required in these arenas excludes the impressionistic and simplistic techniques.

The claimant is free to choose any format he wishes to present his delay claim but should be aware that the courts have rejected some formats. It may be, however, that the claimant has other reasons for selecting a particular format (e.g. as a negotiating tool or because their client has requested a particular type of presentation). Should the claimant proceed with a claim in a particular format for, say, negotiation purposes and then find that negotiations break down and a dispute ensues, then the claimant may be put to the task (and cost) of reworking the delay claim into a format more acceptable to the court.

Now that the Civil Procedure Rules (CPR) are in place, their objectives and principles should be considered, which basically means that issues of fairness, time and cost effectiveness are important. The Statement of Case (which replaced Pleadings) should clearly set out the case to be answered.

The most detailed claims-programming method is time impact analysis and although not specifically mentioned in the above cases, it requires the application of retrospective analysis techniques (accepted in *McAlpine* v. *McDermott*). However, like other programming methods, its application is dependent on the records available. The purpose and intended use of a delay claim is relevant here in that time impact analysis is not necessarily needed if there is little likelihood that the claim will proceed to litigation/arbitration. Time impact analysis is very detailed and time-consuming and the claimant may wish to proceed with a different technique in appropriate circumstances. As stated in the cases above, the claimant can proceed as he sees fit (subject in legal proceedings to ensuring that the other party knows the case against it).

23 EOT assessment techniques

In the English and Commonwealth jurisdictions there are very few cases setting out guidelines for methodology or techniques that should be adopted when preparing or considering an extension of time submission or claim.

The previous chapter outlined four groups categorising most of the recognised extension of time (EOT) assessment techniques:

A impressionistic;
B simplistic;
C prospective analysis;
D retrospective analysis.

Only the latter two groups, prospective and retrospective analysis, are considered to be dynamic analysis techniques.

To demonstrate and compare the presentations of the various EOT assessment techniques, a standard project has been adopted, namely the construction of a garage. For this project, the as-planned programme consists of ten number activities and is displayed in network format as shown in Figure 23.1.

When presented in the more usual barchart format, the as-planned programme appears as shown in Figure 23.2.

As can be seen, construction of the garage was planned to take 32 working days. However, during the course of construction there were delays, and the final as-built barchart is shown in Figure 23.3. A side-by-side comparison of the as-planned and as-built barcharts can be seen in Figure 23.4.

The planned duration for construction of the garage was 32 days, but the actual duration was 40 days, representing an overrun of eight days. As stated earlier, delays on the project directly caused this overrun.

An initial review shows that delays occurred to the work activities detailed in Figure 23.5.

Taking the garage-construction project as an example, the EOT assessment techniques within each group are described below.

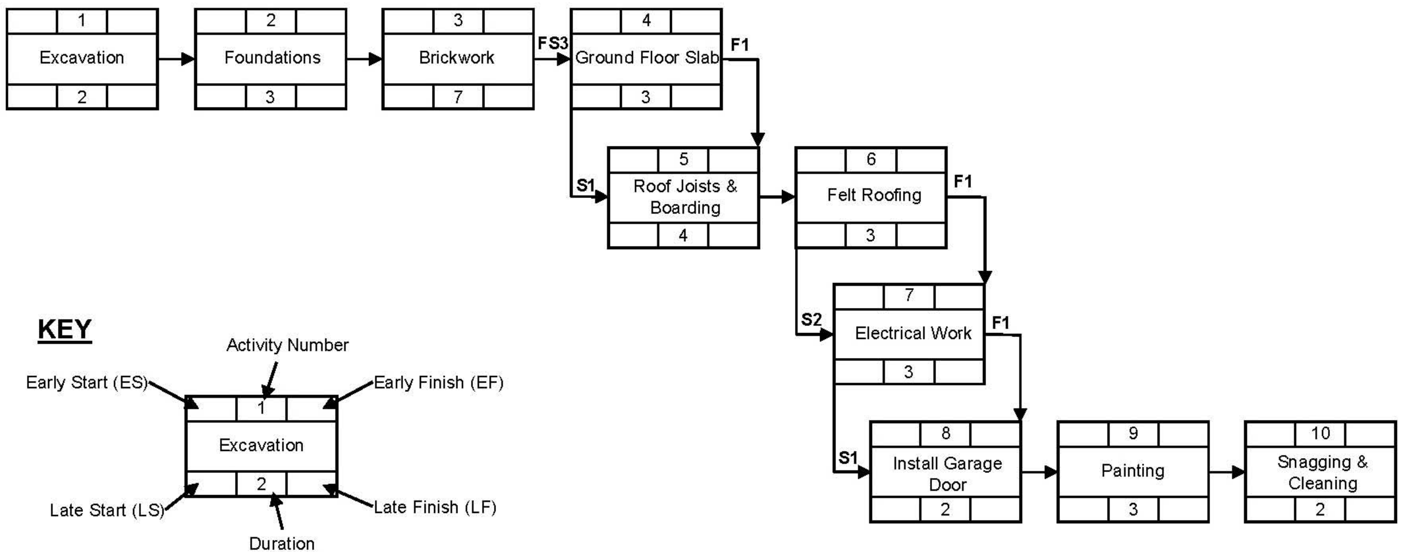


Figure 23.1 As-planned – network format.

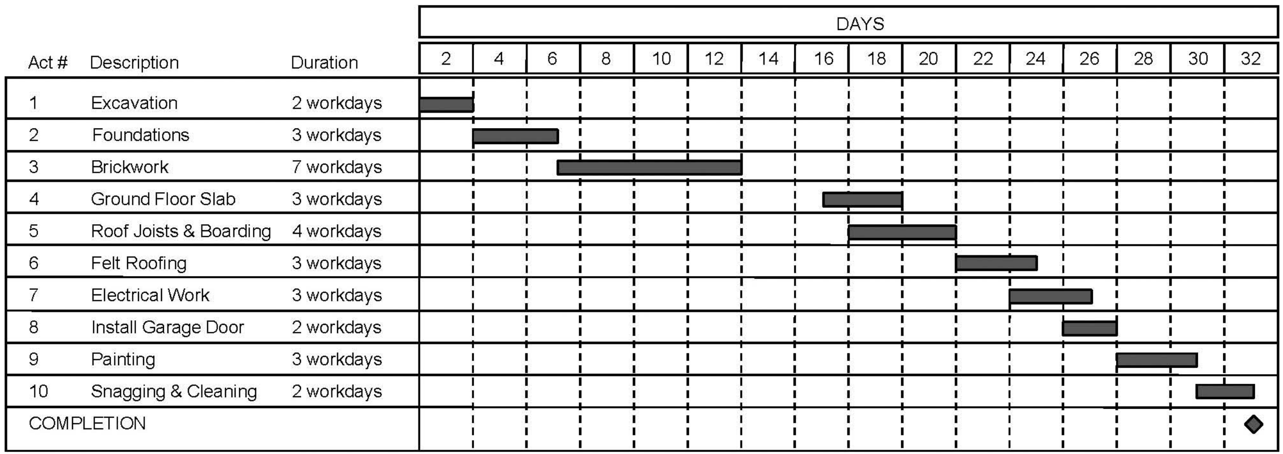


Figure 23.2 As-planned programme.

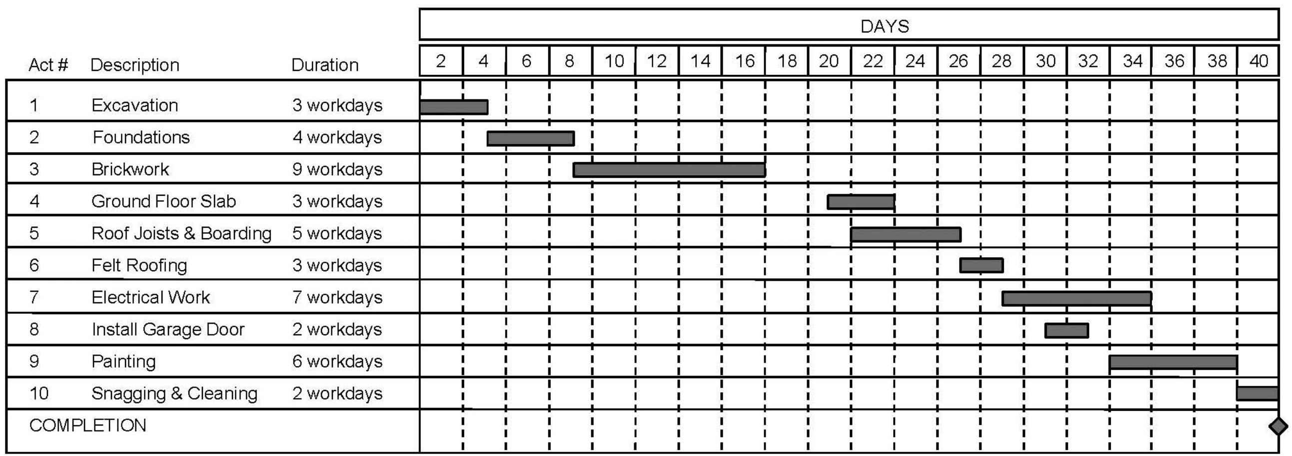


Figure 23.3 As-built programme.

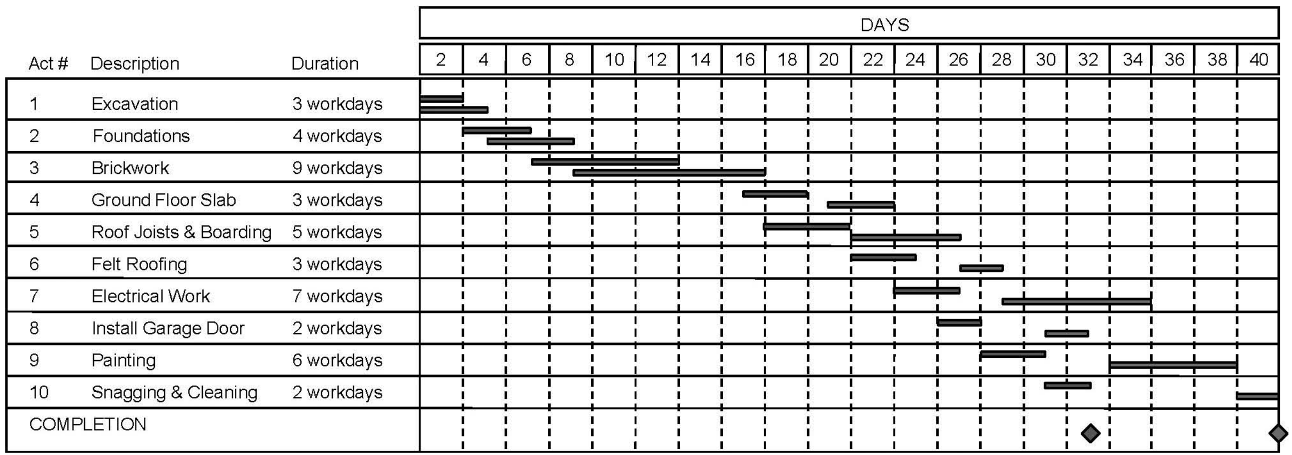


Figure 23.4 As-planned/as-built comparison.

Act.nr.	Description	Duration		Delay responsibility	
		Planned	Actual	Employer	Contractor
1	Excavation	2 workdays	3 workdays		1 workday
2	Foundations	3 workdays	4 workdays	1 workday	
3	Brickwork	7 workdays	9 workdays	2 workdays	
4	Ground Floor Slab	3 workdays	3 workdays		
5	Roof Joists & Boarding	4 workdays	5 workdays	1 workday	
6	Felt Roofing	3 workdays	3 workdays		
7	Electrical Work	3 workdays	7 workdays	4 workdays	
8	Install Garage Door	2 workdays	2 workdays		
9	Painting	3 workdays	6 workdays	3 workdays	
10	Snagging & Cleaning	2 workdays	2 workdays		
			Total	11 workdays	1 workday

Figure 23.5 Initial review showing delays.

A Impressonistic

This group includes the following techniques.

A1 Global impact

The global impact technique is a simplistic way to show the impact of employer-responsible events. All such delays are plotted on a barchart. The delay start and finish dates are determined for each event. The total delay to the project is calculated to be the sum total of all durations of all the individual delaying events. An example of this technique, based on the sample project is shown in Figure 23.6.

In the garage construction project, the planned duration was 32 days and the actual construction was 40 days, an overrun of eight days. The contractor claimed a total of 11 days' extension of time as a consequence of delays which were the responsibility of the employer (see Figure 23.5).

The 'global impact' technique in Figure 23.6 shows on a barchart the as-planned and as-built programmes in summary format, with an additional summary bar representing the total of the delay for which the employer is responsible. The contractor will probably argue that the difference between the 11days' entitlement to an extension of time and the actual project overrun of only eight days was due to his acceleration.

Observations

The 'global impact' technique uses the as-planned programme and therefore assumes the critical path(s) on this programme were constant throughout the project. This leads to delays potentially being deemed as critical when in fact they were not.

There are many other problems with this technique, but the main issues that this technique ignores or disregards, are that

1 it assumes every delay has an impact on the project's date for completion;
2 it does not take into account the effect of concurrent delays.

The above shortcomings can and do lead to a gross overstatement of entitlement due to employer-responsible delays. As in the example, in many cases the entitlement due can exceed the project's actual completion date; the rationale being that the difference between the entitlement completion date and the actual completion date is the amount of time saved by the contractor through his acceleration measures.

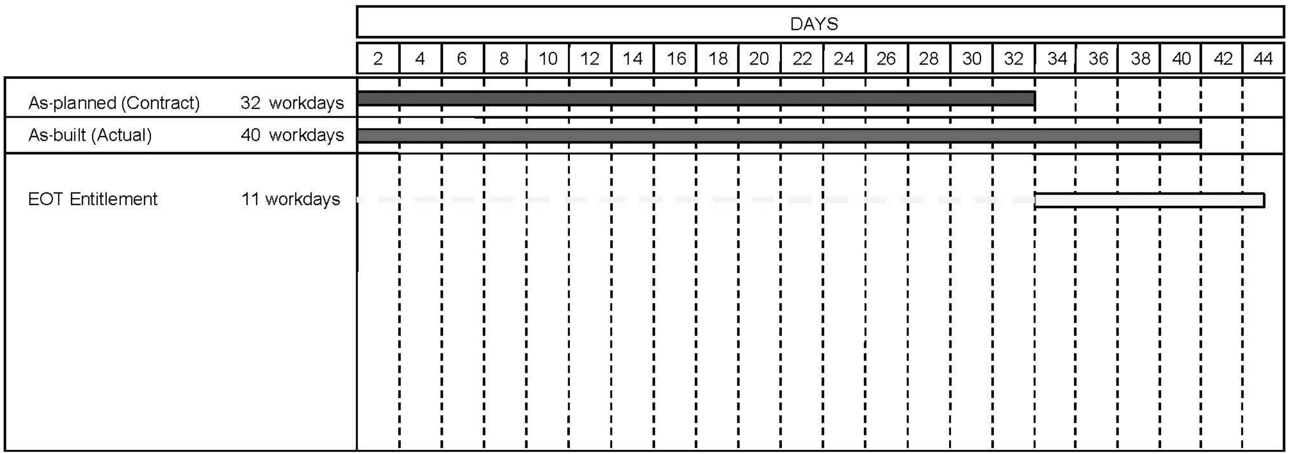


Figure 23.6 Contractor's EOT claim.

A2 Net impact

This technique only depicts the net effect of all employer-responsible delays by plotting these on a barchart. The net effect of all delays is calculated and the overall time extension is taken to be the difference between the contract completion date and the 'net impact' programme completion date.

In the example in Figure 23.7 below, all delaying activities were considered but only the net effect, taking into account the concurrency of the delays, was used. The as-planned and as-built programmes appear in summary format as a single bar, and the 'net impact' bar of all the employer-responsible delays is shown.

The difference between the as-planned and as-built completion dates was eight days; and the 'net impact' bar is showing an extension of time entitlement of nine days.

Observations

As with the 'global impact' method, the 'net impact' technique uses the as-planned programme and therefore assumes the critical path(s) on this programme were constant throughout the project. This leads to delays potentially being deemed as critical when in fact they were not.

Although this method attempts to deal with the issue of concurrent delays, it does not show how concurrency has been established and scrutinised. As a result, the amount of delays having an effect on the project's completion date can be overstated. The 'net impact' technique is neither accurate nor realistic in apportioning liability for critical delays, but may be suitable for quick approximate estimates, perhaps at the outset. The absence of a CPM-based analysis camouflages the true effect of a delay on the overall project completion date.

A3 Scatter diagram

This technique indicates the timing of employer-responsible delaying events during the project. The basis of the diagram is the as-planned barchart, which is annotated with the incidence of employer-responsible events affecting the project, such as variations, instructions and information issues, etc. By supporting the scatter diagram with a narrative and detailed breakdown for each of the events notified, the contractor is able to supply comprehensive information on each event and argue its impact on the progress of the works and the date for completion. Figure 23.8 represents a 'scatter diagram' chart for the garage-construction project.

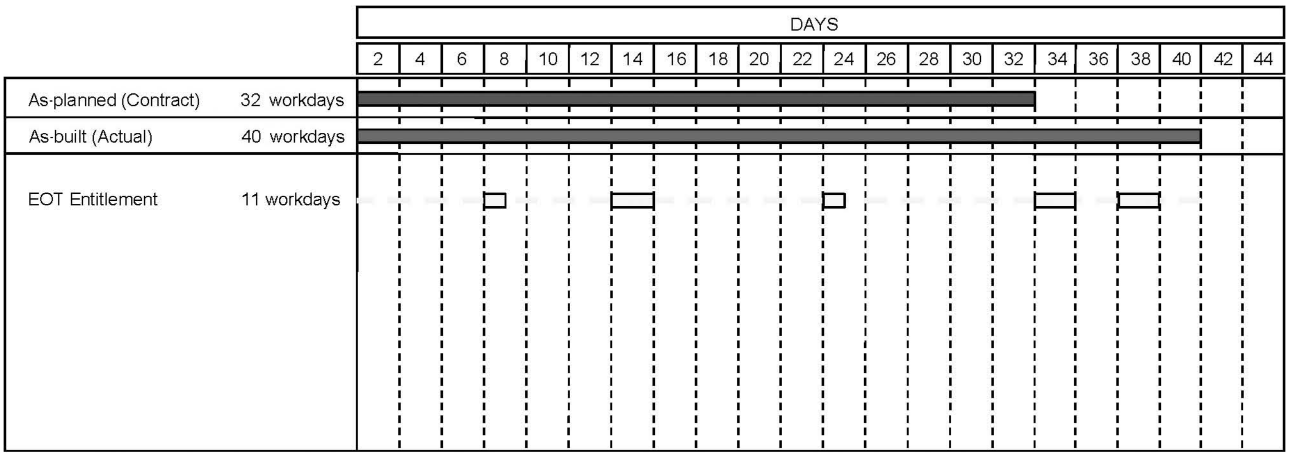


Figure 23.7 Net effect of delays.

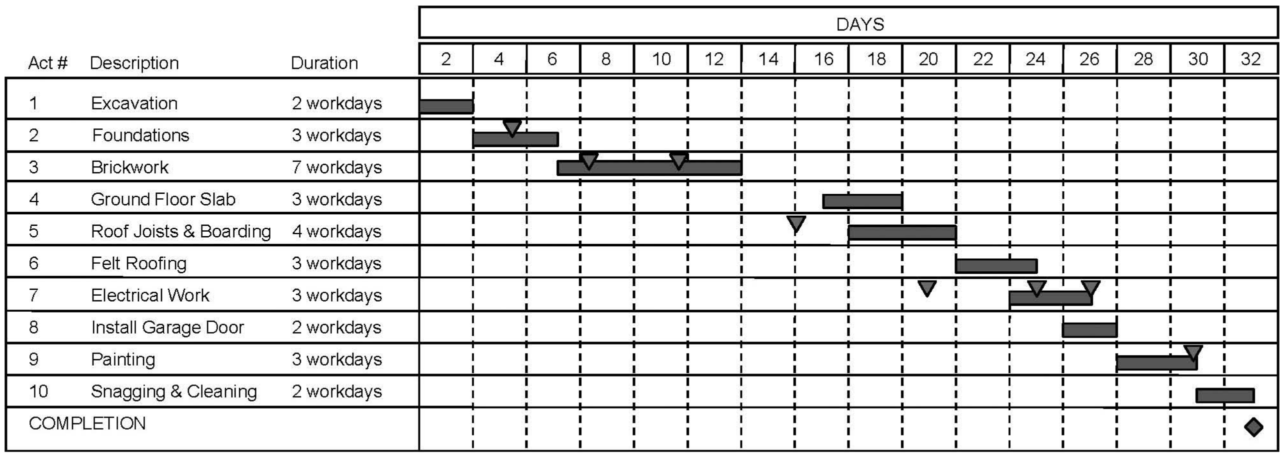


Figure 23.8 Scatter diagram.

Observations

Although a scatter diagram has little evidential value, it has a powerful visual impact in negotiations.

However, with this technique it is impossible to investigate the impact of a single event or combination of events within the overall period of the project.

B Simplistic

This group includes the following techniques.

B1 As-planned impacted (aka baseline adding impacts)

This technique requires the identification and insertion of employer-responsible delays into the original as-planned programme. A schedule of employer-responsible delaying events is produced and each of these is added to the as-planned programme. The resultant scheme is the 'as-planned impacted' programme.

Both programmes should be in network format, i.e. a 'CPM', with the same logic links between activities. A programme time analysis is performed on the 'as-planned impacted' programme and the 'new' date for completion is established.

The difference between the as-planned completion date and the 'new' completion date as shown on the 'as-planned impacted' programme is said to be the EOT entitlement as a result of the employer-responsible delays.

Good practice

The methodology of this technique is as follows:

1 Make a copy of the as-planned programme, and name this the 'as-planned impacted' programme.
2 For each of the employer-responsible delay events, identify the period of time which they would be expected to take on site to carry out, e.g. the addition of suspended ceilings is estimated to take two weeks.
3 Add the new work activity or activities to the 'as-planned impacted' programme, allowing for any off-site time constraints, e.g. procurement of suspended ceilings at four weeks.
4 Make the appropriate relationship logic links from the new activity or activities to the other programme activities, e.g. suspended ceilings to start four weeks after wall plastering commences.
5 Perform a time analysis (recalculate) on the 'as-planned impacted' programme to establish the 'new' date for completion.

Figure 23.9 shows the as-planned programme as at the start of the project. The employer-responsible delay events are then added to the as-planned programme, the CPM re-analysed and the resulting ‘as-planned impacted’ programme constructed as in Figure 23.10.

Observations

The ‘as-planned impacted’ technique has limited applications. It uses a programme prepared by the contractor as at the commencement of the project, i.e. his original intent. The technique is not based on current progress and the contractor’s planned intent as at the time of the employer-responsible event(s). This is an important issue as this technique is not based on the actual progress of the works when the events occurred.

Another important issue here is that whereas the ‘prospective analysis’ and ‘retrospective analysis’ methods are based on actual progress information, the ‘as-planned impacted’ technique does not use or require this information. This means that the impact which is said to have been caused by the delay events analysed may bear scant resemblance to reality.

Furthermore, this technique takes no account of any acceleration or delay on the part of the contractor in calculating the ‘new’ date for completion. Instead it merely looks at the hypothetical effect of the employer-responsible delay events on the contractor’s original planned intent.

Because the results of an ‘as-planned impacted’ analysis rarely bear any relationship to reality, it cannot be used to demonstrate a period of time for which loss and expense might be assessed. The assessment of loss and expense in a period in which delay occurred cannot be properly identified without good evidence of what actually occurred and when it occurred.

On the plus side, the ‘as-planned impacted’ technique is a cheap means of analysis. It tends to work well on smaller projects, and on larger projects where the delay events in question have occurred over limited periods of time.

This method is often misapplied; for example, if the as-planned programme contains invalid logic then the results of the ‘as-planned impacted’ analysis will be meaningless. However, when performed properly, the ‘as-planned impacted’ technique is a valid delay analysis method.

B2 As-built barchart

A barchart is produced showing the actual start, finish and duration of the work activities for the project. It is common for the chart to be an overlay of the as-planned barchart as at the start of the project. In this way it is easy to identify which work activities deviated from the original plan.

Although the ‘as-built barchart’ technique provides a simple visual statement of the difference between what was expected to happen and what actually occurred, it suffers from the absence of explicit logic. In

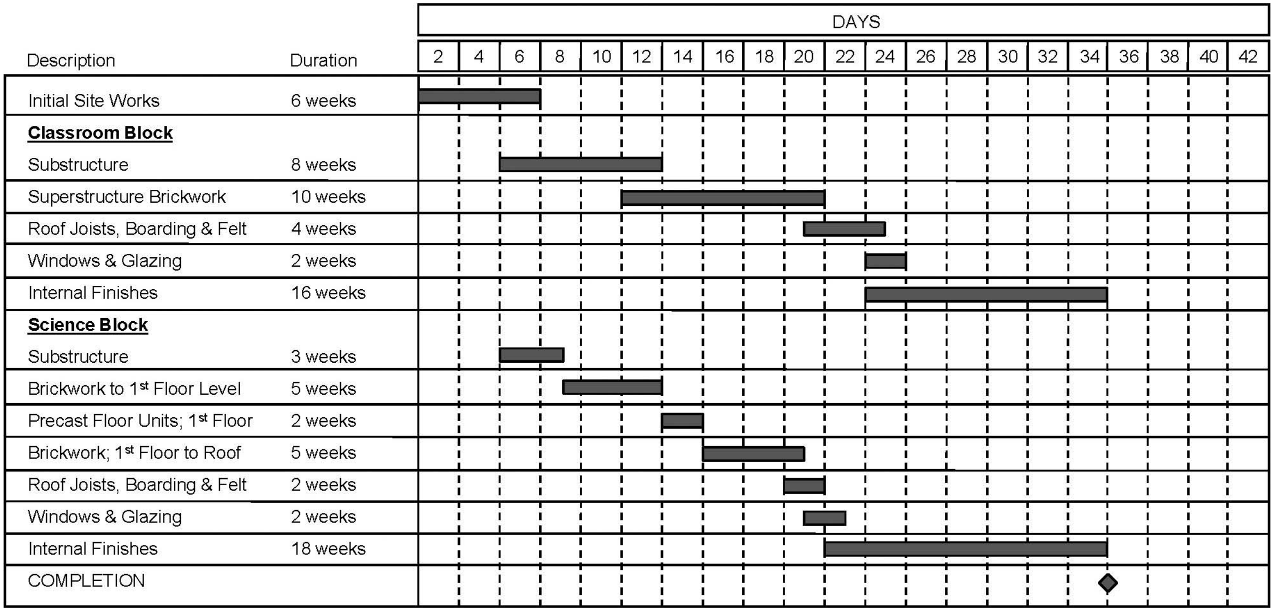


Figure 23.9 As-planned programme.

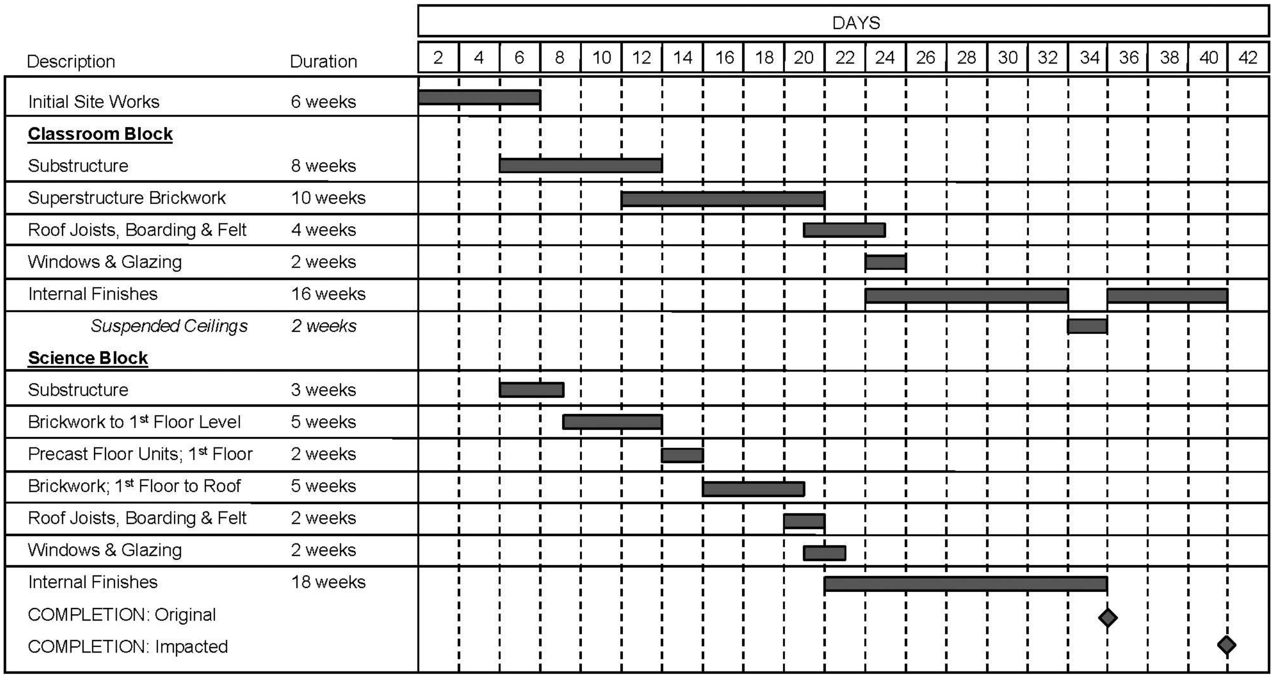


Figure 23.10 As-planned impacted programme.

addition, it does not identify actual events that took place and the delays to the programme and date for completion that resulted. See the example in Figure 23.11.

Observations

The 'as-built barchart' method can be carried out without the need for computerised planning software, although such software is often used to present the results.

The method assumes that the as-built situation arises by reason of changes, late information, etc. for which the contractor is entitled to an extension of time; and not due to its own culpability.

This method also assumes that the planned programme was realistic and that the work was appropriately resourced to enable the plan to be achieved. However, this method is well suited for relatively simple projects where the main delays can be easily identified.

B3 As-built adjusted

This technique uses the CPM format to develop an as-built schedule. Employer-responsible delaying events are included as activities and linked to specific work activities on the 'as-built adjusted' programme. The difference in time between the contract completion date and that shown on the 'as-built adjusted' programme is the extension of time the contractor contends it is entitled to.

Linking all the delay activities to their respective work activities, the programme is then updated. The adjusted completion date and project duration was found to be 36 days. As the original contract period for the project was 32 days, the difference between the contract completion date and the 'as-built adjusted' programme completion date of 36 days is the extension of time claimed by the contractor. See the example in Figure 23.12.

Observations

The main problem with the 'as-built adjusted' technique is that, although it utilises the CPM format, which affords an insight into the interrelationships between activities and delay events, it gives very little supporting detail or analysis. It is not much better than the 'net impact' technique, except that the CPM format creates a more sophisticated impression of an analysis.

Another problem is that contractors invariably tie the employer-responsible delaying events to the critical path. Conversely, contractor-responsible delaying events may be shown, but are more likely to be linked to work activities not on the critical path.

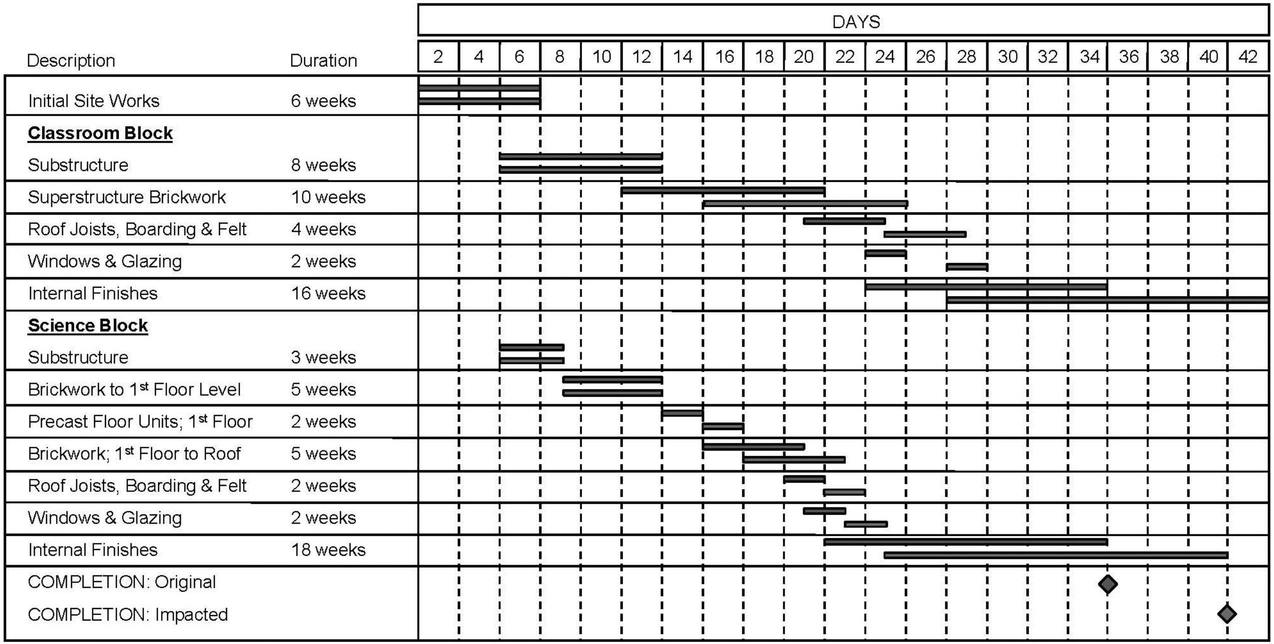


Figure 23.11 As-built programme (also showing the original as-planned programme).

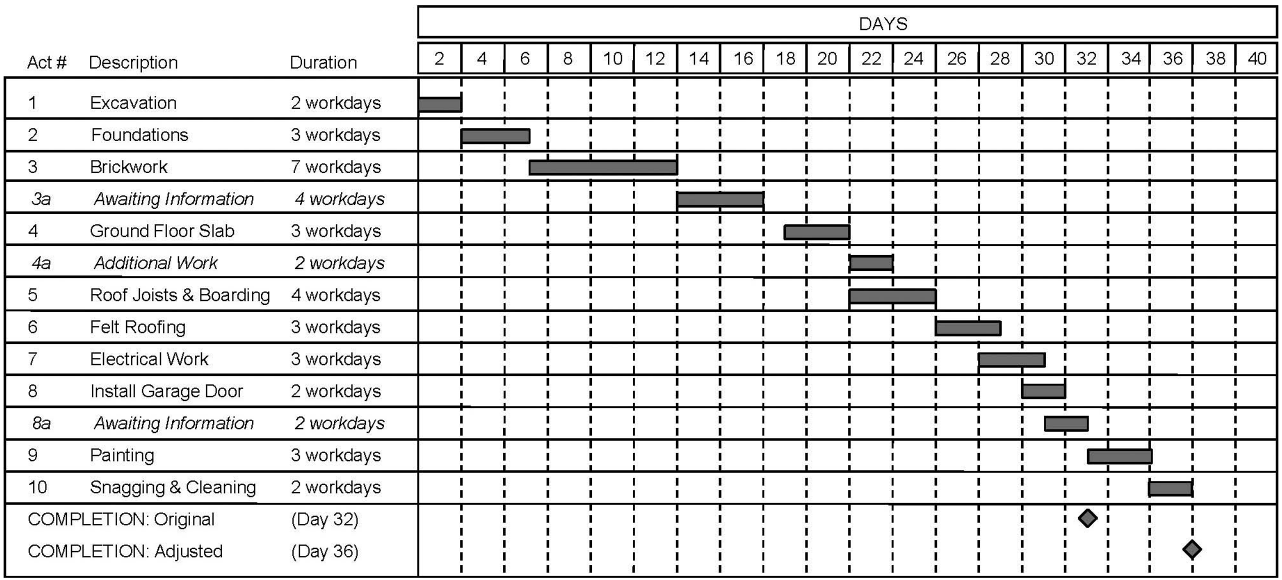


Figure 23.12 As-built adjusted programme.

C Prospective analysis

This group includes the following techniques.

C1 Time impact

This technique examines employer-responsible delaying events and their effects at different times during the progress of the project, i.e. events are analysed contemporaneously with each event being judged on its own merits and information available at that time.

This method takes the contractor's planned programme as the starting point for the analysis. The likely impact of each specific delaying event on the programme is determined at different construction stages, the intention being to obtain a 'stop action picture' of the project before a delay impact. The expected impact of the delay event is then inserted into the programme. The difference between the two project completion dates, i.e. the 'stop action picture' before the delay event is inserted and the one after it has been inserted, is the likely delay to the project and the EOT entitlement as a consequence of the delay event alone. Each delay event is analysed chronologically.

Good practice

The methodology of this technique is that, for each employer-responsible delay event, the following should be done:

1 Update the as-planned programme to show what had actually been achieved by the time of the employer-responsible delay event.
2 Analyse the updated programme that represents the position of the project at the time of the event. The analysed updated programme will forecast whether the project is likely to be completed ahead of, on or behind schedule.
3 Create an impacted programme demonstrating, with supporting descriptions, the duration of new activities flowing from the 'delay event', and their logical interface with the remaining contract works. It is recommended that a subnet be created for this.
4 Add the subnet into the impacted programme and link this to the existing programme activities. Re-analyse the impacted programme.
5 If the project completion date is later than the project completion date on the current updated programme, then there is entitlement to an extension of time.
6 The extent of the EOT is the slippage between either the contract completion date or the completion date shown on the current updated programme and that shown on the impacted programme.

Observations

This prospective method analyses the expected, or likely, effect of the delay event on the completion of the project, and therefore shows a contractor's entitlement to an extension of time.

The main criteria for this technique are a good as-planned programme and reliable progress and as-built data. However, care must be taken to ensure that the planned programme to complete is reasonable and any apparent errors in activity durations and logic are corrected.

A worked example and methodology of time impact analysis is included in chapter 24.

D Retrospective analysis

This group includes the following techniques:

D1 Collapsed as-built (aka 'as-built but for')

This technique applies the 'but for' logic. In simple terms the approach of the 'collapsed as-built' method is to establish the as-built programme, incorporating the planned activities together with activities representing the delaying events by the relevant party, e.g. variations, instructions, issue of information. The consequence of the delaying events is shown by additional work activities.

The activity duration will be the actual duration and the logic links will be so constructed, if technically correct, as to produce the actual start and finish dates for the activities.

The delaying events are then removed, i.e. the programme is collapsed, to produce a programme which in theory shows when the project would have been completed 'but for' the identified delaying events. The difference in project completion dates between that stipulated in the contract and that in the 'collapsed as-built' programme, is the time for which that party is eligible to claim/grant an extension of time from/to the other party. The conclusion thus drawn is that the difference between these dates is the result of delays that were the employer's responsibility.

An example of the 'collapsed as-built' technique is given below. The first chart, Figure 23.13, shows the as-built programme including the discrete delays.

After collapsing the programme, i.e. removing the employer-responsible delays (activity numbers 3a, 4b and 8a) but leaving the contractor-responsible delays (activity numbers 4a and 7a), the collapsed as-built completion date is day 34. As the original contract completion date for the project was day 30 and the actual completion date was day 40, the contractor is entitled to an extension of time of six days as a consequence of employer-responsible delays. See Figure 23.14.

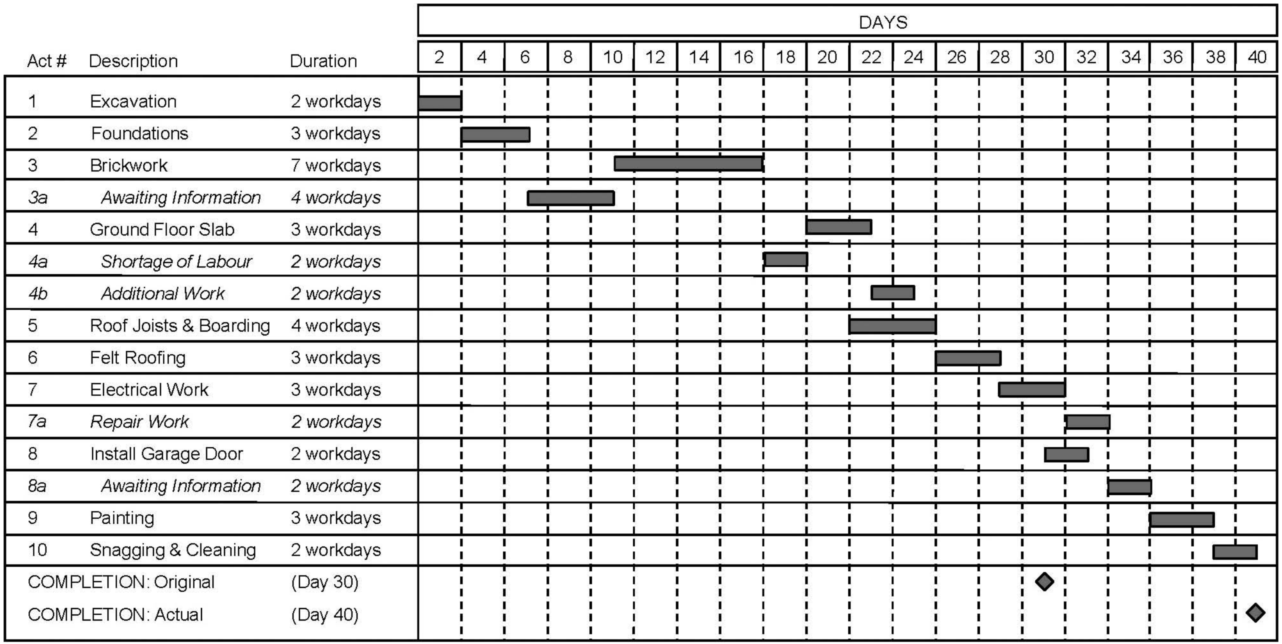


Figure 23.13 As-built programme showing discrete delays.

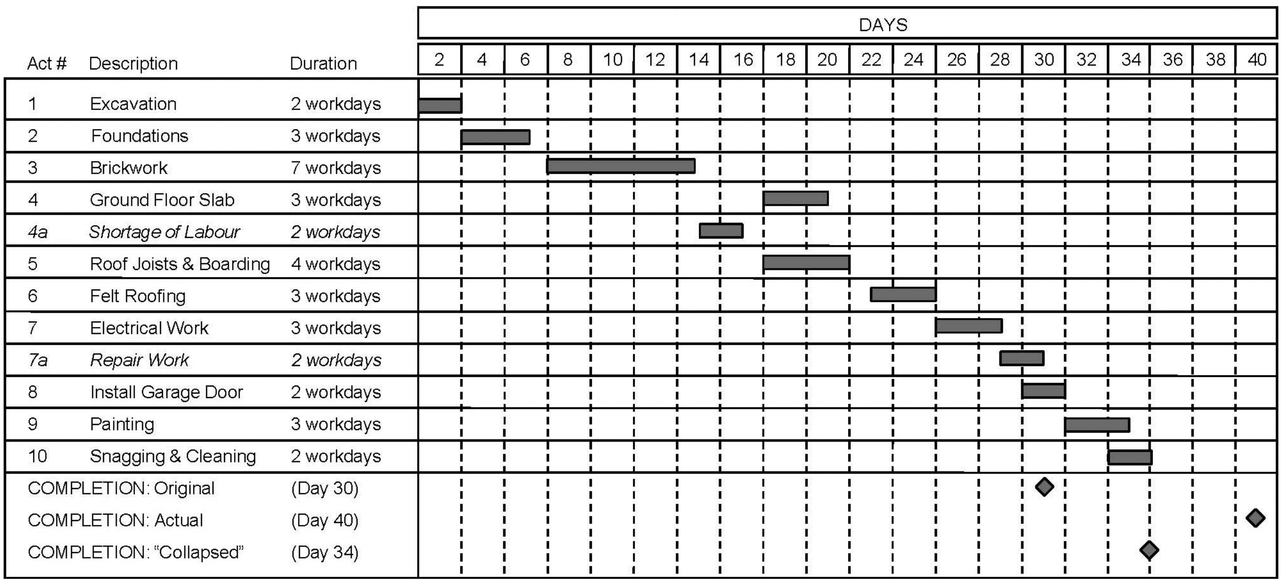


Figure 23.14 Collapsed as-built programme.

Observations

On the face of it the 'collapsed as-built' technique appears accurate and difficult to refute. It uses as-built information and is easy to understand. The production of an as-built network demands considerable time and effort to show a model where both the durations and the logic reflect what actually occurred.

However, supporters of the 'collapsed as-built' technique would argue that the data used is factual and that the analyst interprets the data impartially. This is simply not possible; as with the formulation of the as-built programme, the other stages of the 'collapsed as-built' technique require the analyst to make decisions and form opinions. For example, the analyst must decide matters such as the effect upon productivity of having to move resources more frequently from one activity to another, and that of using inappropriate plant and labour teams on an activity because of resource constraints. These decisions are necessarily subjective and, due to the retrospective nature of the technique, are both theoretical and speculative.

A further important matter is the linking, or relationship, between activities in formulating the as-built programme. These relationships are vitally important because in many cases they will determine the criticality and length of delays. This calls for technical knowledge and experience of the construction process.

A major drawback with this technique is that of 'pacing'. It is not uncommon for a contractor, knowing that he is being delayed by the employer, to take longer on a non-critical activity than he would have done had the delay not occurred. In such a situation, when the employer's delay is collapsed out of the programme, it appears as if the contractor is in default for his late and slow completion of the non-critical activity.

Above all, the 'collapsed as-built' technique requires good and detailed as-built records and contemporaneous information.

Good practice

The following guidelines are recommended:

1. An audit trail should be maintained as to how as-built progress information was determined in formulating the as-built programme.
2. All significant delays should be identified regardless of fault or liability.
3. Where possible, the analyst should identify and model delay activities as discretely identifiable delay periods during the as-built modelling process.
4. The matter of 'pacing' must be addressed by the analyst, by dint of background information and reasoned opinion.

5 For all subjective decisions and opinions, the analyst should record his source information and detail his reasoning.

D2 *Windows (aka 'time slice', or 'snapshot') analysis*

This technique functions to determine the amount of delay that has occurred on a project and when the delay(s) occurred. By identifying the activities that were critically delayed, a more focused investigation as to the causes and responsibility for the delays can take place. The technique is based on as-planned, as-built and revised programmes that have been used during the execution of the project. The basis of the 'windows' technique is that the total life of the project is divided into a number of consecutive time periods, or windows. It is based on the analysis of the effects of delays within each window sequentially. Normally, this is the method adopted in the process of an update of the as-planned programme at monthly project meetings.

The project is updated at the end of each window, i.e. the current progress is recorded against each activity and a time analysis carried out. The 'new' forecast completion date for the project is compared with the forecast completion date for the project as at the start of the window and any slippage between the dates is the delay to the project as a result of delaying events during the window. This procedure is repeated for all windows.

The amount of total delay represents the total extended duration of the project, which should then be investigated for responsibility apportionment between the employer and the contractor.

The 'windows' technique is a systematic and objective method of quantifying the amount of delay incurred in a project on a progressive basis. The accuracy of this technique is a function of the size and number of windows used. It takes into account concurrent delays and considers the effect of delays in the context of time.

Observations

An important aspect of this technique is that it recognises that the critical path of the as-planned programme may, and often does, change during the life of a project. The 'windows' method tracks the actual critical path and the impact on the date for completion. This technique also identifies any contractor mitigation and/or acceleration during the construction of the project.

Only events that affect activities on or near the actual critical path will have an effect on the project completion date. The effect of events is assessed against the critical path of the project at the time the event occurred. This technique also recognises and identifies concurrent delays.

With the project being divided into manageable parts for analysis, i.e.

consecutive 'windows' usually of one-month duration, then the causes and responsibility for the delays highlighted can be reviewed and researched more purposefully.

A worked example and methodology of 'windows analysis' is included in chapter 25.

Good practice

The following guidelines are recommended:

1 The windows should be consecutive commencing at the project start date and ending at date of practical completion of the project.
2 The windows can be weekly, fortnightly or monthly and will generally be defined by the frequency of reports of actual site progress. For example, if progress on a project was recorded monthly as of the last day of each month, then a 'window' would cover the period between 1 January and 31 January, and the next window would cover the period between 1 February and 28 February, and so on up to project completion.
3 It is recommended that the 'baseline programme' established at the start of the project be used for analysis of the first window. However, the programme should be subject to a rigorous 'reliability exercise', and any necessary modifications made, before being used for analysis.
4 If the 'baseline' programme underwent a complete revision, was issued to the contract administrator, and subsequent progress reports were related to the 'revised programme', then this revised programme should replace the original baseline programme for the windows analysis, as and when it became the working programme.
5 If further revised programmes were issued during the life of the project, and became the working programme, then these also should be incorporated into the analysis, replacing the previous programme, again, as and when they became the working programmes.
6 It is recommended that the project's contemporaneous progress reports should be used, where possible, as the basis for the 'progress data' for the analysis.
7 Progress data consist of actual start and finish dates and, where an activity's actual duration spans more than a single window, the percentage progress achieved as at the end of a window.
8 The collected progress data should be reviewed for apparent anomalies, e.g. an activity's reported actual progress achieved reduces in the subsequent window(s); an activity's actual start and finish dates are not consistent with the progress being reported.

24 Prospective analysis

Methodology and worked example

This chapter describes in detail, as a worked example, the 'time impact' method of analysis, as used to demonstrate a contractor's extension of time entitlement.

Project details for the worked example

This technique is applied to the construction of a new science block on a university campus. The contract value was £32 million, the contract start date was 6 August 2002 and the contract period was 87 weeks.

The contractor prepared a detailed programme in CPM format, which was submitted to the employer's project manager at the start of the project. Unfortunately, delays occurred on the project, and practical completion was achieved some 75 weeks late on 8 October 2005.

Detailed methodology used by the contractor for his analysis

The contractor's detailed methodology specifically for the mixed-use development project was as follows:

> ***A: Method of analysis used for this project***
> *The Contract, in respect of Extensions of Time (clause 25), refers to 'the progress of the Works is being or is likely to be delayed', and 'estimate the extent, if any, of the expected delay in the completion of the Works beyond the Completion Date'. Both these statements clearly show that a 'prospective' method of analysis is to be used for the quantification of Extension of Time entitlement for an Employer Risk Event.*
>
> *We consider that the appropriate methodology for a 'prospective' Extension of Time entitlement analysis is the 'Time Impact Analysis' technique, as recommended in the Society of Construction Law's 'Delay and Disruption Protocol'.*
>
> *Furthermore, the Architect in his reviews for Extensions of Time*

has followed the SCL's 'Time Impact Analysis' methodology. In his letter of 'xxx', he states, 'As discussed previously, we have followed the approach of sequentially assessing both "employer risk events" and actual progress, as recommended by the Protocol published by the Construction Law Society.'

Therefore, both the Architect and ourselves are of the same opinion; that for assessment of Extension of Time entitlement, the correct approach is a 'prospective' analysis using the SCL's 'Time Impact Analysis' methodology.

(i) Baseline programme

The starting point is to establish a 'baseline' programme. This should be the Contractor's first meaningful overall programme for the project, and used during the life of the project for monitoring purposes.

The programme should be prepared as a critical path network (more commonly referred to as a 'CPM') using commercially available project planning software. For the programme to be suitable for use as a tool for the analysis and management of change, it must be properly prepared so that when a change occurs, it can accurately predict the affects of that change.

(ii) Events and Subnets

The Employer Risk Events are to be analysed independently and sequentially as they occur chronologically.

A subnet representing the likely consequences of the Employer Risk Event is created. The subnet should be prepared by the Contractor in the same manner and using the same software as used for the 'baseline' programme. It should comprise the activities and durations resulting from the Employer Risk Event.

For example, the subnet for a variation would comprise the instruction for the variation, the activities required to carry out that variation and its linkage to the updated 'baseline' programme.

(iii) Analysis

Immediately prior to the date of the Employer Risk Event, the 'baseline' programme should be updated to reflect the current progress of the project at that time. The updated programme should be 'time-analysed', and the forecast completion date for the project noted.

The subnet representing the Employer Risk Event should be entered into the updated programme. This programme is then time-analysed, and the 'new' forecast completion date for the project is noted.

(iv) EOT Entitlement

The Extension of Time entitlement as a consequence of the Employer

Risk Event is the difference, if any, between the completion dates for the project on (a) the updated programme without the subnet, and (b) the updated programme with the subnet.

B: What information was available and used for the 'Time Impact' analysis

'xxx' submitted their overall programme for the project to the Architect in 'xxx'. This programme is tiled 'Construction Activities', 'Prog. MP01'. The programme is known as 'MP01'.

An important aspect of 'MP01' is the time periods, or 'lead-in', which 'xxx' used for the important work packages in preparing the programme. For example, Windows (activity number 98) has a lead-in period of 18 weeks.

The 'lead-in' period is from placement of order to start on site, and encompasses the subcontractor's off-site work, being detailed design & working drawings, approval, manufacture/fabrication and delivery to site.

A schedule of the subcontractor lead-in periods, as shown in the MP01 programme, is included in appendix 'xxx'.

C: Application of the methodology for this submission

a Outline of the Approach

To follow the methodology of the Society of Construction Law's 'Delay and Disruption Protocol' for Time Impact Analysis, requires the following approach:

- *i Establish a 'Baseline' programme.*
- *ii Establish the As-Built data for all activities on the baseline programme.*
- *iii Investigate and schedule chronologically the 'Events' considered to potentially give an entitlement to an Extension of Time.*
- *iv Create a subnet for each Event.*
- *v Analyse the impact, or likely impact, of the Event on the progress of the works and determine if any delay to progress is likely to cause delay to the Completion Date of the Project.*

Practical completion of the project was achieved on 8 October some 26 months after project commencement on 6 August 2002. For presentation purposes, we have divided the overall time period of the project into 4 number tranches.

The start/finish of each tranche being a key landmark in the project, as follows,

- *i Tranche 1: from start of Project (6 August 2002) to start of Superstructure Work on 24 January 2003.*

ii Tranche 2: from start of Superstructure Work (24 January 2003) to start of Steel Structural Work on 2 July 2003.

iii Tranche 3: from start of Steel Structural Work (2 July 2003) to Building Substantially Watertight on 3 February 2004.

iv Tranche 4: from Building Substantially Watertight (3 February 2004) to start of Practical Completion on 8 October 2005.

b As-Built Data

As the Time Impact Analysis methodology requires a progress update of the 'baseline' programme at the time of each Event, an important aspect is the as-built data for each activity on the MP01 programme.

During the course of the project 'xxx' made various EOT submissions to the Architect. Included in these submissions were as-built data, i.e. actual start & finish dates, for activities on their MP01 programme. We have used this data in establishing an 'As-Built Schedule'.

However, the data shown on the EOT submissions, does not show interim percentage completions for activities that spanned several months. For this information we have relied upon 'xxx's' progress updates which were carried out at approximately monthly intervals, and in most cases presented at the regular monthly site meetings.

A schedule of the As-Built data we have established, and used in the extension of time analysis, is included in appendix xx.

c The 'Events'

A thorough technical investigation of the project's contemporaneous records has been carried out to identify those events which possibly give entitlement to an extension of time.

The results of this exercise are contained within 5 number ring binders accompanying this submission, which include supporting information for each of these possible events.

Following this initial exercise, a subsequent exercise was carried out which involved a review of the possible events by those closely involved with the project to ascertain which of the 'possible events' should now be considered as potential 'Events' for the extension of time analysis.

This rationalisation exercise required the input of those closely involved during the construction of the project to avoid the inclusion of spurious events which may have no factual or likely impact basis.

After this second exercise, the list of 'Events' is now some 762 number; and these are the potential events that were analysed individually for delay, or likely delay, to progress.

The 'Schedule of 762 Events' is included in appendix xx.

A brief explanation of the columns and their 'headings' on this schedule is given below,

i *Col. 1, 'Event ref.nr.'; this is the unique reference number of the Event.*
ii *Col. 2, 'Event date'; the date of the Event, i.e. the date of occurrence of the Employer's Risk Event.*
iii *Col. 3, 'xxx ref.'; the unique reference number of the supporting factual and technical information contained in the technical files.*
iv *Col. 4, 'Description'; a brief description of the Event.*
v *Col. 5, 'Document reference'; a note of the technical reference document for the Event, e.g. RFI, drawing number, etc.*
vi *Col. 6, 'Programme act.nr. Affected: MP01'; the programme activity number on programme 'MP01', which was directly affected by the Event.*
vii *Cols. 7 & 8, 'Clause 25 sub-clause ref.'; an indication of the specific sub-clause(s) of clause 25 for the specific Event.*

d The Subnets for each Event
For each Event we have created a subnet. The subnet illustrates the work flowing from the Event.

For example, on receipt of a revised drawing it may be necessary to procure some materials, such as ventilation ductwork. There will be an activity shown on the subnet 'Procurement of ductwork (xx weeks)'. This will then be linked to the MP01 programme activity(s) that the materials are required for.

Similarly, where Events necessitate the design/approval/manufacture of materials, then the 'lead-in' periods for the major sub-contract packages as defined in 'xxx's' original MP01 programme are used.

Full details for each subnet for each Category 1 Event are included in appendix xx.

e 'Time Impact Analysis' Methodology as detailed in the SCL Protocol
The SCL Protocol's guidance and methodology for Time Impact Analysis is set down in three steps in section 3.2.7.

First, 'the Programme should be brought fully up to date (as to progress and the effect of all delays that have occurred up to that date, whether Employer Delays or Contractor Delays) to the point immediately before the occurrence of the Employer Risk Event'.

Second, 'the programme should then be modified to reflect the Contractor's realistic and achievable plans to recover any delays that have occurred, including any changes to the logic of the Programme proposed for that purpose (subject to CA review and acceptance as provided in Guidance Section 2.2.3)'.

Third, 'the sub-network representing the Employer Risk Event should then be entered into the programme and the impact on the contract completion dates should be noted'.

f Performing the Extension of Time Analysis

To adhere to this methodology, for each Event we carried out a progress update (of programme MP01) as of the date of the Event. The project was then time-analysed, i.e. statused to determine the new forecast completion date for the project based on the progress achieved to date.

We then inserted the subnet for the Event into the updated progress update of Ren.01. The programme is then time-analysed, or statused, again, and the new forecast completion date for the project determined.

Any slippage in the forecast completion date for the project from the progress update without the subnet and the progress update with the subnet is a consequence of the subnet, i.e. the Event.

The amount of slippage is the Extension of Time entitlement for that Employer Risk Event.

At this point in the submission, the contractor referred to his baseline programme 'MP01' and informed the reviewer that copies of these were included in appendix 'xxx' to the submission.

A copy of the contractor's programme 'MP01', is included in appendix 4A of this book. Appendix 4A contains two charts as follows:

i Chart 4A a shows all the programme activities, sorted by work area.
ii Chart 4A b shows the planned critical path for the project.

As referred to under item 'b' above, 'As-Built Data', the 'time impact analysis' relies on the project's progress to be recorded at the time of each event. Where progress has been reported contemporaneously, e.g. in the contractor's monthly reports, this information should be used, subject to checking for errors. For this submission, the contractor used his contemporaneous progress reports, and these were presented in tabular format in his submission. A copy is given in appendix 4B at the end of this book.

D: Results of the analysis

a Introduction

As explained earlier, our first exercise for this submission was to identify possible events which may on further investigation give entitlement to an extension of time.

Our second exercise, in essence a rationalisation exercise of our first exercise, identified those Events which were to be analyses for entitlement to an Extension of Time under the terms of the Contract; particularly clause 25 which states that, 'If and whenever it becomes reasonably apparent that the progress of the Works is being or is likely to be delayed…'

We also explained, in section A, that 'It is our position that to be *awarded an extension of time under the Contract, there are "four steps" in the process for reviewing each potential event.' The 'four steps' are,*

Step 1; Is the potential event, an Event which under the terms of the Contract between the parties gives entitlement to an extension of time.

Step 2; If so, is the progress of the Works being, or likely to be delayed as a result of the Event.

Step 3; If so, is the 'progress delay' caused by the Event expected to cause delay to the completion of the Works beyond the Completion Date.

Step 4; If so, to what extent is the Event likely to cause delay to the completion of the Works beyond the Completion Date.

In our second exercise; the rationalisation exercise, we satisfied ourselves that the events as listed on the 'Schedule of Events' comply with 'step 1' and do give entitlement to an Extension of Time, subject to the results of steps 2, 3 & 4.

Therefore, to comply with steps 2, 3 & 4, we have carried out an Extension of Time Analysis for each of the 762 events. The approach and methodology of the analysis has been fully explained earlier in this submission.

Our main reasons for selecting the Time Impact Analysis methodology are:

- *i Time Impact Analysis follows the requirements of clause 25 of the Contract.*
- *ii Time Impact Analysis is recommended to be used to determine extension of time entitlement by a recognised organisation, The Society of Construction Law, and they have published guidelines for its use in their 'Delay and Disruption Protocol'.*
- *iii Time Impact Analysis has already been used by the Architect to determine and quantify extension of time entitlements during the project.*

As stated earlier, we have analysed all 762 Events in accordance with the Time Impact Analysis methodology. To assist the Architect, and others, we have classified the results for each Event into one of five categories, to allow those Events which show the greater period of entitlement to be at the heart of this submission.

This will, we hope, considerably assist the Architect, and the Parties, to reach a speedy resolution on this matter.

This also allows us to demonstrate that this is not a global claim. We are not saying, 'all of these 762 events delayed the works to the extent that the project was not complete until 8 October 2005'; we have researched, investigated and analysed each Event individually.

The categories we have used to classify each Event are as follows:

- *Category 5; minimal delay to the progress of the works, but no likely delay to Completion of the Works beyond the Completion Date.*
- *Category 4; delay to work/activities in progress, but no likely delay to Completion of the Works beyond the Completion Date.*
- *Category 3; likely delay to future work/activities, but no likely delay to Completion of the Works beyond the Completion Date.*
- *Category 2; delay or likely delay to the progress of the works, and likely delay to Completion of the Works beyond the Completion Date.*
- *Category 1; delay or likely delay to the progress of the works, and likely delay to Completion of the Works beyond the Completion Date. Furthermore, the likely delay to Completion of the Works provides a revised Completion Date later than the previous extended Completion Date.*

As stated earlier, whilst category 1 and 2 Events are at the heart of this submission, Events classified as categories 3 to 5 are being further investigated and we reserve the right to re-classify these Events if necessary. Similarly, our initial exercise identified other possible Events which may give entitlement to extensions of time; but these are not being pursued in this submission. However, again, we reserve the right to submit these Events if, after further investigation, we consider they give entitlement to extensions of time.

We now give a synopsis of the Extension of Time Analysis for each Tranche.

b Synopsis of EOT Analysis: Tranche 1

Tranche 1 covers the time period from the Start of the Project to Start of Superstructure Work on 24 January 2003.

For Tranche 1 we have analysed some 110 number Events. The analysis results show the following:

a 11 number category 1 Events.
b 42 number category 2 Events.
c 57 number category 3, 4 or 5 Events.

The 11 number category 1 Events in chronological order, are:

1 *Event T1–008 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). 4 workdays EOT entitlement, revising the Date for Completion to 8 May 2004.*
2 *Event T1–011 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 5 workdays EOT entitlement, further revising the Date for Completion to 15 May 2004.*

3 *Event T1–017 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 4 workdays EOT entitlement, further revising the Date for Completion to 21 May 2004.*
4 *Event T1–031 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 2 workdays EOT entitlement, further revising the Date for Completion to 23 May 2004.*
5 *Event T1–038 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 2 workdays EOT entitlement, further revising the Date for Completion to 28 May 2004.*
6 *Event T1–040 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 3 workdays EOT entitlement, further revising the Date for Completion to 2 June 2004.*
7 *Event T1–042 Internal Works: Internal Walls (clause 25.4.5 & 25.4.6). An additional 4 workdays EOT entitlement, further revising the Date for Completion to 6 June 2004.*
8 *Event T1–109 Substructure: Basement (clause 25.4.6). An additional 11 workdays EOT entitlement, further revising the Date for Completion to 23 June 2004.*
9 *Event T1–127 Envelope: Stonework (clause 25.4.6). An additional 2 workdays EOT entitlement, further revising the Date for Completion to 25 June 2004.*
10 *Event T1–129 Envelope: Stonework (clause 25.4.5 & 25.4.6). An additional 1 workday EOT entitlement, further revising the Date for Completion to 26 June 2004.*
11 *Event T1–142 Envelope: Stonework (clause 25.4.5 & 25.4.6). An additional 3 workdays EOT entitlement, further revising the Date for Completion to 1 July 2004.*

The 42 number category 2 Events, also arranged by programme work area, are:

<u>Substructure</u> (18 number in total)
i ‘Piling’ 1 number
ii ‘Substructure’ 8 number
iii ‘Basement’ 7 number
iv ‘RC Retaining Walls’ 2 number

<u>Frame/Upper Floors</u> (6 number in total)
i ‘Level 0–1’ 3 number
ii ‘Level 1–2’ 2 number
iii ‘Level 2–3’ 1 number

<u>Envelope</u> (15 number in total)
i ‘Roof’ 3 number
ii ‘Windposts’ 2 number

iii 'Glazing/Louvres' 1 number
iv 'Brick/Blockwork' 2 number
v 'Stonework' 7 number

<u>Internal Works</u> (2 number in total)
i 'Internal Walls' 2 number

In summary, at the end of Tranche 1, there is an overall Extension of Time entitlement of 41 workdays, or 8 weeks and 3 calendar days; which revises the Date for Completion to 1 July 2003.

It is noted that the last progress update for this Tranche, on 24 January 2003, shows the project to be 19 workdays in critical delay with the forecast Date for Completion being 30 May 2004.

<u>c Synopsis of EOT Analysis: Tranche 2</u>
Tranche 2 covers the time period from the Start of Superstructure Work (24 January 2003) to Start of Steel Structural Work on 2 July 2003.

For Tranche 2 we have analysed some 182 number Events. The analysis results show the following:

a 14 number category 1 Events.
b 62 number category 2 Events.
c 106 number category 3, 4 or 5 Events.

The 14 number category 1 Events in chronological order, are:

1. *Event T2–025 Envelope: Stonework (clause 25.4.5 & 25.4.6). An additional 3 workdays EOT entitlement, revising the Date for Completion to 4 July 2004.*
2. *Event T2–029 Envelope: Stonework (clause 25.4.5 & 25.4.6). An additional 1 workday EOT entitlement, further revising the Date for Completion to 7 July 2004.*
3. *Event T2–031 Envelope: Stonework (clause 25.4.5 & 25.4.6). An additional 1 workday EOT entitlement, further revising the Date for Completion to 8 July 2004.*

And so on, down to the last category 1 Event in Tranche 2,

14. *Event T2–276 Envelope: Stonework (clause 25.4.6). An additional 7 workdays EOT entitlement, further revising the Date for Completion to 16 October 2004.*

The 62 number category 2 Events, also arranged by programme work area, are,

<u>Substructure</u> (6 number in total)
i ‘Substructure’ 1 number
ii ‘Basement’ 2 number
iii ‘RC Retaining Walls’ 3 number

<u>Frame/Upper Floors</u> (16 number in total)
i ‘Level 0–1’ 3 number
ii ‘Level 1–2’ 5 number
iii ‘Level 2–3’ 4 number
iv ‘Level 3–4’ 4 number

<u>Envelope</u> (32 number in total)
i ‘Roof’ 8 number
ii ‘Windposts’ 9 number
iii ‘Brick/Blockwork’ 2 number
iv ‘Stonework’ 10 number
v ‘Glazing/Louvres’ 3 number

<u>Internal Works</u> (5 number in total)
i ‘Internal Walls’ 2 number
ii ‘Ceilings’ 3 number

<u>M & E Services</u> (3 number in total)
i ‘Mechanical’ 2 number
ii ‘Electrical’ 1 number

In summary, at the end of Tranche 2, there is an additional 75 workdays, or 15 weeks and 2 calendar days, Extension of Time entitlement. This brings the overall Extension of Time entitlement to 116 workdays, or 23 weeks and 5 calendar days; which revises the Date for Completion to 16 October 2004.

It is noted that the last progress update for this Tranche, on 2 July 2002, shows the project to be 44 workdays in critical delay with the forecast Date for Completion being 4 July 2004.

<u>d Synopsis of EOT Analysis: Tranche 3</u>
Tranche 3 covers the time period from the Start of Steel Structural Work (2 July 2003) to Building Substantially Watertight on 3 February 2004.

For Tranche 3 we have analysed some 156 number Events. The analysis results show the following:

a 7 number category 1 Events.
b 63 number category 2 Events.
c 86 number category 3, 4 or 5 Events.

The 7 number category 1 Events in chronological order, are:

1 *Event T3–076 Envelope: Windposts (clause 25.4.6). An additional 1 workday EOT entitlement, revising the Date for Completion to 17 October 2004.*
2 *Event T3–146 Envelope: Steel Roof Works (clause 25.4.6). An additional 13 workdays EOT entitlement, revising the Date for Completion to 5 November 2004.*
3 *Event T3–155 Internal Works: Laboratory Fit-out (clause 25.4.6). An additional 66 workdays EOT entitlement, revising the Date for Completion to 13 February 2005.*

And so on, down to the last category 1 Event in Tranche 3,

7 *Event T3–181 Internal Works: Laboratory Fit-out (clause 25.4.6). An additional 3 workdays EOT entitlement, further revising the Date for Completion to 27 February 2004.*

The 63 number category 2 Events, also arranged by programme work area, are,

Envelope (35 number in total)
i 'Roof' 12 number
ii 'Windposts' 10 number
iii 'Brick/Blockwork' 4 number
iv 'Stonework' 6 number
v 'Glazing/Louvres' 3 number

Internal Works (22 number in total)
i 'Internal Walls' 3 number
ii 'Ceilings' 9 number
iii 'Laboratory Fit-out' 10 number

M & E Services (6 number in total)
i 'Mechanical' 4 number
ii 'Electrical' 2 number

In summary, at the end of Tranche 3, there is an additional 90 workdays, 19 weeks and 1 calendar day, Extension of Time entitlement. This brings the overall Extension of Time entitlement to 206 workdays, or 42 weeks and 6 calendar days; which revises the Date for Completion to 27 February 2005.

It is noted that the last progress update for this Tranche, on 26 January 2004, shows the project to be 140 workdays in critical delay with the forecast Date for Completion being 18 November 2004.

<u>e Synopsis of EOT Analysis: Tranche 4</u>
Tranche 4 covers the time period from Building Substantially Watertight (3 February 2004) to the date of Practical Completion on 8 October 2005.

For Tranche 4 we have analysed some 213 number Events. The analysis results show the following:

a 33 number category 1 Events.
b 72 number category 2 Events.
c 108 number category 3, 4 or 5 Events.

The 33 number category 1 Events in chronological order, are:

1. *Event T4–102 Internal Works: Laboratory Fit-out (clause 25.4.6). An additional 1 workday EOT entitlement, further revising the Date for Completion to 1 March 2005.*
2. *Event T4–132 Internal Works: Laboratory Fit-out (clause 25.4.6). An additional 8 workdays EOT entitlement, further revising the Date for Completion to 11 March 2005.*
3. *Event T4–165 Internal Works: Ceilings (clause 25.4.5 & 25.4.6). An additional 4 workdays EOT entitlement, further revising the Date for Completion to 17 March 2005.*

And so on, down to the last category 1 Event in Tranche 4,

33. *Event T6–091B M & E Services (clause 25.4.5 & 25.4.6). An additional 28 workdays EOT entitlement, revising the Date for Completion to 14 November 2005.*

The 72 number category 2 Events, also arranged by programme work area, are:

<u>Internal Works</u> (50 number in total)
i ‘Internal Walls’ 2 number
ii ‘Wall Finishes’ 1 number
iii ‘Ceilings’ 1 number
iv ‘Laboratory Fit-out’ 46 number

<u>M & E Services</u> (22 number in total)
i ‘Mechanical’ 12 number
ii ‘Electrical’ 10 number

In summary, at the end of Tranche 4, there is an additional 186 workdays, or 2 weeks and 5 calendar days, Extension of Time entitlement. This brings the overall Extension of Time entitlement to 392 *workdays, or 80 weeks; which revises the Date for Completion to 14 November 2005.*

Practical Completion was achieved on 8 October 2005, a delay of 372 workdays, or 74 weeks and 5 calendar days, to the original Contract Completion Date.

f Summary

A total of 762 Events have been analysed for Extension of Time entitlement. These have been analysed individually against the current progress of the project at the time of the Event.

Only those Events that were likely to delay the then current forecast Completion Date for the project are considered to give entitlement to an Extension of Time. These Events are some 304 number in total; and classified in our analysis as either category 1 or 2.

A full schedule of 'Time Impact Analysis Results' is included in appendix xx.

A brief explanation of the columns and their 'headings' on this schedule is given below:

- *i Column 1, 'Event ref.nr.'; this is the unique reference number of the Event.*
- *ii Col. 2, 'Event date'; the date of the Event, i.e. the date of occurrence of the Employer Risk Event.*
- *iii Col. 3, 'Description'; a brief description of the Event.*
- *iv Col. 4, 'Programme MP01 act.nr. Affected'; the programme activity number on programme 'MP01', which was directly affected by the Event.*
- *v Col. 5, 'Forecast completion date Prior to subnet'; this is the forecast completion date of the Project from the progress update as at the date of the Event.*
- *vi Col. 6, 'Forecast completion date After subnet'; after inserting the subnet for the Event into the progress update, this is the forecast completion date of the Project. Any slippage in the Project's completion date from that in column 5 is the likely effect of the Event.*
- *vii Col. 7, 'Extension of Time Entitlement'; the EOT entitlement as a consequence of the Event. The difference between the dates in columns 5 & 6.*
- *viii Col. 8, 'Adjusted Completion Date'; the adjusted, or revised, Completion Date for the Project, taking into account all EOT entitlement to date.*
- *ix Col. 9 to 13, The Event is classified into one of the '5 categories', as explained earlier.*

Appendix xx contains details of the analysis for each of the 65 number category 1 Events.

Included in this appendix for each Event are:

a *Chart A; Progress update at the time of the Event.*
b *Chart B; the progress update with the subnet inserted showing the likely consequences on the progress of the works and the likely delay to the Completion Date of the project.*

As stated earlier, the progress records for the project are an important part of a 'time impact analysis'. For this submission, the contractor used his contemporaneous progress reports which had been presented to the employer and the architect at each monthly site meeting. A tabular report of these progress records was presented in the submission, and a copy of the first few pages is included in appendix 4B at the end of this book.

Appendix 4C contains pages 1 to 5 of the 'full schedule of "Time Impact Analysis Results"', as included in the contractor's submission and referred to earlier in this chapter.

The factual circumstances of four of the category 1 Events for Tranche 1 are explained below, together with the results of their individual analyses.

T1–008 Revisions to stairs 1, 2 and 3

This event is an example of additional works being instructed which did not delay current ongoing progress but did lead to future delay to the works. The work activities affected by the additional works are on the critical path as at the time of the event and there is a likely delay to the completion of the project.

On 27 August 2002, the contractor received revised drawings for three of the four internal stairs. These drawings showed considerable additional works involving reinforced concrete, facing brickwork and blockwork, and stud partitions and joinery works.

An estimate of the additional works was produced and the durations of the work activities on the programme were increased to reflect the new scope of works.

The overall programme was updated with the progress on the project as at 27 August 2002, and the result showed a forecast completion date of 23 April 2004. See chart 4D a, which shows the project's critical path based on progress achieved as at 27 August 2002.

The subnet for this event (T1–008) is then inserted into the progress updated programme and the impact of the event on the progress of the works and any likely delay to completion of the project is calculated. For this event the result showed a new forecast completion date of 4 May 2004; which represents a critical delay of six workdays caused exclusively by this event. See chart 4D b, which shows the project's new critical path based on progress achieved as at 27 August 2002, plus the likely impact from the subnet for Event T1–008.

T1–011 Riser 6 shaftwall changes

This event is another example of additional works being instructed which did not delay current ongoing progress but led to future delay to the works. The significance of this event is that the works affected were not due to be carried out for some ten months, but a close examination of the work activities affected by the additional works shows that they are on the critical path as at the time of the event and that there is a likely delay to the completion of the project.

On 30 August 2002, the contractor received revised drawings showing considerable additional internal stud partitions.

An estimate of the additional work was produced and the duration of the 'stud partition' work activity on the programme was increased to reflect the new scope of works.

The overall programme was updated with the progress on the project as at 30 August 2002, and the result showed a forecast completion date of 27 April 2004. See chart 4D c, which shows the project's critical path based on progress achieved as at 30 August 2002.

The subnet for this event (T1–011) is then inserted into the progress updated programme and the impact of the event on the progress of the works and any likely delay to completion of the project is calculated. For this event the result showed a new forecast completion date of 12 May 2004; which is a critical delay of ten workdays caused exclusively by this event. See chart 4D d, which shows the project's new critical path based on progress achieved as at 30 August 2002, plus the likely impact from the subnet for Event T1–011.

T1–102 Information on foul sump chamber

This event is an example of late information impacting ongoing progress which is on the current critical path and will cause a likely delay to completion of the project.

On 27 November 2002, the contractor received information concerning the ongoing underslab drainage. The information meant that additional materials were required particularly for the deep foul sump chamber. The necessary materials were on three weeks' delivery, and the contractor assessed that 'underslab drainage' works could not be completed until ten workdays after the materials were delivered to site.

The overall programme was updated with the progress on the project as at 27 November 2002, and the result showed a forecast completion date of 19 May 2004. See chart 4D e, which shows the project's critical path based on progress achieved as at 27 November 2002.

The subnet for this event (T1–102) is then inserted into the progress updated programme and the impact of the event on the progress of the works and any likely delay to completion of the project is calculated. For this event the result showed a new forecast completion date of 14 June 2004; which is a critical delay of 17 workdays caused exclusively by this event. See chart 4D f, which shows the project's new critical path based on progress achieved as at 27 November 2002, plus the likely impact from the subnet for Event T1–102.

T1–108 Reconstituted stone changes

This event is an example of changes to the external façade material, i.e. reconstituted stone cladding, which has a long procurement period.

On 4 December 2002, the contractor received revised drawings for the external reconstituted stone cladding. The changes were significant and meant that the supplier would have to carry out new design work and obtain approval, fabricate moulds, cast and cure the stone elements. The overall procurement period for the off-site work being 24 weeks; the supplier re-confirmed this procurement period. Furthermore, the changes resulted in more stone elements to be fixed and the affected activity durations were increased accordingly.

The overall programme was updated with the progress on the project as at 4 December 2002, and the result showed a forecast completion date of 26 May 2004. See chart 4D g, which shows the project's critical path based on progress achieved as at 4 December 2002.

The subnet for this event (T1–108) is then inserted into the progress updated programme and the impact of the event on the progress of the works and any likely delay to completion of the project is calculated. For this event the result showed a new forecast completion date of 18 June 2004; which is a critical delay of 16 workdays caused exclusively by this event. See chart 4D h, which shows the project's new critical path based on progress achieved as at 4 December 2002, plus the likely impact from the subnet for Event T1–108.

Appendix 4D contains the supporting charts for the four category 1 Events in Tranche 1, as explained above.

The next section in the submission document should be a narrative on the delaying events. For each event, there should be:

1 An introductory narrative explaining the 'event' and its importance in the construction process.
2 The contemporaneous factual information related to the event, e.g. requests for information, letters, AIs or other instructions, drawing issues, procurement of materials, labour records. Copies of any documents referred to should be included in the submission.
3 The results of the time impact analysis, essentially in tabular format but with specific graphics if necessary. The extension of time claimed as a consequence of the event should be clearly stated.
4 The contract clause under which the extension of time is claimed.

A fully detailed submission, as described above, will demonstrate the cause and effect, i.e. 'causation', of the extension of time claimed.

25 Retrospective analysis

Methodology and worked example

The 'windows' method of analysis is considered to be the most reliable of the various retrospective analysis techniques. Therefore, this chapter uses a worked example of the 'windows' method to demonstrate a contractor's extension of time entitlement and his subsequent entitlement to time-related costs.

Project details for the worked example

The project chosen for applying this technique to is a mixed-use development, comprising 84 apartments, shops, offices, an arts centre with a theatre and studios. The contract value was £72 million, with a start date of 5 November 2002 and a contract period of 110 weeks.

The contractor prepared a detailed programme in CPM format, which was submitted to the employer's project manager at the start of the project. Subsequently, just prior to completing the structural works and before commencing internal finishing works, a more detailed programme for the remaining works was issued by the contractor.

Unfortunately, delays occurred on the project, and practical completion was achieved some 82 weeks late.

Detailed methodology used by the contractor for his analysis

The contractor based his 'windows' methodology on the 'model specification' (included in appendix 3 of the book).

However, his detailed methodology specifically for the mixed-use development project was as follows.

> ***A: Method of analysis used for this project***
> *The analysis technique we have used for this delay analysis is an adaptation of the as-planned – v – as-built technique.*
>
> *The technique we have used is called the 'windows' method of analysis; and is a recognised and accepted method of analysis for analysing delays on construction and engineering projects.*

Using the project's progress records, we carried out comparisons at numerous intervals during the project. By these comparisons, we identified the actual critical path of the project as the work progressed, and established the chain, or chains, of work activities that caused the completion date of the project to be delayed.

B: Detailed methodology of a 'windows' analysis

The 'windows' method is based on analysis of affects of delays over the life of a project. The project is divided into a series of 'windows'. A 'window' is the period of time between progress updates. For example, if progress on a project was recorded monthly as of the 1st of each month, then a 'window' would cover the period between 1st January & 31st January, and the next window would cover the period between 1st February & 28th February, and so on up to project completion.

Because each 'window' is only a segment of the contract period, the results of each 'window' analysis must be summarised and carried forward to the next window.

For a 'windows' method analysis, the key information necessary is:

- *i* *the contractor's baseline programme. That is, the sequence of work activities and their durations based on his knowledge at the start of the project in order to achieve the contractual completion date for the project; and,*
- *ii* *progress updates at intervals during the period of the project. Ideally these progress updates should be related directly to the contractor's 'baseline' programme.*

C: What information was available and used for the 'windows' analysis

As of end of February 2005, there have been two overall programmes for the project prepared by xxx (the contractor) *and issued to the Employer's project manager. These are:*

- *i* *'01', prepared at the start of the project, and*
- *ii* *'02', prepared at the onset of internal finishing works.*

The contractor recorded progress against these programmes, both internally and in their 'Contractor's Report' submitted monthly to the project manager. Progress was recorded as follows:

- *i* *Against programme '01', from start of the project until 2 November 2003.*
- *ii* *Against programme '02', from 3 November 2003 until end of February 2004 (and still being reported against).*

The 'windows' analysis for this project is therefore divided into two consecutive time periods as follows:

1 *Time Period One: from start of the project until 2 November 2003.*
2 *Time Period Two: from 3 November 2003 to 28 February 2005.*

At the start of each time period, i.e. window, we will explain the information we have used and the preparation steps we took before commencing each analysis. We also list the date span of the 'windows' based on the progress updates.

For each 'window' within each time period, we identify the period of critical delay; give the new forecast project completion date; and identify the work activity that was driving the critical delay.

Our investigation of the analysis results for each 'window' also identifies all the work activities that were delayed and we highlight those activities, as Critical Delay Events, causing critical delay to completion of the Works. We also identify areas of mitigation or acceleration achieved by xxx (the contractor).

As stated earlier, any of the Critical Delay Events identified by the 'Windows' analysis will give entitlement to an extension of time, if the cause or causes are a Relevant Event as described in the Contract.

D: Time Period 'One': information used and preparation for the analysis

As the 'baseline' programme for the 'Windows' analysis for this time period we have used the programme noted as '01'. This programme was prepared by xxx (the contractor) *and issued to the project manager.*

Using the contractor's progress updates, Time Period One was divided into 10 'windows' as follows:

1 *Start of project to 5 January 2003,*
2 *6 January to 2 February 2003,*
3 *3 February to 2 March 2003,*
4 *3 March to 30 March 2003,*
5 *31 March to 4 May 2003,*
6 *5 May to 8 June 2003.*
7 *9 June to 29 June 2003,*
8 *30 June to 3 August 2003,*
9 *4 August to 5 October 2003,*
10 *6 October to 2 November 2003.*

E: Time Period 'Two': information used and preparation for the analysis

As the 'baseline' programme for the 'Windows' analysis for this time

> *period we have used the programme noted as '02'. This programme was prepared by the contractor and issued to the project manager.*
>
> *Using the contractor's progress updates, Time Period Two was divided into a further 16 'windows' as follows:*
>
> *11 3 November to 30 November 2003,*
> *12 1 December to 21 December 2003,*
> *13 22 December 2003 to 30 January 2004,*
> *14 31 January to 1 March 2004,*
> *15 2 March to 29 March 2004,*
> *16 30 March to 3 May 2004,*
> *17 4 May to 31 May 2004,*
> *18 1 June to 4 July 2004,*
> *19 5 July to 1 August 2004,*
> *20 2 August to 30 August 2004,*
> *21 31 August to 3 October 2004,*
> *22 4 October to 31 October 2004,*
> *23 1 November to 29 November 2004,*
> *24 30 November 2004 to 12 January 2005,*
> *25 13 January to 30 January 2005,*
> *26 31 January to 27 February 2005.*

At this point in the submission, the contractor referred to his baseline programmes '01' and '02' and informed the reviewer that copies of these were included in appendix 'xxx' to the submission.

A copy of the contractor's programme '01' for time period one, is included in appendix 5A of this book. Appendix 5A contains two charts:

1 Chart 5A a which shows all the programme activities, sorted by work area;
2 Chart 5A b which shows the planned critical path for the project.

As referred to under item 'B' above, 'Detailed methodology of a "windows" analysis', such an analysis requires the project's progress to be recorded at regular intervals, usually monthly. Where progress has been reported contemporaneously, e.g. in the contractor's monthly reports, this information should be used, subject to checking for errors. For this submission, the contractor used his contemporaneous progress reports, and these were presented in tabular format in his submission. A copy is given in appendix 5B at the end of this book. This records the progress for windows 1 to 10 against the activities shown on the contractor's programme '01', being the programme that was current for 'time period one'.

The contractor then presented the results of the 'windows' analysis in his submission. Detailed below are the results for the first five (of 26) windows.

G: Results of the analysis

Introduction

For each of the 26 number windows that constitute the 'Windows Analysis', we give details and a commentary under the following sub-headings:

- *i 'Works planned to be carried out and actual progress achieved': In this sub-section we give a brief commentary on the works that were planned to be carried out in the window; followed by a brief commentary on the work actually carried out or in progress as at the end of the window.*
- *ii 'Analysis results at closing of 'Window': In this sub-section we give the new forecast completion date for section, based on the progress achieved as at the end of the window. The period of critical delay, if any, to the project completion, and the slippage, in workdays, within the particular window.*
- *iii 'Delayed activities in this window: Critical & sub-critical': The tables in this section show the programme activity(s) that are 'driving' any critical delay to the project completion date. That is to say, the activity identified under the sub-heading 'Delayed activity: critical', is the activity as at the end of the window that is dictating or controlling the new forecast completion date for the project. In other words, it is the work activity on the actual critical path as at the end of the window.*

Under the sub-heading 'Delayed activities: near-critical', we list those activities that are on parallel paths to the date for completion of the project, and whereas they are in some critical delay, they will not delay completion of the project to the same extent as the 'driving' activity on the actual critical path. These activities have been classified as near-critical. The criteria for selecting these activities is that they will cause delay to completion of the project between 1 and 20 workdays less than the critical delay being caused by the 'driving' activity. For example, if the 'driving' activity is on a path that is forecast to cause 38 workdays delay to completion of the project, then a near-critical activity must be on a parallel path that is forecast to cause between 18 and 37 workdays delay.

We give an explanation of the data contained in the tables in this sub-section.

The results for each window are complemented by two charts, which are included in appendix xxx in this submission.

The first chart is titled 'Progress Comparison Chart', and shows the following:

- *i All activities which were actually completed in the current window,*

ii All activities which are currently in progress as at the closing of the current window,
iii Based upon the current progress position, within the next 3 windows.
iv The current forecast completion dates for the contractual section completion milestones.

The second chart is titled 'The Critical Path', and shows the current critical path from the current activity that is driving this path to the final activity of the project with its completion of 'Section 8'.

Results for the Individual Windows

Window 1: from project start to 5 January 2003; end of week 5

Work planned to be done during this Window

Only 'Preliminary Works' were planned to be carried out during this first window. Whilst this included completion of 'General Site Mobilisation' (act.nr. 0030) and 'Site Establishment' (act.nr. 0050); 'Pile Probing' (act.nr. 0060) was to be completed by 21 December 2001. Similarly, 'Guide Walls' (act.nr. 0070) and 'Install Secant Piles' (act.nr. 0080), were to be progressing and be 67% and 22% complete by the end of this window.

'Analysis' results: at closing of Window

Window 1: from project start to 5 January 2003; end of week 5

A	*New forecast completion date*	12 January 2005				
				T.F.	Delay to project completion	
B	*Critical delay to project:-*			-7	7 workdays	23 cal. days
C	*Time lost in this window*				7 workdays	23 cal. days
D	*Critical (driving) activity at closing of window* Preliminary Works: "Pile Probing"	act.no.	'0060'	-7	7 workdays	23 cal. days
E	*Other 'near-critical' activities at closing of window* -none-					

Figure 25.1 Analysis results at closing of window.

'Analysis' results: impact on sectional completion dates

Position at closing of window	*Forecast completion*	*Slippage in window*	*Total slippage*
Section 1: Show Flat (floor 03)	*18-Feb-04*	*5 days*	*5 days*
Section 2: Arts Complex (partial)	*17-Mar-04*	*5 days*	*5 days*
Section 3: Residential Floors 04 to 07 (incl.)	*13-May-04*	*9 days*	*9 days*
Section 4: Shops	*13-May-04*	*9 days*	*9 days*
Section 7: Remaining Residential	*29-Sep-04*	*9 days*	*9 days*
Section 8: All Other Areas	*12-Jan-05*	*23 days*	*23 days*

Figure 25.2 Analysis results: impact on sectional completion dates.

Commentary on work carried out in this Window

Preliminary Works

1 *'General Site Mobilisation' (act.nr. 0030) was completed on 4 December 2002; some 2 workdays later than its late finish date, thereby causing a potential critical delay to the project completion date. However, this delay was mitigated (out-of-sequence working) by its successor activity.*
2 *'Site Establishment' (act.nr. 0050) commenced on 6 November and was completed on 29 November 2002. There was no critical delay to this activity.*
3 *'Pile Probing' (act.nr 0060) commenced on 13 November 2002, and was 70% complete at the end of this window, as opposed to being 95% complete as was planned at the start of the window. This progress delay is causing a 7 workday critical delay, or 23 calendar days delay, to the project completion date.*
4 *'Guide Walls' (act.nr. 0070) commenced on 5 December 2002 and was 50% complete at the end of this window, as opposed to being 67% complete as planned at the start of this window. The activity is shown as being in critical delay of 7 workdays; however, completion of this activity is being controlled by completion of its predecessor activity 'Pile Probing'; which itself is in critical delay of 7 workdays.*
5 *'Install Secant Piles' (act.nr. 0080) commenced on 11 December 2002 and was 14% complete at the end of this window, as opposed to being 17% complete as planned at the start of this window. The activity is shown as being in critical delay of 7 workdays; however, completion of this activity is being controlled by completion of the activity 'Pile Probing'; which itself is in critical delay of 7 workdays.*
6 *'Cut Down Piles' (act.nr 0090) commenced on 16 December 2002 and was 10% complete at the end of this window, and the activity is shown as being in critical delay of 7 workdays. However, completion of this activity is being controlled by completion of the activity 'Pile Probing'; which itself is in critical delay of 7 workdays.*

Summary of critically delayed activities in this Window

Window 2: from 6 January to 2 February 2003; end of week 9

Work planned to be done during this Window

'Preliminary Works' were planned to continue during this window period. This included completion of 'Pile Probing' (act.nr. 0060), and 'Guide Walls' (act.nr. 0070). 'Install Secant Piles' (act.nr. 0080) and 'Cut Down Piles' (act.nr. 0090), were to be progressing and be 44% and 15% complete respectively by the end of this window.

'Apartment Block; Substructure' works were due to commence this

SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days	CDA Ref.
PRELIM.WKS: Piling; Pile Probing	0060	Delayed progress	7 wkdays	23 cal.days	Ref.01 (part 1 of 2)

Figure 25.3 Summary of critically delayed activities in window.

window, with 'FRC Capping Beam' (act.nr. 0110) being 5% complete at the end of the window.

'Time Analysis' results: at closing of Window

Window 2: from 6 January to 2 February 2003; end of week 9

A	New forecast completion date	02 February 2005				
			T.F.	Delay to project completion		
B	Critical delay to project:-		-22	22 workdays	44 cal. days	
C	Time lost in this window			15 workdays	21 cal. days	
D	Critical (driving) activity at closing of window Preliminary Works: "Pile Probing"	act.no. '0060'	-23	23 workdays	44 cal. days	
E	Other 'near-critical' activities at closing of window -none-					

Figure 25.4 Time analysis results at closing of window.

'Time Analysis' results: impact on sectional completion dates

Position at closing of window	Forecast completion	Slippage in window	Total slippage
Section 1: Show Flat (floor 03)	10-Mar-04	21 days	26 days
Section 2: Arts Complex (partial)	07-Apr-04	21 days	26 days
Section 3: Residential Floors 04 to 07 (incl.)	04-Jun-04	22 days	31 days
Section 4: Shops	04-Jun-04	22 days	31 days
Section 7: Remaining Residential	20-Oct-04	21 days	30 days
Section 8: All Other Areas	02-Feb-05	21 days	44 days

Figure 25.5 Time analysis results: impact on sectional completion dates.

Commentary on work carried out in this Window
Preliminary Works

1 *'Pile Probing' (act.nr 0060) was 90% complete at the end of this window, as opposed to being 100% complete as planned at the start of the window. The activity is showing as being in critical delay of 23 workdays, and which in turn is causing a 22 workday critical delay to completion of the project. The progress delay in this window caused an additional 15 workday critical delay, or 21 calendar days delay, to the project completion date.*
2 *'Guide Walls' (act.nr. 0070) was 90% complete at the end of this window, as opposed to being 100% complete as planned at the start of this window. The activity is shown as being in critical delay of 23 workdays; however, completion of this activity is being controlled by completion of its predecessor 'Pile Probing', which itself is in critical delay of 23 workdays.*
3 *'Install Secant Piles' (act.nr. 0080) was 60% complete at the end of*

this window, as opposed to being 44% complete as planned at the start of this window. The activity is shown as being in critical delay of 23 workdays; however, completion of this activity is being controlled by completion of 'Pile Probing', which itself is in critical delay of 23 workdays.

4 *'Cut Down Piles' (act.nr 0090) was 18% complete at the end of this window, as opposed to being 14% complete as planned at the start of this window. The activity is shown as being in critical delay of 23 workdays. However, completion of this activity is being controlled by completion of 'Pile Probing', which itself is in critical delay of 25 workdays.*

<u>*Summary of critically delayed activities in this Window*</u>

SECTION: Element; Activity of Work	Act.IW	Nature of delay	Workdays	Calendar days	CDA Ref
PRELIM.WKS: Piling; Pile Probing	0060	Delayed progress	15 wkdays	21 days	Ref.01 (part 2 of 2)

Figure 25.6 Summary of critically delayed activities in window.

Window 3: from 3 February to 2 March 2003; end of week 13

<u>*Work planned to be done during this Window*</u>

'Preliminary Works' were planned to continue during this window period. This included completion of 'Pile Probing' (act.nr. 0060), and 'Guide Walls' (act.nr. 0070). 'Install Secant Piles' (act.nr. 0080) and 'Cut Down Piles' (act.nr. 0090), were to be progressing and be 60% and 30% complete respectively by the end of this window.

'Apartment Block; Substructure' works were planned to commence in this window. 'Frc Capping Beam' (act.nr. 0110) to commence on 20 February 2002, and 'Bulk Dig Leaving Supporting Berms' (act.nr. 0120) on 24 February 2002. These activities were to be 20% and 6% complete respectively at the end of the window.

<u>*'Time Analysis' results: at closing of Window*</u>

Window 3: from 3 February to 2 March 2003; end of week 13

A	*New forecast completion date*	31 January 2005			
			T.F.	Delay to project completion	
B	*Critical delay to project:-*		-20	20 workdays	42 cal. days
C	*Time lost in this window*			0 workdays	0 cal. days
D	*Critical (driving) activity at closing of window* 'Bulk Dig Leaving Support Berms'	act.no. '0120'	-20	20 workdays	42 cal. days
E	*Other 'near-critical' activities at closing of window* -none-				

Figure 25.7 Time analysis results at closing of window.

'Time Analysis' results: impact on sectional completion dates

Position at closing of window	Forecast completion	Slippage in window	Total slippage
Section 1: Show Flat (floor 03)	08-Mar-04	none	24 days
Section 2: Arts Complex (partial)	05-Apr-04	none	24 days
Section 3: Residential Floors 04 to 07 (incl.)	02-Jun-04	none	29 days
Section 4: Shops	02-Jun-04	none	29 days
Section 7: Remaining Residential	18-Oct-04	none	28 days
Section 8: All Other Areas	31-Jan-05	none	42 days

Figure 25.8 TA results: impact on sectional completion dates.

Commentary on work carried out in this Window
Preliminary Works

1 *'Pile Probing' (act.nr 0060) was completed on 14 February 2003, some 7 workdays later than its planned finish date at the start of this window. There was no critical delay to this activity in this window.*
2 *'Guide Walls' (act.nr. 0070) was completed on 1 March 2002, some 7 workdays later than its planned finish date at the start of this window. There was no critical delay to this activity in this window.*
3 *'Install Secant Piles' (act.nr. 0080) was 85% complete at the end of this window. The activity is shown as being in critical delay of 8 workdays; however, completion of this activity is being controlled by completion of its predecessor 'Guide Walls' (act.nr. 0070).*
4 *'Cut Down Piles' (act.nr 0090) was 25% complete at the end of this window. The activity is shown as being in critical delay of 8 workdays; however, completion of this activity is being controlled by completion of its predecessor 'Install Secant Piles' (act.nr. 0080).*

Apartment Block

5 *'Frc Capping Beam' (act.nr. 0110) commenced on 18 February 2003, was 18% complete and showing a critical delay of 8 workdays at the end of this window. The actual start date was ahead of the planned start date; and although progress is slightly behind that planned at the start of the window, this activity's completion is being controlled by completion of 'Cut Down Piles', which itself is in 8 workdays critical delay.*
6 *'Bulk Dig Leaving Supporting Berms' (act. nr. 0120) commenced on 20 February 2003 and was 20% complete at the end of this window. An earlier than planned commencement and achieving better than planned progress for this activity resulted in the overall critical delay to the project completion date being reduced by 2 workdays. This is an example of mitigation by the contractor.*

Summary of critically delayed activities in this Window

SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days	CDA Ref.	
NO CRITICAL DELAYS IN THIS WINDOW	---	---	---	---	---	---

Figure 25.9 Summary of critically delayed activities in window.

Window 4: from 3 March to 30 March 2003; end of week 17

Work planned to be done during this Window

'Preliminary Works' were planned to continue during this window period. 'Install Secant Piles' (act.nr. 0080) and 'Cut Down Piles' (act.nr. 0090), were to be progressing and be 90% and 70% complete respectively by the end of this window.

'Apartment Block; Substructure' works were planned to progress in this window, with 'Frc Capping Beam' (act.nr. 0110) and 'Bulk Dig Leaving Supporting Berms' (act.nr. 0120) to be 60% and 37% complete respectively at the end of the window.

'Time Analysis' results: at closing of Window

Window 4: from 3 March to 30 March 2003;				end of week 17	
A	New forecast completion date	11 February 2005			
			T.F.	Delay to project completion	
B	Critical delay to project:-		-29	29 workdays	53 cal. days
C	Time lost in this window			6 workdays	9 cal. days
D	Critical (driving) activity at closing of window 'Bulk Dig Leaving Support Berms'	act.no. '0120'	-29	29 workdays	53 cal. days
E	Other 'near-critical' activities at closing of window -none-				

Figure 25.10 TA results at closing of window.

'Time Analysis' results: impact on sectional completion dates

Position at closing of window	Forecast completion	Slippage in window	Total slippage
Section 1: Show Flat (floor 03)	19-Mar-04	9 days	35 days
Section 2: Arts Complex (partial)	26-Apr-04	19 days	45 days
Section 3: Residential Floors 04 to 07 (incl.)	15-Jun-04	11 days	42 days
Section 4: Shops	15-Jun-04	8 days	39 days
Section 7: Remaining Residential	29-Oct-04	18 days	39 days
Section 8: All Other Areas	11-Feb-05	9 days	53 days

Figure 25.11 TA results: impact on sectional completion dates.

Commentary on work carried out in this Window

Preliminary Works

1 *'Install Secant Piles' (act.nr 0080) was completed on 20 March 2003, some 11 workdays earlier than its planned finish date at the start of this window.*

2 *'Cut Down Piles' (act.nr 0090) was 70% complete at the end of this window. The activity is shown as being in critical delay of 9 workdays; however, this is not causing any critical delay to any of its successor activities.*

Apartment Block

3 *'Frc Capping Beam' (act.nr. 0110) was 40% complete and showing a critical delay of 14 workdays at the end of this window. This was somewhat less than the 60% progress planned to be achieved as at the start of this window; however, this is not causing any critical delay to any of its successor activities.*

4 *'Bulk Dig Leaving Supporting Berms' (act.nr. 0120) was 25% complete at the end of this window. This was somewhat less than the 37% progress planned to be achieved as at the start of this window. This delayed progress is causing a 29 workday critical delay to the project completion; which is a slippage of a further 6 workdays in this window.*

5 *'Frc Section of Area 3 Slab for Tower Crane 1' (act.nr. 0130) was 85% complete at the end of the window. At the start of this window no work was planned to be carried out on this activity.*

Summary of critically delayed activities in this Window

SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days	CDA Ref.
APARTM.BLK.: Substruc.; Bulk Dig Leav. Supp Bms	0120	Delayed progress	6 w'kdays	9 days	Ref.02

Figure 25.12 Summary of critically delayed activities in window.

Window 5: from 31 March to 4 May 2003; end of week 22

Work planned to be done during this Window

'Preliminary Works' were planned to continue during this window period. 'Install Secant Piles' (act.nr. 0080) and 'Cut Down Piles' (act.nr. 0090), were to be progressing and be 90% and 70% complete respectively by the end of this window.

'Apartment Block; Substructure' works were planned to progress in this window, with 'Frc Capping Beam' (act.nr. 0110) and 'Bulk Dig Leaving Supporting Berms' (act.nr. 0120) to be 95% and 45% complete respectively at the end of the window. 'Frc Section of Area 3 Slab for Tower Crane 1' (act.nr. 0130) and 'Erect Tower Crane' (act.nr. 0140) were planned to be completed by the end of the window. 'Frc Basement Slab Area 1' (act.nr. 0150) was planned to commence and be 55% complete by the end of the window.

'Time Analysis' results: at closing of Window

Window 5: from 31 March to 4 May 2003; end of week 22

A	*New forecast completion date*	17 February 2005				
			T.F.	Delay to project completion		
B	*Critical delay to project:-*		-33	33 workdays	59 cal. days	
C	*Time lost in this window*			4 workdays	6 cal. days	
D	*Critical (driving) activity at closing of window* 'Frc Capping Beam'	act.no. '0110'	-33	33 workdays	59 cal. days	
E	*Other 'near-critical' activities at closing of window* -none-					

Figure 25.13 TA results at close of window.

'Time Analysis' results: impact on sectional completion dates

Position at closing of window	*Forecast completion*	*Slippage in window*	*Total slippage*
Section 1: Show Flat (floor 03)	*25-May-04*	*6 days*	*41 days*
Section 2: Arts Complex (partial)	*30-Apr-04*	*4 days*	*49 days*
Section 3: Residential Floors 04 to 07 (incl.)	*21-Jun-04*	*6 days*	*48 days*
Section 4: Shops	*21-Jun-04*	*6 days*	*45 days*
Section 7: Remaining Residential	*04-Nov-04*	*6 days*	*45 days*
Section 8: All Other Areas	*17-Feb-05*	*6 days*	*59 days*

Figure 25.14 TA results' impact on dates.

Commentary on work carried out in this Window
Preliminary Works

1 *'Cut Down Piles' (act.nr. 0090) was 88% complete at the end of this window. The activity is shown as being in critical delay of 21 workdays; however, this is not causing any critical delay to any of its successor activities.*

Apartment Block; Substructure

2 *'Frc Capping Beam' (act.nr. 0110) was 40% complete and showing a critical delay of 33 workdays at the end of this window. There was no progress on this activity in the window, and this activity is now in critical delay by 33 workdays.*
3 *'Bulk Dig Leaving Supporting Berms' (act.nr. 0120) was 70% complete at the end of this window. This activity is 33 workdays in critical delay, which is being caused by its predecessor activity 'Frc Capping Beam' (act.nr. 0110)*
4 *'Frc Section of Area 3 Slab for Tower Crane 1' (act.nr. 0130) was completed on 5 April 2003. No delay was caused to its successor activity.*
5 *'Erect Tower Crane' (act.nr. 0140) was completed on 15 April 2003. No delay was caused to its successor activity.*
6 *'Frc Basement Slab Area 1' (act.nr. 0150). This activity was*

commenced on 10 April 2003 and completed on 29 April 2003. No delay was caused to its successor activity.

7 *'Install Temporary Works Jigs 1 and 2' (act.nr. 0160). This activity was commenced on 8 April 2003 and completed on 1 May 2003. No delay was caused to its successor activity.*

8 *'Frc Basement Slab Area 2' (act.nr. 0220). This activity was commenced on 3 April 2003 and completed on 3 May 2003. No critical delay was caused to its successor activity.*

9 *'Frc Walls and Columns, Lower – Upper Basement' (act.nr. 0190). This activity commenced on 1 May 2003 and was 10% at the end of the window. The activity was in critical delay of 17 workdays.*

Apartment Block; Substructure

10 *'Frc Basement Slab Area 3' (act.nr. 0660). This activity commenced on 28 April 2003 and was 60% at the end of the window. The activity was in critical delay of 29 workdays; this critical delay is being caused by its predecessor activity 'Frc Capping Beam' (act.nr. 0110).*

11 *'Relocate Temporary Works Jigs 1 and 2' (act.nr. 0670). This activity commenced on 2 May 2003 and was 70% at the end of the window. The activity was not in critical delay.*

12 *'Frc Basement Slab Area 4' (act.nr. 0660). This activity commenced on 2 May 2003 and was 40% at the end of the window. The activity was in critical delay of 28 workdays; this critical delay is being caused by its predecessor activity 'Frc Capping Beam' (act.nr. 0110).*

Summary of critically delayed activities in this Window

SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days	CDA Ref.
APARTM.BLK.: Substruc.; Frc Capping Beam	0110	Delayed progress	4 w'kdays	6 days	Ref.03

Figure 25.15 Summary of critically delayed activities.

The submission reviewed and presented the results of the remaining 'windows analysis' in a similar manner, up to the final window, number 26.

As can be seen from the results of the first five number windows above, there were three actual delaying events to the project causing critical delay to the project completion. These are shown in Figure 25.16.

CDA Ref.	SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days
Ref.01	PRELIM.WKS: Piling; Pile Probing	0060	Delayed progress	22 w'kdays	44 days
Ref.02	APARTM.BLK.: Substruc.; Bulk Dig Leav. Supp Bms	0120	Delayed progress	6 w'kdays	9 days
Ref.03	APARTM.BLK.: Substruc.; Frc Capping Beam	0110	Delayed progress	4 w'kdays	6 days

Figure 25.16 The actual delaying events.

At the end of window 10, on 2 November, the progress update shows the forecast completion date for the project to be 15 April 2005, which is some 75 workdays or 117 calendar days in delay.

However, taking into account the 'windows analysis' results from the first ten windows, the table of critical delaying events at the end of window 10 is shown in Figure 25.17.

CDA Ref.	SECTION: Element; Activity of Work	Act.Nr.	Nature of delay	Workdays	Calendar days	
Ref.01	PRELIM.WKS: Piling; Pile Probing	0060	Delayed progress	22 wkdays	44 days	
Ref.02	APARTM.BLK.: Substruc.; Bulk Dig Leav. Supp Bms	0120	Delayed progress	6 wkdays	9 days	
Ref.03	APARTM.BLK.: Substruc.; Frc Capping Beam	0110	Delayed progress	4 wkdays	6 days	
Ref.04	APARTM.BLK.: Substruc.; Inst.Temp.Supp.Props	0420	Delayed start	9 wkdays	12 days	
Ref.05	APARTM.BLK.: Substruc.; Frc Basem.Sl. gl.l.1/M-R	0490	Delayed start	10 wkdays	14 days	These critical delays
Ref.06	ARTS CENTRE: Substruc.;Frc Walls/Cols, Area 5	0930	Delayed start	13 wkdays	17 days	are concurrent
Ref.07	APARTM.BLK.: Substruc.; Upp Basem.Sl. gl.l.1/A-J	0410	Delayed progress	4 wkdays	6 days	These critical delays
Ref.08	ARTS CENTRE: Substruc.;Frc Basem.Sl. Area 7	0980	Delayed start	7 wkdays	9 days	are concurrent
Ref.09	ARTS CENTRE: Superstr.;Frc GF Slab, gl.9-11/A-K	2260	Delayed start	5 wkdays	7 days	
Ref.10	APARTM.BLK.: Superstr.; 2nd Floor Slab gl.1-7/A-F	1340	Delayed progress	6 wkdays	8 days	These critical delays
Ref.11	ARTS CENTRE: Superstr.;Walls/Cols, Ground to 2nd	2360	Delayed start	9 wkdays	13 days	are concurrent

Figure 25.17 Updated table of critical events.

The next section in the submission document should be a narrative on the critical delaying events. For each event, there should be:

1 An introductory narrative explaining the 'event' and its importance in the construction process.
2 The contemporaneous factual information related to the event, e.g. requests for information, letters, AIs or other instructions, drawing issues, procurement of materials, labour records. Copies of any documents referred to should be included in the submission.
3 The results of the 'windows analysis' focusing on the critical delay caused by the event, with specific graphics if necessary. The extension of time claimed as a consequence of the event should be clearly stated; this may be the full critical delay caused or only part of the delay.
4 The contract clause under which the extension of time is claimed.

A fully detailed submission, as described above, will demonstrate the cause and effect, i.e. 'causation', of the extension of time claimed.

Part VI

Prolongation claims (and time-related costs)

26 Introduction

Claims are an inevitable feature of many projects that have to be dealt with on the majority of contracts and subcontracts let. Most claims result from the project designer's inability to fully provide for all eventualities, which means that changes will be made to the contract as it proceeds and, where these involve additional work, adjusted payments will be necessary. Disagreements on the level of these payments will be a typical source of claims. As well as changes to the payments made, these variations may also result in delays to the works and where these delays have a knock-on effect on the project as a whole, they may give rise to extra costs. These costs result from the contractor's additional presence on site, generating additional overhead costs for the extended period.

By no means will all changes to a contract delay the project. Some will involve changes in detail that merely affect the nature of the work to be done without increasing its difficulty, requirement for resources or duration. Other changes will actually reduce the work to be carried out. There will, however, typically be changes that do delay, increase the duration of or force a change in sequence in the activities making up the contractor's programme.

The expression 'delay claim' is generally used to describe a monetary claim which follows on from a delay to the project completion. Similarly, the expression 'disruption claim' is generally used to describe a monetary claim in circumstances where part of the works has been disrupted, without affecting the completion date of the project; this typically equates with a delay which is not on the critical path.

There is no such thing as the ideal format for a delay claim; each claim is dependent upon the individual facts of its own project or case. There are, however, some simple guidelines or good practice which are applicable to almost all claim submissions. These are detailed in chapter 28, followed by worked examples in chapter 29.

The starting point for the assessment of a prolongation claim should be 'in respect of what period is the contractor entitled to further payment?'. What is equally important not only concerns how many weeks the contractor is entitled to be paid for, but which weeks. This is because the amount of his entitlement will depend on his actual costs, particularly his time-related preliminary costs which will vary throughout the project.

Classification of 'delays'

Delays can first be classified as either 'excusable' or 'non-excusable'.

Excusable delays are those for which the contractor can be excused due to an act or omission by the employer or his agents. For example, late issue of design information by the architect to the contractor.

Non-excusable delays are those arising from the contractor's own actions or inactions. For example, when a contractor fails to provide sufficient manpower to complete the project on time.

Excusable delays are in turn divided into 'compensable' and 'non-compensable' categories. The former entitles the delayed party, usually the contractor, to monetary compensation for the period of delay through acts or omissions by the employer or his agents. Non-compensable delays on the other hand arise from neutral events (such as exceptionally inclement weather), third parties, etc.; indeed any event for which under the contract between the parties there is no recompense for loss and expense.

Overheads

Overheads can constitute an important element of any claim and are often controversial. It is therefore essential to demonstrate that the overheads being claimed are additional and/or that they could have been deployed elsewhere to commercial advantage but for the problems encountered. It is therefore advisable to allocate additional resources to individual events or only rely on formula methods of overhead recovery, such as Hudson's or Emden's, for those elements which cannot be allocated to individual events.

Overheads are considered under the following broad headings.

1 Site overheads and establishment

Although site overheads are generally dedicated to a particular project, it does not follow that if a project is delayed due to an event on a critical activity then the whole of the site overhead is extended by a period corresponding to that delay. The identification is best achieved through site diaries or daily reports. Associated items such as vehicles and office space usually follow on if the individuals involved can be identified.

Many items will not have a critical delaying effect but will still involve additional supervisory hours being expended; again these should be identifiable through site diaries or daily reports.

Very often it can be demonstrated that such events result in an increase in supervisory staff and associated items. Many other site resources are common items and may be claimable depending upon the circumstances.

2 Head office overheads

Specific head office overheads are those which can be allocated to a project either on a full-time or part-time basis. In the case of certain costs (e.g. drawing office and planning resources) it should be possible to relate the use of such resources to individual events. For example, the necessity to produce a revised drawing may originate from instructions received, while planning work may result from delays and the necessity to revise the programme. It will be more difficult to directly link other resources (e.g. a contracts manager) to specific events although it may be possible to show that, for instance, time was spent attending meetings dealing with problems associated with an event. Similarly, it may be possible to show that additional site visits were required. As a general rule where overheads are claimed, these should be specifically identified and allocated as far as possible to individual events. The head office on-costs (e.g. office space and furniture) of such resources should also be treated as specific head office overheads. Formulae should only be used for calculating the cost of those resources that are not specific to a project and could not therefore be allocated on any other basis.

3 Financing and other charges

General head office overheads can only be allocated to projects on an apportioned basis and for this reason are the most contentious area of overheads when attempting to recover additional costs. In order to have the best chance of being successful in the recovery of such costs, it is necessary to show that there was sufficient work available to one in the general marketplace and that opportunities were turned down because of continuing commitments to a project attributable to claimable events. Comprehensive records should therefore be kept of tender invitations and bids.

Chapter 28 contains more details on the 'heads of claim' for prolongation claims, and chapter 29 contains a worked example of a prolongation, or loss and expense, claim.

27 Contract requirements

The two most commonly used forms of contract in the UK stipulate the following requirements and conditions regarding monetary compensation for time-related delays and changes.

The contractual requirements: JCT

Section 4 of the *JCT 2005 Standard Building Contract with Quantities*, deals with 'Payment', and clauses 4.23 to 4.26 under the sub-heading 'Loss and Expense' state:

> ***Matters materially affecting regular progress***
> ***4.23*** *If in the execution of this Contract the Contractor incurs or is likely to incur direct loss and/or expense for which he would not be reimbursed by a payment under any other provision in these Conditions due to a deferment of giving possession of the site or relevant part of it under clause 2.5 or because the regular progress of the Works or of any part of them has been or is likely to be materially affected by any part of the Relevant Matters, the Contractor may make written application to the Architect/Contract Administrator. If the Contractor makes such application, save where these Conditions provide that there shall be no addition to the Contract Sum or otherwise exclude the operation of this clause, then, if and as soon as the Architect/Contract Administrator is of the opinion that the regular progress has been or is likely to be materially affected as stated in the application or that direct loss and/or expense has been or is likely to be incurred due to such deferment, the Architect/Contract Administrator shall from time to time thereafter ascertain, or instruct the Quantity Surveyor to ascertain, the amount of the loss and/or expense which has been or is being incurred; provided always that the Contractor shall:*
>
> *.1 make his application as soon as it has become, or should reasonably have become, apparent to him that the regular progress has been or is likely to be affected;*

.2 in support of his application submit to the Architect/Contract Administrator upon request such information as should reasonably enable the Architect/Contract Administrator to form an opinion; and
.3 upon request submit to the Architect/Contract Administrator or to the Quantity Surveyor such details of the loss and/or expense as are reasonably necessary for such ascertainment.

Relevant Matters
4.24 *The following are the Relevant Matters:*

.1 Variations (excluding any loss and/or expense relating to a Confirmed Acceptance of a Schedule 2 Quotation but including any other matters or instructions which under theses Conditions are to be treated as, or as requiring, a Variation);
.2 instructions of the Architect/Contract Administrator:
  .1 under clause 3.15 or 3.16 (excluding an instruction for expenditure of a Provisional Sum for defined work);
  .2 for the opening up for inspection or testing of any work, materials or goods under clause 3.17 (including making good), unless the cost is provided for in the Contract Bills or unless the inspection or test shows that the work, materials or goods are not in accordance with this Contract; or
  .3 in relation to any discrepancy in or divergence between the Contract Drawings, the Contract Bills and/or other documents referred to in clause 2.15;
.3 suspension by the Contractor under clause 4.14 of the performance of his obligations under this Contract, providing the suspension was not frivolous or vexatious;
.4 the execution of work for which an Approximate Quantity is not a reasonably accurate forecast of the quantity of work required;
.5 any impediment, prevention or default, whether by act or omission, by the Employer, the Architect/Contract Administrator, the Quantity Surveyor or any of the Employer's Persons, except to the extent caused or contributed to by any default, whether by act or omission, of the Contractor or of any of the Contractor's Persons.

Amounts ascertained – addition to Contract Sum
4.25 *Any amounts from time to time ascertained under clause 4.23 shall be added to the Contract Sum.*

Reservation of Contractor's rights and remedies
4.26 *The provisions of clauses 4.23 to 4.25 are without prejudice to any other rights and remedies which the Contractor may possess.*

The contractual requirements: NEC

The New Engineering and Construction Contract is somewhat different to the JCT Contract. Within the NEC is core clause 6, which is titled 'Compensation Events'. Under this clause a contractor is entitled to both time and money, with sub-clauses 62 to 65 inclusive relevant to the money aspect of compensation events. These sub-clauses state:

62 Quotations for compensation events

62.1 After discussing with the Contractor different ways of dealing with the compensation event which are practicable, the Project Manager may instruct the Contractor to submit alternative quotations. The Contractor submits the required quotations to the Project Manager and may submit quotations for other methods of dealing with the compensation event which he considers practicable.

62.2 Quotations for compensation events comprise proposed changes to the Prices and any delay to the Completion Date and Key Dates assessed by the Contractor. The Contractor submits details of his assessment with each quotation. If the programme for remaining work is altered by the compensation event, the Contractor includes the alterations to the Accepted Programme in his quotation.

62.3 The Contractor submits quotations within three weeks of being instructed to do so by the Project Manager. The Project Manager replies within two weeks of the submission. His reply is

- *an instruction to submit a revised quotation,*
- *an acceptance of a quotation,*
- *a notification that a proposed instruction will not be given or a proposed changed decision will not be made or*
- *a notification that he will be making his own assessment.*

62.4 The Project Manager instructs the Contractor to submit a revised quotation only after explaining his reasons for doing so to the Contractor. The Contractor submits the revised quotation within three weeks of being instructed to do so.

62.5 The Project Manager extends the time allowed for

- *the Contractor to submit quotations for a compensation event and*
- *the Project Manager to reply to a quotation*

if the Project Manager and the Contractor agree to the extension before the submission or reply is due. The Project Manager notifies the extension that has been agreed to the Contractor.

62.6 *If the Project Manager does not reply to a quotation within the time allowed, the Contractor may notify the Project Manager to this effect. If the Contractor submitted more than one quotation for the compensation event, he states in his notification which quotation he proposes is to be accepted. If the Project Manager does not reply to the notification within two weeks, and unless the quotation is for a proposed instruction or a proposed changed decision, the Contractor's notification is treated as acceptance of the quotation by the Project Manager.*

63 Assessing compensation events

63.1 *The changes to the Prices are assessed as the effect of the compensation event upon*

- *the actual Defined Cost of the works already done,*
- *the forecast Defined Cost of the work not yet done and*
- *the resulting Fee.*

The date when the Project Manager instructed or should have instructed the Contractor to submit quotations divides the work already done from the work not yet done.

63.2 *If the effect of a compensation event is to reduce the total Defined Cost, the Prices are not reduced except as stated in this contract.*

63.3 *A delay to the Completion Date is assessed as the length of time that, due to the compensation event, planned Completion is later than planned Completion as shown on the Accepted Programme. A delay to a Key Date is assessed as the length of time that, due to the compensation event, the planned date when the Condition stated for a Key Date will be met is later than the date shown on the Accepted Programme.*

63.4 *The rights of the Employer and Contractor to changes to the Prices, the Completion Date and the Key Dates are their only rights in respect of a compensation event.*

63.5 *If the Project Manager has notified the Contractor of his decision that the Contractor did not give an early warning of a compensation event which an experienced contractor could have given, the event is assessed as if the Contractor had given early warning.*

63.6 *Assessment of the effect of a compensation event includes risk allowances for cost and time for matters which have a significant chance of occurring and are at the Contractor's risk under this contract.*

63.7 *Assessments are based upon the assumptions that the Contractor reacts competently and promptly to the compensation event, that any Defined Cost and time due to the event are reasonably incurred and that the Accepted Programme can be changed.*

63.8 A compensation event which is an instruction to change the Works Information in order to resolve an ambiguity or inconsistency is assessed as if the Prices, the Completion Date and the Key Dates were for the interpretation most favourable to the Party which did not provide the Works Information.

63.9 If a change to the Works Information makes the description of the Condition for a Key Date incorrect, the Project Manager corrects the description. This correction is taken into account in assessing the compensation event for the change to the Works Information.

64 The Project Manager's assessments

64.1 The Project Manager assesses a compensation event

- *if the Contractor has not submitted a quotation and details of his assessment within the time allowed,*
- *if the Project Manager decides that the Contractor has not assessed the compensation event correctly in a quotation and he does not instruct the Contractor to submit a revised quotation,*
- *if, when the Contractor submits quotations for a compensation event, he has not submitted a programme or alterations to a programme which this contract requires him to submit or*
- *if, when the Contractor submits quotations for a compensation event, the Project Manager has not accepted the Contractor's latest programme for one of the reasons stated in this contract.*

64.2 The Project Manager assesses a compensation event using his own assessment of the programme for the remaining work if

- *there is no Accepted Programme or*
- *the Contractor has not submitted a programme or alterations to a programme for acceptance as required by this contract.*

64.3 The Project Manager notifies the Contractor of his assessment of a compensation event and gives him details of it within the period allowed for the Contractor's submission of his quotation for the same event. This period starts when the need for the Project Manager's assessment becomes apparent.

64.4 If the Project Manager does not assess a compensation event within the time allowed, the Contractor may notify the Project Manager to this effect. If the Contractor submitted more than one quotation for the compensation event, he states in his notification which quotation he proposes to be accepted. If the Project

Manager does not reply within two weeks of this notification the notification is treated as acceptance of the Contractor's quotation by the Project Manager.

65 Implementing compensation events

65.1 A compensation event is implemented when

- *the Project Manager notifies his acceptance of the Contractor's quotation,*
- *the Project Manager notifies the Contractor of his own assessment, or*
- *a Contractor's quotation is treated as having been accepted by the Project Manager.*

65.2 The assessment of a compensation event is not revised if a forecast upon which it was based is shown by later recorded information to have been wrong.

28 Prolongation claims

It is good practice for the detailed prolongation, or loss and expense, claim to be set out in three sections, namely:

1 site overheads and establishment;
2 head office overheads;
3 other costs and charges.

1 Site overheads and establishment

This section can be subdivided as necessary into the following heads of claim:

A Staff

Under this head, the site staff actually based on the project, or directly associated with the project on a part-time basis, for the specific delay period or periods, should be listed together with their actual cost per week. For example:

Delay period one: 4 weeks (weeks 26 to 29 inclusive)

Project Manager	Mr 'aaa'	4 weeks @ £1,200.00 per week
General Foreman	Mr 'bbb'	4 weeks @ £950.00 per week
Assistant Foreman	Mr 'ccc'	4 weeks @ £800.00 per week
Quantity Surveyor	Mr 'ddd'	4 weeks @ £900.00 per week
Area Manager (part)	Mr 'eee'	4 weeks @ £600.00 per week
Buyer (part)	Mr 'fff'	4 weeks @ £250.00 per week

B Site establishment

Under this head, the site establishment costs actually spent on the project for the specific delay period or periods should be listed. For example,

Delay period one: 4 weeks (weeks 26 to 29 inclusive)

Hire of Offices	4 weeks @ £800.00 per week
Office Equipment	4 weeks @ £250.00 per week
Plant & Equipment	4 weeks @ £550.00 per week
Small Tools	4 weeks @ £200.00 per week
Scaffolding	4 weeks @ £500.00 per week
Electricity charges	£1,800.00 ? 4/13 weeks
Telephone charges	£360.00 ? 4/13 weeks
Security	4 weeks @ £400.00 per week
Welfare	4 weeks @ £450.00 per week

C *Other project-related costs*

Preliminary thickening

This relates to additional staff being employed on the project during the contract period, as a consequence of the number of instructions, revisions to drawings and dealing with a flow of information that was above that anticipated at tender stage.

A narrative will be necessary explaining the circumstances in detail. For example, an assistant QS may have been employed to action an excessive number of architects' instructions and other information flow items; an additional general foreman employed on site to review the many drawing revisions and instructions; an agency engineer to assist the general foreman. Additional to their basic costs are their associated site establishment costs.

Head office-related costs; general

One aspect of a loss and expense claim which is commonly misunderstood is the loss of contribution to head office overheads and profit. In fact many contractors forget the impact of a delayed project on their head office costs. It is, after all, the head office that provides the support and guidance to the on-site project team. Head office costs are paid for by the money received for carrying out work on the company's projects, and head office staff and support facilities are allocated to each project accordingly. Therefore, if a project is delayed and extended in time, then the support provided by the head office must also be extended for the same duration.

Typically, claims for loss of overheads and profit are combined as one head of loss. While this is not necessarily inappropriate, it is important to consider the characteristics of head office overheads and thus to recognise when they can be distinguished as a separate head of claim from loss of profits. Head office costs, sometimes referred to as home-office costs, are typically associated with the overall management of the business. They will usually include property costs, rent, rates, heat and light together with other central services and utilities. They also include the cost of head office staff, the directors and other senior management and support staff, their salaries and other benefits including cars and pension payments; the cost of information systems, finance and accounting departments, perhaps the in-house legal team and secretariat; and, often, the cost of a central QS/design team as well as related selling and marketing costs.

2 Head office overheads

This head of claim is for recovery of, or contribution to, the contractor's overheads and profit. While strictly speaking these are two heads, namely lost overheads and loss of profits, as stated earlier, they are usually combined and treated as one 'head of claim'. In essence, the logic behind a 'contribution claim' is that, as a result of delay or disruption to a given contract, head office resources inevitably become involved in dealing with the problems that arise in managing and providing support services to the contract in such circumstances. This will divert management resources from other duties, including the efficient and profitable running of other contracts, and perhaps, more importantly, looking for and winning new work.

Both of these diversions can lead to a reduction in the claimant's profit, through inefficiencies on other contracts or through failure to obtain contributions towards the overheads and profit of the business from new work.

The concept of lost contribution to overheads and profit is fairly straightforward to argue. But it is often a different matter producing sufficient robust evidence in a particular case to prove loss, even on the balance of probabilities. Again much will depend on the extent and quality of the contractor's records; and this means not just its accounting records. It can be equally important to be able to furnish contemporaneous records demonstrating the impact of the contract disruption on other parts of the business. The records could also include a schedule of tender opportunities not taken up or perhaps an analysis showing a reduction in tender success rate.

Calculation of the loss

Where the evidence justifies a claim for lost contribution to head office overheads and profit, how should it be calculated? By its very nature as a hypothetical loss there is no single right figure for any given claim.

The fact that damages cannot be assessed with certainty does not relieve the wrongdoer of paying damages. Where the precise evidence is obtainable the certifier, contract administrator, arbitrator, adjudicator or court naturally expects to have it; but where it is not, the certifier or court must do the best it can.

As much certainty and particularity must be given, both in submissions and pleadings, as proof of damages. However, damages can be received for future or projected loss – if reasonably anticipated – as a result of the defendant's wrong, whether such future damage is certain or contingent.

Very few companies are prepared to open up their accounting records to demonstrate their head office costs, so this is resolved by applying formulae based on the contract price and the duration of the extended contract period. The three most common formulae for calculating head office overheads are,

1 the Hudson formula;
2 Emden's formula;
3 Eichleay formula.

The Hudson formula

This formula was put forward in *Hudson's Building and Engineering Contracts*, tenth edition (1970). It uses the percentage allowance made by the contractor in his original contract sum for head office overheads and profit as the basis for the loss of contribution to overheads. The following formula is then applied.

$$\frac{\text{HO overheads/profit \%}}{100} \times \frac{\text{Contract price}}{\text{Contract period (weeks)}} \times \text{Period of delay (weeks)} = \text{weekly rate recoverable}$$

The Hudson formula is a very broadbrush approach to dealing with claims for head office overheads. However, it may not be appropriate to claim for loss of profit unless there is a clear indication that the contractor would have been able to earn profits on other contracts but for the overrun. Also it takes as its base overhead and profit percentages from the original contract price and these may not properly reflect the contractor's true overhead cost and profitability.

Emden's formula

This formula can be found in *Emden's Building Contracts and Practice*, eighth edition. It involves a two-stage calculation that applies the percentage that the contractor's total overheads and profit bear to the total revenue of the company. The second stage applies this percentage to the contract price, contract period and the period of delay to determine the weekly cost recoverable.

The advantage of this formula is that it uses a head office overhead percentage based on the contractor's total business rather than on the specific contract in dispute. Again this formula does not necessarily reflect the real effect on overhead costs arising from the delay, but it may provide a reasonable approximation particularly if some simplistic approach is looked for to assist in negotiating an out-of-court settlement. See below.

Stage 1

$$\frac{\text{Company overhead cost/profit}}{\text{Company revenue}} = \text{Z\%}$$

Stage 2

$$\frac{\text{Z\%}}{100} \times \frac{\text{Contract price}}{\text{Contract period (weeks)}} \times \text{Period of delay (weeks)} = \text{weekly rate recoverable}$$

The Eichleay formula

This formula originated in the United States, and seeks to establish the proportion of a contractor's head office overhead attributable to the project in question. It uses this proportion to compute an amount of overhead cost per week or per month and applies this to the period of delay. The Eichleay formula is a three-stage calculation shown below:

Stage 1

$$\frac{\text{Total value of project (incl. variations)}}{\text{Company revenue for contract period}} \times \text{Company overhead cost/profit} = \text{Allocable overhead for the project}$$

Stage 2

$$\frac{\text{The allocable overhead for the project}}{\text{Actual project period, incl. delay (weeks)}} = \text{weekly rate recoverable}$$

Stage 3

$$\text{Weekly rate recoverable} \times \text{Period of delay (weeks)} = \text{Head office's overhead costs}$$

Worked examples of the three formulae are included in chapter 29.

Which formula should be used?

The selection of a formula for head office overheads will depend on the circumstance of each case.

However, a word of caution about the Hudson formula. This relies on the accuracy and reliability of the contractor's tender. Also, the contract sum used for the calculation may contain an element of head office overheads and profit, so there could be double counting.

A further word of caution concerning the Eichleay formula. If a significant proportion of the total value of the project, say 10 per cent, is the value of variations, then an adjustment should be made to the input value into the formula to take account of the fact that the variations themselves may contain an element of head office overheads and profit.

Finally, it is suggested that the certifier, contract administrator, arbitrator, adjudicator or court should not be bound by the results of a particular formula, and that the use of one formula be compared with the results of another formula.

3 Other costs and charges

It is clear from established case law that contractors are entitled to finance charges as part of their prolongation, or loss and expense, claims.

When evaluating the cost of financing, the following important issues should be taken into account:

1 The appropriate rate of interest is that actually paid by the contractor provided that it is not unreasonable.
2 The financing cost shall be calculated on the basis that it is charged by the contractor's bank, i.e. the same rates and compounding interest at the same intervals.
3 However, where the contractor is self-financed or financed from within its own corporate group, the appropriate rate of interest is that earned by the contractor, or its corporate group, on monies it has placed on deposit.

Setting a date for interest payments to start

The Society of Construction Law's 'Delay and Disruption Protocol' offers good advice on this matter in paragraphs 1.15.6 and 1.15.7:

> *There are often arguments as to the date on which interest on a Contractor's claim should start to run. Contractors will argue that it should be the date on which they incurred expenditure for which they are entitled to compensation. Employers will say that interest should run only from the date that the Contractor has provided all information needed to satisfy them that the expenditure has been incurred.*
>
> *The appropriate starting date will not be the same in all circumstances, but generally the starting date for the payment of interest should be the earliest date on which the principal sum could have become payable, which will be the date for payment of the certificate issued immediately after the date the Contractor applied for payment of the loss and/or expense. This will be subject to any notice requirements in the contract. In contracts where there are no certificates, the*

> *Protocol recommends that interest should start to run 30 days after the date the* Contractor *suffered the loss and/or expense.*

These are sensible suggestions, and it is recommended that they are followed.

Prolongation of individual activities

For delays not on the actual critical path, there will be no general prolongation costs. However, there may be some time-related costs attributable to a particular activity, and its associated activities.

For example, an activity, not on the project's actual critical path, such as the fixing of specialist roof fascia and soffit panels may have required scaffolding to be in place for its entire duration together with craneage for part of its duration. If this work was delayed as a consequence of late information for which the employer was responsible then the cost of the scaffolding and craneage required solely for the activity should be recoverable.

Preceding the detailed section of the prolongation claim, it is good practice for the opening sections of the claim to contain the following information:

1 Introduction
2 The parties: formal details of the employer, contractor, architect and others in the professional team.
3 The contract: the form and specific type of contract, the contract sum, and then details of the clauses in the contract that the claim is made under.
4 The works: a brief description of the project.
5 Summary of facts: factual details of major events during the project together with dates of notices issued to the architect, engineer or contract administrator regarding additional costs or loss and expense incurred. Copies of the documents referred to should be included in an appendix.
6 Basis of the claim, referring in detail to the provisions (clauses) in the contract under which the claim is made.
7 Prolongation, the period of prolongation to be stated together with other relevant details such as extension of time and delay analyses submissions.

29 Worked example

Project details for the worked example

The project chosen for the worked example is a new mixed-use development, comprising 22 apartments, shops and offices. The contract value was £22 million, the contract start date was 3 October 2005 and the contract period was 56 weeks. The contract between the parties was the *Joint Contracts Tribunal Standard Building Contract with Quantities*, 2005 edition.

Unfortunately, delays occurred on the project, and practical completion was achieved some 22 weeks late. The contractor submitted several extension of time submissions based on the 'windows' technique, which is a retrospective delay analysis methodology. After reviewing the contractor's extension of time submissions, the contract administrator awarded extensions of time of 18 weeks in total.

After receiving the extension of time award, the contractor submitted the following prolongation claim.

1 Introduction

2 The Parties

Details of the employer, contractor, architect, structural engineer, services engineer and Quantity Surveyor are given.

3 The Contract

The Contract between the parties was the *Joint Contracts Tribunal Standard Building Contract with Quantities*, 2005 edition. The Contract Sum is stated, together with the contract start date and Date for Completion of the Works.

This submission provides the necessary detail to allow the sum of loss and expense that we, the contractor, have incurred under clauses 4.23 to 4.25, 'Loss and Expense', of the Contract.

4 The Works

The nature and location of the intended works are detailed in the first Recital of the Contract, namely,

'A new mixed-use development, comprising 22 apartments, shops and offices, located at "*xxx*".'

5 *Summary of Facts*

- *i* *On 15 September 2005, the Contract Administrator gave written notice to the Contractor to take possession of the site and commence the works on 3 October 2005.*
- *ii* *The Contractor took possession of the site and commenced the works on 3 October 2005.*
- *iii* *The Contractor gave the following notices of delay in accordance with clause 2.27 of the Contract.*
  - *i* *Letter dated 12 December 2005, as a result of architect's instruction 007.*
  - *ii* *Letter dated 17 January 2006, as a result of architect's instruction 022.*
  - *iii* *Letter dated 22 February 2006, as a result of architect's instruction 043.*
  - *iv* *Letter dated 16 March 2006, as a result of architect's instruction 062.*
  - *v* *Letter dated 6 April 2006, as a result of architect's instruction 070.*
  - *vi* *Letter dated 6 May 2006, as a result of architect's instruction 083.*
  - *vii* *Letter dated 22 July 2006, as a result of architect's instruction 108.*
  - *viii* *Letter dated 19 August 2006, as a result of architect's instruction 122.*
  - *ix* *Letter dated 24 September 2006, as a result of architect's instruction 145.*
  - *x* *Letter dated 7 October 2006, as a result of architect's instruction 161.*
  - *xi* *Letter dated 19 October 2006, as a result of architect's instruction 176.*
  - *xii* *Letter dated 7 November 2006, as a result of architect's instruction 183.*
  - *xiii* *Letter dated 17 December 2006, as a result of architect's instruction 201.*
  - *xiv* *Letter dated 7 January 2007, as a result of architect's instruction 211.*
  - *xv* *Letter dated 22 February 2007, as a result of architect's instruction 222.*
- *iv* *The Contractor provided further particulars, as requested by the Contract Administrator.*
- *v* *Before the date of Practical Completion the Contract Administrator made 5 number Awards of extension of time totalling 16 weeks, thereby revising the Date for Completion of the Works to 20 February 2007.*
- *vi* *Practical Completion of the project was achieved on 3 April 2007, some 22 weeks later than the original Date for Completion of the*

Works and 6 weeks later than the latest revised Date for Completion of the Works.

vii *On 4 May 2007, the Contractor submitted a further submission, supported by a detailed Delay Analysis, requesting an extension of time until 3 April 2007.*

viii *After consideration of the Contractor's latest extension of time, and after reviewing his previous decisions, the Contract Administrator awarded a further extension of time of 2 weeks (making a total of 18 weeks), thereby revising the Date for Completion of the Works to 6 March 2007.*

ix *Copies of the documents referred to above are included in appendix 'xx'.*

5 *Basis of this Loss and Expense Claim*

The Contract contains the following provisions.

(Note: clauses 4.23 to 4.25 of the Contract are repeated in full)

6 *Evaluation of Loss and Expense*

For the reasons given in 5 above, the contractor is entitled to direct loss and/or expense as follows:

Prolongation Costs

Site Overheads & Establishment

The period of prolongation is 18 weeks. The contractor is entitled to reimbursement of direct loss and/or expense for 18 weeks which occurred in the following time periods.

a *2005; 4th quarter* *3 weeks*
b *2006; 1st quarter* *4 weeks*
c *2006; 3rd quarter* *4 weeks*
d *2006; 4th quarter* *5 weeks*
e *2007; 1st quarter* *2 weeks*

a *Direct loss and expense incurred for the 3-week delay in 4th quarter of 2005.*

2005, 4TH QUARTER; 3-WEEK DELAY

		Rate per week	% allocated	Number of weeks	Actual cost
1	**Staff**				
1a	Project Manager	£1,100.00	100%	3 weeks	£3,300.00
1b	General Foreman	£950.00	100%	3 weeks	£2,850.00
1c	Site Engineer	£800.00	100%	3 weeks	£2,400.00
1d	Quantity Surveyor	£900.00	100%	3 weeks	£2,700.00
1e	Area Manager (part-time)	£1,500.00	33%	3 weeks	£1,500.00
1f	Buyer (part-time)	£850.00	20%	3 weeks	£2,550.00
2	**Site Establishment**				
2a	Hire of Offices	£800.00	100%	3 weeks	£2,400.00
2b	Office Equipment	£250.00	100%	3 weeks	£750.00
2c	Plant & Equipment	£550.00	100%	3 weeks	£1,650.00
2d	Small Tools	£200.00	100%	3 weeks	£600.00
2e	Scaffolding	£500.00	100%	3 weeks	£1,500.00
2d	Electricity charges	£100.00	100%	3 weeks	£300.00
2e	Telephone charges	£70.00	100%	3 weeks	£210.00
2f	Security	£400.00	100%	3 weeks	£1,200.00
2g	Welfare	£450.00	100%	3 weeks	£1,350.00
				Total	£25,260.00

b *Direct loss and expense incurred for the 4-week delay in 1st quarter of 2006.*

2006, 1ST QUARTER; 4-WEEK DELAY

		Rate per week	% allocated	Number of weeks	Actual cost
1	**Staff**				
1a	Project Manager	£1,100.00	100%	4 weeks	£4,400.00
1b	General Foreman	£950.00	100%	4 weeks	£3,800.00
1c	Site Engineer	£800.00	50%	4 weeks	£3,200.00
1d	Quantity Surveyor	£900.00	100%	4 weeks	£3,600.00
1e	Area Manager (part-time)	£1,500.00	33%	4 weeks	£1,500.00
1f	Buyer (part-time)	£850.00	20%	4 weeks	£3,400.00
2	**Site Establishment**				
2a	Hire of Offices	£800.00	100%	4 weeks	£3,200.00
2b	Office Equipment	£300.00	100%	4 weeks	£1,200.00
2c	Plant & Equipment	£600.00	100%	4 weeks	£2,400.00
2d	Small Tools	£230.00	100%	4 weeks	£920.00
2e	Scaffolding	£600.00	100%	4 weeks	£2,400.00
2d	Electricity charges	£150.00	100%	4 weeks	£600.00
2e	Telephone charges	£100.00	100%	4 weeks	£400.00
2f	Security	£450.00	100%	4 weeks	£1,800.00
2g	Welfare	£500.00	100%	4 weeks	£2,000.00
				Total	£34,820.00

c *Direct loss and expense incurred for the 4-week delay in 3rd quarter of 2006.*

2006, 3RD QUARTER; 4-WEEK DELAY

		Rate per week	% allocated	Number of weeks	Actual cost
1	**Staff**				
1a	Project Manager	£1,200.00	100%	4 weeks	£4,800.00
1b	General Foreman	£1,000.00	100%	4 weeks	£4,000.00
1c	Site Engineer	£850.00	25%	4 weeks	£3,400.00
1d	Quantity Surveyor	£950.00	50%	4 weeks	£3,800.00
1e	Area Manager (part-time)	£1,600.00	33%	4 weeks	£1,500.00
1f	Buyer (part-time)	£900.00	20%	4 weeks	£3,600.00
1g	Finishing Foreman	£800.00	100%	4 weeks	£3,200.00
2	**Site Establishment**				
2a	Hire of Offices	£800.00	100%	4 weeks	£3,200.00
2b	Office Equipment	£300.00	100%	4 weeks	£1,200.00
2c	Plant & Equipment	£600.00	100%	4 weeks	£2,400.00
2d	Small Tools	£230.00	100%	4 weeks	£920.00
2e	Scaffolding	£600.00	100%	4 weeks	£2,400.00
2d	Electricity charges	£150.00	100%	4 weeks	£600.00
2e	Telephone charges	£100.00	100%	4 weeks	£400.00
2f	Security	£450.00	100%	4 weeks	£1,800.00
2g	Welfare	£500.00	100%	4 weeks	£2,000.00

d *Direct loss and expense incurred for the 5-week delay in 4th quarter of 2006.*

2006, 4TH QUARTER; 5-WEEK DELAY

		Rate per week	% allocated	Number of weeks	Actual cost
1	**Staff**				
1a	Project Manager	£1,200.00	100%	5 weeks	£6,000.00
1b	General Foreman	£1,000.00	100%	5 weeks	£5,000.00
1c	Site Engineer	£850.00	10%	5 weeks	£4,250.00
1d	Quantity Surveyor	£950.00	50%	5 weeks	£4,750.00
1e	Area Manager (part-time)	£1,600.00	33%	5 weeks	£1,500.00
1f	Buyer (part-time)	£900.00	10%	5 weeks	£4,500.00
1g	Finishing Foreman	£850.00	100%	5 weeks	£4,250.00
2	**Site Establishment**				
2a	Hire of Offices	£700.00	100%	5 weeks	£3,500.00
2b	Office Equipment	£250.00	100%	5 weeks	£1,250.00
2c	Plant & Equipment	£450.00	100%	5 weeks	£2,250.00
2d	Small Tools	£180.00	100%	5 weeks	£900.00
2e	Scaffolding	£350.00	100%	5 weeks	£1,750.00
2d	Electricity charges	£170.00	100%	5 weeks	£850.00
2e	Telephone charges	£90.00	100%	5 weeks	£450.00
2f	Security	£350.00	100%	5 weeks	£1,750.00
2g	Welfare	£400.00	100%	5 weeks	£2,000.00
				Total	£44,950.00

e *Direct loss and expense incurred for the 2-week delay in 1st quarter of 2007.*

2007, 1ST QUARTER; 2-WEEK DELAY

		Rate per week	% allocated	Number of weeks	Actual cost
1	**Staff**				
1a	Project Manager	£1,200.00	100%	2 weeks	£2,400.00
1b	General Foreman	£1,000.00	50%	2 weeks	£2,000.00
1d	Quantity Surveyor	£950.00	100%	2 weeks	£1,900.00
1e	Area Manager (part-time)	£1,600.00	15%	2 weeks	£1,500.00
1f	Buyer (part-time)	£900.00	10%	2 weeks	£1,800.00
1g	Finishing Foreman	£850.00	100%	2 weeks	£1,700.00
2	**Site Establishment**				
2a	Hire of Offices	£600.00	100%	2 weeks	£1,200.00
2b	Office Equipment	£200.00	100%	2 weeks	£400.00
2c	Plant & Equipment	£350.00	100%	2 weeks	£700.00
2d	Small Tools	£150.00	100%	2 weeks	£300.00
2e	Scaffolding	£250.00	100%	2 weeks	£500.00
2d	Electricity charges	£150.00	100%	2 weeks	£300.00
2e	Telephone charges	£90.00	100%	2 weeks	£180.00
2f	Security	£300.00	100%	2 weeks	£600.00
2g	Welfare	£250.00	100%	2 weeks	£500.00
				Total	£15,980.00

Total Site Overheads and Establishment £160,230.00

Head Office Overheads

As a consequence of the 18 weeks' delay to the project, the Contractor was required to retain key staff and resources on site for an additional period of 18 weeks and was deprived of making a contribution to the company's head office overheads and profit. Furthermore, head office support staff and services were involved with the project for a period of 18 weeks. The Contractor is therefore entitled to recover this loss pursuant to the provisions mentioned in '5' above.

Using the Eichleay formula,

Stage 1

$$\frac{£21{,}000{,}000}{£56{,}000{,}000} \times £2{,}800{,}000.00 = £1{,}050{,}000.00$$

Stage 2

$$\frac{£1{,}050{,}000.00}{74} = £13{,}461.54$$

Stage 3

$$£13{,}461.54 \times 18 \text{ weeks} = £242{,}307.72$$

Total Head Office Overheads £242,307.72

Note: the Eichleay formula was presented in the submission, but for comparison purposes, the results using the Hudson and Emden formulae are given below.

$$\frac{6\%}{100} \times \frac{£22{,}000{,}000.00}{56} \times 18 = £388{,}928.57$$

Stage 1

$$\frac{£3{,}080{,}000.00}{£56{,}000{,}000.00} \quad 5.50\%$$

Stage 2

$$\frac{5.50\%}{100} \times \frac{£22{,}000{,}000.00}{56} \times 18 = £392{,}464.29$$

Total Loss and Expense claim for 18 weeks' Prolongation £402,527.72

Appendices

Appendix 1
Definitions and glossary

This appendix provides definitions and explanations for words and expressions commonly used in extension of time and delay situations.

The appendix includes information in the 'Glossary of Terms' as produced by the Planning Engineers Organisation, which has kindly given its permission for this inclusion.

Acceleration Taking or planning active measures to complete work ahead of the project programme and/or to recover delays. Such action usually increases the overall cost of the project. See also **Mitigation**.

Accepted programme A programme submitted by a contractor, or subcontractor, for the whole of the works for acceptance by the CA (or similar). Once so accepted, it becomes known as the 'accepted programme'.

Activity An operation or process in a project that consumes time and also usually consumes or uses other resources, e.g. people, materials, equipment. An activity is a measurable element of the total project programme, but depending on the hierarchy or level of detail of the programme, may be divisible into smaller or more detailed activities.

Activity duration The time calculated or estimated to carry out an activity, generally taking into account a specific level of resource.

Activity ID A unique code, usually alpha-numeric that identifies each activity in a project.

Activity-on-arrow network A network technique that uses arrows to represent activities. Preceding and succeeding activities join at nodes or events.

Activity-on-node network A network technique that uses nodes (generally symbolised by 'boxes') to represent activities. Also known as a precedence diagram.

Activity-orientated scheduling The method of developing a programme that determines the sequence and timing of activities based on the logical work process only and does not take account of any potential limitations of resources.

Actual dates The dates relating to when an activity started and/or finished.

Actual duration The length of time an activity took to complete.

Actual finish The date when an activity finished.

Actual progress The amount of work that has been completed at a given point in time.

Actual start The date when an activity started.

As-built dates The actual start and finish dates for an activity.

As-built network A network such that the activity durations, sequence and start and finish dates reflect the actual durations, actual start and actual finish dates. Dependencies and other constraints in the as-built network should be carefully considered to represent the actual dependencies and constraints encountered in the project and as such they result in the actual durations, actual start and actual finish dates of the activities.

As-built programme A programme that represents the history of the project showing the actual start, actual finish and actual duration of the activities. The as-built programme does not necessarily have any logic links. It is usually in barchart format.

As-late-as-possible Timing or positioning of an activity in a programme at its latest start/latest finish dates such that there is no free float on the activity and the timing of other activities in the programme and overall duration of the programme is not affected.

Backward pass The procedure whereby the latest dates of activities in a network are calculated.

Barchart A graphical chart on which activities are represented as bars drawn to a common time scale. Typically, a date scale is drawn across the top of the page and a list of activities down the lefthand side of the page. Activity timing and durations are represented by horizontal bars. Additional information, such as resources, costs and dependencies are also often shown on the chart.

Baseline programme A fixed or record programme against which current or future activity is referenced. Often taken to mean the first or original plan, but can be reset (for instance following a change to the project scope) at which point the reset programme becomes the baseline programme.

Branch A discrete part of a programme generally represented by a single activity that is broken down by a project hierarchy and comprises further detail at sub-activity level.

Buffer activity An activity in a programme that acts as a contingency or to artificially absorb float.

Calculate schedule The mathematical analysis of a network, generally using a computer and project management software, to determine the earliest and latest starts and finishes and float of the activities and the overall project duration. Often carried out following the addition of actual progress to determine the effect of progress on the network, primarily the completion date of the project.

Calendar A list of the time intervals during which activities can be worked and/or resources used. Typical data includes working days/non-working days, start and finish times for shifts, weekends, holiday periods and extra workdays. Each activity and/or resource will have a calendar attached to it. A project can contain many calendars, each with different working and non-working periods.

Change or **variation** Any difference between the circumstances and/or content of the contract works as carried out, compared with the circumstances and/or content under which the works are described in the contract documents as required to be or intended to have been carried out. A change or variation may or may not carry with it a right to an extension of time and/or additional payment.

Collapsed as-built A method of delay analysis where the effects of events are 'subtracted' from the as-built programme to determine what would have occurred but for those events.

Compensable event Expression sometimes used to describe an employer risk event in respect of which the contractor is entitled to compensation.

Compensation The recovery or payment of money for work done or time taken up whether by way of valuation, loss and/or expense or damages.

Concurrency True concurrent delay is the occurrence of two or more delay events at the same time, one an employer risk event, the other a contractor risk event, the effects of which are also felt at the same time. The term 'concurrent delay' is often used to describe the situation where two or more delay events arise at different times, but the effects of them are felt (in whole or in part) at the same time. To avoid confusion, this is more correctly termed the 'concurrent effect' of sequential delay events.

Constraints Restrictions that affect the sequence or timing of an activity. These include predecessor dependencies but more often refer to imposed dates.

Constructive acceleration Acceleration following failure by the employer to recognise that the contractor has encountered employer delay for which it is entitled to an EOT and which failure required the contractor to accelerate its progress in order to complete the works by the prevailing contract completion date. This situation may be brought about by the employer's denial of a valid request for an EOT.

Contract administrator (CA) The person responsible for administration of the contract, including certifying what extensions of time are due, or what additional costs or loss and expense should be allowed. Depending on the form of contract, the person may be referred to by such terms as employer's agent, employer's representative, contract administrator, project manager or supervising officer or be specified as a particular professional, such as the architect or the engineer. The contract administrator may be one of the employer's employees.

Contract completion date The date by which the contractor is contractually obliged to complete the works. As well as being an overall date for completion, the contract completion date may be the date for completion of a section of the works or a milestone date. The expression 'completion date' is sometimes used by contractors to describe the date when they plan to complete the works (which may be earlier than the contract completion date).

Contractor risk event An event or cause of delay which under the contract is at the risk and responsibility of the contractor.

Critical activity An activity with zero float. If a critical activity is delayed or extended, it will delay or extend the completion of the project and, generally, if a critical activity is advanced or reduced it will advance or reduce the completion of a project.

Critical delay A delay to progress of any activity on the critical path will, without acceleration or re-sequencing, cause the overall project duration to be extended, and is therefore referred to as a 'critical delay'.

Critical path The sequence of activities through a project network from start to finish, the sum of whose durations determines the overall project duration. There may be more than one critical path depending on workflow logic.

Critical path analysis (**CPA**) and **Critical path method** (**CPM**) The critical path analysis or method is the process of deducing the critical activities in a programme by tracing the logical sequence of tasks that directly affect the date of project completion. It is a methodology or management technique that determines a project's critical path. The resulting programme may be depicted in a number of different forms, including a Gantt or barchart, line-of-balance diagram, pure logic diagram, time-scaled logic diagram or as a time-chainage diagram, depending on the nature of the works represented in the programme.

Culpable delay An expression sometimes used to describe a contractor delay.

Delay analysis The methodological investigation of the causes and effects of activities, or sequences of activities, completing later than planned.

Delay event An event or cause of delay, which may be either an employer risk event or a contractor risk event.

Delay to completion This expression may mean either delay to the date when the contractor planned to complete its works, or a delay to the contract completion date.

Delay to progress A delay which will merely cause delay to the contractor's progress without affecting the contract completion date. It is either an Employer Delay to Progress or a Contractor Delay to Progress.

Dependency Logical interrelationships between activities. In a network there can be one or more dependency between any two activities. There are four types of dependency: 'finish to finish', 'finish to start', 'start to finish' and 'start to start'. The dependencies dictate the sequence in which activities can be carried out.

Disruption Disturbance, hindrance or interruption of a contractor's normal work progress, resulting in lower efficiency or lower productivity than would otherwise be achieved. Disruption does not necessarily result in a delay to progress or delay to completion.

Driving Where there are a number of dependencies to an activity the driving dependency is the dependency, or dependencies, that result in the timing of the start and/or finish of that activity. The implication is that there is free float on non-driving dependencies.

Drop line A method of indicating progress of activities on a barchart. A vertical line starting at Time Now links the ends of the bars at the point representing the progress achieved for that activity. Where the drop line deviates to the left the activity is behind programme, where the drop line is vertical the activity is on programme and where the drop line deviates to the right the activity is ahead of programme.

Duration The length of time needed to complete an activity. The time period can be determined inductively, by determining the start and finish date of an activity or deductively by calculation from the time necessary to expend the resources applied to the activity.

Early finish This is the earliest programmed calendar date on which an activity can be finished before any of its succeeding float is consumed.

Early start This is the earliest programmed calendar date on which an activity can be started before any of its preceding float has been consumed.

Employer delay An expression commonly used to describe any delay caused by an employer risk event.

Employer delay to completion A delay which will cause a contract completion date not to be met.

Employer delay to progress A delay which will merely cause delay to the contractor's progress without causing a contract completion date not to be met.

Employer risk event An event or cause of delay which under the contract is at the risk and responsibility of the employer.

Excusable delay Sometimes used to describe an employer delay in respect of which the contractor is entitled to an extension of time.

Extension of time (EOT) Additional time granted to the contractor to provide an extended contractual time period or date by which work is to be, or should be completed and to relieve it from liability for damages for delay (usually liquidated damages).

Float or **Slack** The amount of time between the early start date and the late start date, or the early finish date and the late finish date of any of the activities in a programme.

Free float The amount of time an activity can be delayed beyond its early start/early finish dates without delaying the early start or early finish of any immediately following activity.

Gantt Chart Barchart named after its originator, Henry Gantt.

Global claim A global claim is one in which the contractor seeks compensation for a group of employer risk events but does not or cannot demonstrate a direct link between the loss incurred and the individual employer risk events.

Hammock An activity representing the period from the start of an activity to the completion of another. Sometimes used as a way of summarising the duration of a number of activities in a programme as one single duration.

Hanging activity An activity not linked to any preceding or successor activities. Sometimes called a 'dangling activity'.

Head office overheads Head office overheads are the incidental costs of running the contractor's business as a whole and include indirect costs, which cannot be directly allocated to production, as opposed to direct costs, which are the costs of production. Among other things, these overheads may include such things as rent, rates, directors' salaries, pension fund contributions and auditors' fees.

Impact The effect that a change has on an activity or the effect that a change to one activity has on another activity.

Key date Expression sometimes used to describe a date by which an identifiable accomplishment must be started or finished. Examples include 'power on', 'weathertight' or the start or completion of phases of construction or of phases or sections of the contract, or completion of the works.

Lag Lag in a network diagram is the minimum necessary lapse of time between the finish of one activity and the finish of another overlapping activity.

Lead The opposite of lag, but in practice having the same meaning. A preceding activity may have a lag to a successor activity – from the perspective of the successor activity, that is a lead.

Liquidated and ascertained damages (LADs) or **Liquidated damages (LDs)** A fixed sum, usually per week or per day, written into the contract as being payable by the contractor in the event that the works are not completed by the contract completion date, original or extended.

Logic links The normal links are as follows:

- finish-to-start (FS);
- lagged finish-to-start (FS+/–);
- start-to-start (SS);
- lagged start-to-start (SS+/–);
- finish-to-finish (FF);
- lagged finish-to-finish (FF+/–);
- lagged start and finish (SF+/–).

See Appendix 2 for further details and examples of logic links.

Method statement A written description of the contractor's proposed manner of carrying out the works or parts thereof, setting out the assumptions underlying the programme, the reasoning behind the approach to the various phases of construction and listing all the work encapsulated in the programme activities. It may also contain the activity duration calculations and details of key resources and gang strengths.

Milestone A key event selected for its importance in the project. Commonly used in relation to progress, a milestone often serves to signify a key date.

Mitigation To mitigate means to make less severe or less serious. In connection with delay to progress or delay to completion, it means minimising the impact of the risk event. In relation to disruption or inefficient working, it means minimising the disruption or inefficiency. Failure to mitigate is commonly pleaded as a defence or partial defence to a claim.

Must start/Must finish Most project management software allows the user to specify that an activity must start or must finish on a specific date. Using the software in this way restricts the ability of the programme to react dynamically to change on the project.

Negative lag See **Logic links** above.

Negative total float Expression sometimes used to describe the time by which the duration of an activity or path has to be reduced in order to permit a limiting imposed date to be achieved. Negative float only occurs when an activity on the critical path is behind programme. It is a programming concept, the manifestation of which is, of course, delay.

Non-compensable event Expression sometimes used to describe what the protocol calls a contractor risk event.

Non-excusable delay Sometimes used to describe what the protocol calls contractor delay.

Path An activity or an unbroken sequence of activities in a project network.

PERT 'Programme Evaluation and Review Technique': a programming technique, similar to critical path analysis, but whereby the probability of completing by the contract completion date is determined and monitored by way of a quantified risk assessment based on optimistic, pessimistic and most likely activity durations.

Planned completion date See **Contract completion date**.

Practical completion The completion of all the construction work, subject only to very minor items left incomplete. It is generally the date when the obligation to insure passes from the contractor to the employer and the date from which the defects liability period runs. This is the term used under the Joint Contracts Tribunal family of contracts. Under the Institution of Civil Engineers forms and in the International Federation of Consulting Engineers forms it is referred to as substantial completion.

Precedence diagram A multiple dependency, activity-on-node network in which a sequence arrow represents one of four forms of precedence relationship, depending on the positioning of the head and the tail of the sequence arrow. See also **Logic links**.

Programme The programme illustrates the major sequencing and phasing requirements of the project. Otherwise known as the schedule.

Prolongation The extended duration of the works during which costs are incurred as a result of a delay.

Resource Expression to describe any variable capable of definition that is required for the completion of an activity and may constrain the project. This may be a person, item of equipment, service or material that is used in accomplishing a project task.

Resource levelling Expression used to describe the process of amending a schedule to reduce the variation between maximum and minimum values of resource requirements. The process removes peaks, troughs and conflicts in resource demands by moving activities within their early and late dates and taking up float. Most project-planning software offers an automated resource-levelling routine that will defer the performance of a task within the imposed logical constraints until the resources assigned to the tasks are available.

Risk event See **Employer risk event** and **Contractor risk event**.

Schedule Another name for the programme.

Slack Another name for total float.

Sub-network A group of activities or durations, logically linked. In the protocol it is to be used to illustrate the work flowing directly from an employer risk event.

Substantial completion See **Practical completion**.

Time impact analysis Method of delay analysis where the impacts of particular delays are mapped out at the point in time at which they occur, allowing the discrete effect of individual events to be determined.

Total float The amount of time that an activity may be delayed beyond its early start/early finish dates without delaying the contract completion date.

Updated programme In the protocol the updated programme is the accepted programme updated with all progress achieved. The final updated programme should depict the as-built programme.

Works What the contractor is obliged to construct is referred to as the works.

Variation See **Change**.

Appendix 2

Levels of programmes

Contents

1 Client's or owner's programme/schedule

The purpose of the client's or owner's programme/schedule is to set out the client's/owner's desired overall time requirements for the project.

A number of different types of organisation might produce this programme or schedule, including the client/owner themselves, their project manager, an architect, engineer or quantity surveyor. This will vary from industry to industry and will be largely dependent upon the structure and contractual arrangements of the individual project.

The purpose of this programme/schedule is to inform the project participants as to what the client/owner wants to be achieved. This programme/schedule is sometimes used as the basis for obtaining tenders for the work that follows. It also sometimes serves to describe the client's vision or aspirations, in terms of time, appointments, phasing, handovers and the like.

Rarely is this programme/schedule based on a critical path analysis. Sometimes it is not presented as a programme or schedule at all, instead being described by a set of dates in a contract, enquiry document, or as a set of milestone target dates to be achieved. This often lays out the major date time frames for design, procurement, assembly, production, construction, etc.

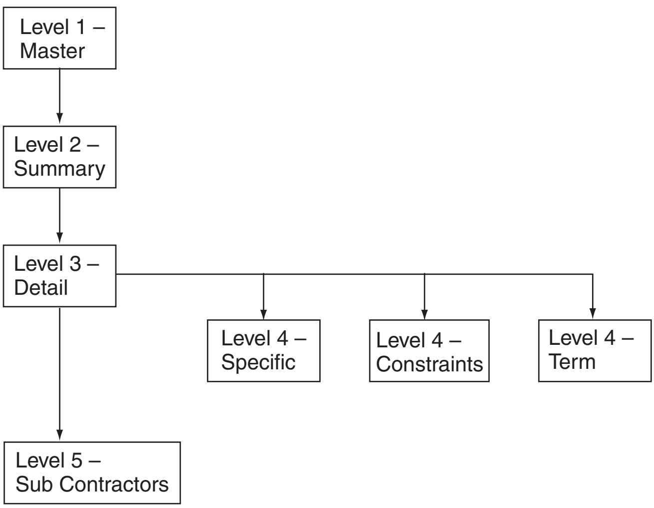
This programme/schedule has not been included within the standard levels as defined in this volume; it invariably is not part of the main planning/scheduling undertaken on the project – it defines the key stages and dates of all of the work that follows.

2 Proposed levels of programme/schedule for a single project

Appendix 1 at the end of this document presents the proposed standardised levels of programme/schedule for a single project. Later in this document the levels for an entire range of projects, or programme of projects, are described.

The various programmes or schedules produced for a single project are generally produced using five levels, and each is discussed within this volume.

The basic premise of this volume is that programmes/schedules should be produced using a standard set of levels.



Level 1 The overall master programme/schedule for the project

The purpose of this level 1 programme/schedule is to show the overall coordinated timing of all aspects of the project. This will include topics such as feasibility, design, procurement, manufacture, assembly, production, construction, installation and commissioning.

Sometimes, this level 1 programme/schedule is used during the initiation or feasibility stage of a project and may form part of an overall business plan.

This is the high-level programme/schedule against which the overall timing of the project is set out and communicated against which the overall progress is reported to the client/owner. Often, it is presented not only as a barchart, but also with a set of milestone dates against which the project is monitored.

Ideally, this programme/schedule should be no more than a single sheet, containing perhaps 30 to 100 activities (depending upon the complexity of the project). The target milestone dates defined by the client/owner are often also included.

This programme/schedule will normally illustrate the critical path of the project.

The important point here is to consider who will receive and review this level 1 programme/schedule, which can often include people who do not readily understand such matters, meaning that the level of complexity should reflect this. There is little point in producing something that cannot be understood by those who need to access it.

Level 2 The summary level programmes/schedules for the project

The main purpose of these programmes/schedules at level 2 is to set out when each of the key elements will take place. For example, they should detail when each part of the design will be undertaken, or each part of the procurement/assembly, or each part of the installation, production or construction. These programmes/schedules are to illustrate a summary of the more detailed levels that follow.

They will often comprise a suite of linked individual programmes for each key element of the project, such as design, procurement and production or construction. Alternatively this could be one programme that includes the work of all key elements of the project, with the programmes of individual elements, such as design, procurement, production or construction, being created by using filters to select which activities are to be represented on individual programmes/schedules.

Ideally, these various programmes/schedules will all be produced or coordinated by a single party, although this will depend on the contractual arrangements for the project.

The entire scope of the project should be covered at this and subsequent levels. These summary programmes will show the critical path for the project. Another main purpose may be the control of the project by EVA, CPA, etc. They should involve sufficient detail to do three things.

First, they should enable all involved in that element to fully understand what needs to be done when and by whom.

Second, they should enable those involved in a particular element to fully understand how their own work interfaces with that work in another element (or within the same element). For the purposes of this volume, different elements might be design, procurement, installation, production or construction. A good example of this is the design of the project. The level 2 summary design programme will be used by, say, the procurement or construction team to understand how the timing of the design will affect the procurement or installation/construction activities that follow.

Third, they should facilitate the monitoring and reporting of progress on the project.

The number of activities on these level 2 programmes will obviously depend on the complexity of the project. As a suggestion, individual activities should take no longer than four to six weeks each, as longer periods make it difficult to assess progress.

In most cases, it will be essential for each of the level 2 programmes to be logically linked together, in order that the implications of progress achieved on one element can be seen on another element.

On smaller projects, these summary programmes/schedules may not be needed.

Level 3 The detailed level

The purpose of detailed level 3 programmes/schedules is to show the detailed timing of all of the activities on the project. They should definitely show the critical path, and will often include details of the resources needed to undertake that element or stage of the work.

Sometimes, depending on the contractual arrangements for the project, one party will be responsible for producing all of these level 3 programmes/schedules and for coordination between them. For example, on a project being undertaken on a design and build contractual arrangement, this will almost certainly be the case.

In other instances, say where the design is undertaken by one party and the installation/production/construction by a different separate party (for example, in UK traditional, fixed-price construction contracts) these various level 3 programmes/schedules might be produced by different organisations.

Examples of the different types of level 3 programme/schedule include the following:

- The detailed design programme, showing every drawing to be produced.
- The detailed authorities' approvals and statutory processes programme.
- The detailed procurement programme, outlining the timing of subcontract tenders to be obtained, placing of orders, manufacture times, lead times, delivery dates and the like.
- The detailed production, construction, installation or assembly programmes/schedules, including the timing of all physical works on site, for each part of the project.

Additionally, each of the programmes/schedules could be further broken down into off-site and on-site works.

Often, these detailed programmes are produced in advance of appoint-ing the various specialists (designers and subcontractors) in order to set out the overall detailed timing of activities and interfaces on the project. This is often difficult to achieve as the input from those specialists is required to fully test the detail. Also, some degree of replacing the original detail will be required once the various specialists' own programmes/schedules are received.

Depending upon the contractual arrangements for the project, these programmes/schedules might or might not be shared with the client. Whether they are or not, the purpose of them is to clearly set out when each individual detailed part of the project is to be undertaken and by whom.

Level 4 The specific, term and constraints level

The main purpose of this level is to extract material from the level 3 key detailed information that is then used to create further programmes/schedules at level 4. These are a group of programmes/schedules often produced by filtering the detail of the level 3 programmes although sometimes these level 4 programmes are stand-alone programmes not linked electronically to other levels.

These cover a wide range of uses, these typically being:

- programmes/schedules produced to cover specific areas or aspects of the project;
- short-term and medium-term look-ahead programmes/schedules covering the detailed activities for the next few days, weeks or months, sometimes referred to as look-ahead programmes/schedules;
- programmes/schedules specifically produced to give guidance to individual subcontractors on when their work will need to be carried out, sometimes called constraints programmes.

Often these specific level programmes/schedules are derivatives of the detailed level 3 ones and are created by applying a number of different filters based on the coding structure and capabilities of the software used. For example, these filters/coding structures can be used to produce programmes/schedules of work for each manager, each subcontractor, or for different areas of work or location, or by floor level, etc.

Level 5 The subcontractors' programmes/schedules

These level 5 programmes/schedules allow the subcontractors to set out the detailed timing of their own work. They are often produced by subcontractors to further define their work if the detail contained at level 3 is insufficient for their purposes. No matter what system the subcontractors adopted, the overall time frame for their work must conform to the time frames set out in the level 3 programme/schedule.

The subcontractors uses these programmes/schedules to monitor and report progress of their own works. Most often, they are held in different software databases to the level 1, 2, 3 and 4 programmes/schedules.

The particular contractual arrangements and processes involved might determine that the level 5 programmes are not electronically linked to the levels above. They might be regarded as stand-alone in their own right. However, whether electronically linked to the levels above or not, it is essential that the critical path for each individual subcontractor's work is shown on their own programme. Later, if there is a claim from a subcontractor, it is crucial that the originally anticipated subcontractor's critical path was shown in order to assess the validity of that claim.

There are essentially two approaches to the subcontractors' programmes/schedules. The subcontractors could either produce these as stand-alone programmes/schedules, or the subcontractors could assist in the development of the level 3 programmes/schedules, with their own specific activities being included within the main level 3 programme/schedule.

3 Proposed levels for smaller projects

On some smaller projects, different arrangements may be used for the various levels of programming/scheduling.

Depending upon the size of the project, levels 3, 4 and 5 are sometimes combined together into one single level. This can incorporate the work of all parties into one detailed programme, with one party retaining responsibility for that detailed programme.

Additionally, on some smaller projects, the level 2 summary programmes/schedules may not be necessary.

4 Proposed levels of programme/schedule for a group or programme of projects

The proposed standardised levels of programme/schedule for a group or programme of projects are almost exactly the same as described for an individual project in section 4 above, in that the levels of programme/schedule for each project within a group of projects will be the same as that described in section 2.

The main difference with a group of projects is that an additional level of programme/schedule, called level 0, is introduced to show the summary of all projects within the group.

The level of detail in this level 0 programme/schedule depends on how many projects make up that group or programme. If it is a small number, say three or four, then each of the individual projects could be represented by, say ten activities each. If a large number of individual projects make up the group, then each project might be represented by only one activity.

5 Important associated considerations

When reviewing the various programmes/schedules defined in this volume, one also has to consider how they will be created. While this is not the purpose of this volume, it is worth mentioning here that there could be two approaches to this.

The first is whether all of the various levels are created as one integrated programme/schedule. One can see that the various levels could be produced working towards what will eventually be a single, totally integrated, fully logic-linked programme/schedule that is divided into the various levels. This can be achieved by the creation of the level 1 programme/schedule first, with level 2 being a detailed expansion of level 1, the level 2 programme/schedule is then in turn further detailed to create level 3, and so on.

This approach ensures that all activities are fully integrated with all other activities at every level. This is without a doubt the most suitable option as it aids simplicity – having all of the programme/schedule information in one place maintains control and limits the chance of confusion, or even worse, unco-ordinated programmes/schedules with the inevitable problems that will arise.

The second approach is potentially more difficult, in that the various levels are produced as separate individual programmes/schedules that are not integrated, but maintained as stand-alone. This approach is sometimes practically easier to achieve, in that the various parties responsible for certain aspects of the scheduling – say a design firm, a manufacturing firm, a construction contractor and subcontractors – will find it easier to produce their own programmes/schedules. However, this approach can lead to the content being held in different locations on different databases and can lead to confusion and out-of-date information being used.

It can be argued that one approach is more valid than the other but, as stated above, this is not the purpose of this volume.

Whichever approach is adopted, what is important is that, once the various levels of programme/schedule have been completed and approved by all, they become the as-planned programme/schedule against which all subsequent programmes/schedules are measured.

Occasionally, one hears of projects that run two sets of programmes/schedules – the master set and what is commonly known as a target programme or schedule. The latter is often used in an attempt to shorten the overall duration of the project but employing this method is fraught with difficulties due to the potential for confusion as to which programme/schedule different organisations, designers, contractors and subcontractors are working to. Extreme caution must be exercised if this approach is adopted.

Additionally, when creating the various levels of a programme/schedule, one often also has to consider the impact of the work breakdown structure

(WBS) of the project. From a programming/scheduling point of view, there is often no real requirement to take the WBS into consideration, but practical application shows that this can be helpful on complex projects in finding common ground between cost/budget and programming/scheduling.

The various programmes produced at prequalification and tender stage have been deliberately excluded here. This is due to the fact that most often, these are separate programmes/schedules that are not linked to the main project programmes/schedules.

What is not covered here is *how* the various levels of programme/schedule are produced. In some organisations, the level 1 programme is produced first, with all subsequent levels being created as a derivative of that. In other words, the various levels are created in sequence level 1, level 2, level 3, and so on. In researching for this volume, it has become apparent that in other organisations the detailed levels of programme/schedule may be created first and then generate the master level.

Appendix 3

Model specification for a 'windows' analysis

The starting point, as with any method of delay analysis, is the contract. This should be reviewed, together with contractual/legal advisers if appropriate, to find out if there are any specific or implied clauses which determine the methodology or type of analysis.

Introduction

A windows analysis focuses on the impact of delays in specific periods of time, identifying gains or losses (delays and recovery) to the actual critical and sub-critical paths as they occur within each period of time.

The project life is divided into a series of consecutive time 'windows'. Each 'window' is analysed to identify the activities that were impacted, i.e. delay or recovery, and the results are investigated to identify the events that caused the deviation in progress.

This form of analysis identifies concurrent delays, through the examination of progress within a defined and short period of the project's life. The length and impact of concurrent delays on the project is established by applying the same approach in consecutive windows.

It must be emphasised that the results of the analysis will not identify the causes of delays, but only quantify the effect, or time impact, of such causes. However, the linkage to a cause, or causes, should be able to be established by using the analysis results to research and locate the necessary contemporaneous factual information. This approach verifies the cause-and-effect relationship.

Further, as windows analysis is based on actual delay that has occurred, the results are more easily linked to quantum.

Methodology

General

1 The programme(s) used for analysis should be in the form of a network (CPM format). This format enables the impact of a delay on

the project completion date, or other contractual milestones, to be established. However, for some projects the 'baseline programme' is only in the form of a barchart with no logic relationships between activities. In these cases, a network should be created from the barchart by the analyst, using his construction experience and technical knowledge to introduce logic links between related work activities. The activity durations should remain the same. When 'time-analysed', the planned start and finish dates for activities should mirror those as shown on the 'baseline programme' barchart.

2 The use of specialist in-house software should be avoided.

3 It is recommended that a transparent approach in carrying out a windows analysis be adopted, and that an audit trail of the project's contemporaneous information reviewed and used for the analysis be maintained and made available to support the analysis results. It is advisable to provide reasoning for the selection of important information and for any amendments to progress data, etc.

Preparation

1 Define the baseline programme, or programmes, to serve as a basis for the analysis.

   a It is recommended that the 'baseline programme' established at the start of the project be used for analysis of the first window. However, the programme should be subject to a rigorous 'reliability exercise', and any necessary modifications made, before being used for analysis.

   b If the baseline programme underwent a complete revision, was issued to the contract administrator, and subsequent progress reports were related to the 'revised programme', then this revised programme should replace the original baseline programme for the windows analysis, as and when it became the working programme.

   c If further revised programmes were issued during the life of the project, and became the working programme, then these should also be incorporated into the analysis, replacing the previous programme, again, as and when they became the working programme.

2 Establish the length of each window, and the number of windows.

   a The windows can be weekly, fortnightly or monthly and will generally be defined by the frequency of reports of actual site progress. For example, if progress on a project was recorded monthly as of the last day of each month, then a 'window' would cover the period between 1 January and 31 January, and the next window would cover the period between 1 February and 28 February, and so on up to project completion.

   b Unless there are specific reasons, the first window should start on the project commencement date and the last window should end on *the project completion date, i.e. certified date of handover or practical completion. This gives a series of consecutive windows covering the life of the project.*

3 Collect the progress data and review apparent anomalies.

a It is recommended that the project's contemporaneous progress reports should be used, where possible, as the basis for the 'progress data' in the analysis.

b Progress data consists of actual start and finish dates and, where an activity's actual duration spans more than a single window, the percentage progress achieved as at the end of a window.

c The collected progress data should be reviewed for apparent anomalies, e.g. an activity's reported actual progress achieved reduces in the subsequent window(s); an activity's actual start and finish dates are not consistent with the progress being reported.

Performing the analysis

Step 1 For the first window, the programme defined as the baseline programme, having undergone the reliability exercise (see item 1a above), is used. This is now known as the 'start of window programme' as at the window start.

Step 2 Review and verify that the 'start of window programme' represents the planned intent as known at the time. This is done by reviewing the available contemporaneous project documentation, e.g. correspondence, meeting minutes, change orders/variations, etc.

Step 3 Input into the 'start of window programme' the 'progress data' for the end of the first window, and carry out a time analysis as at the end of the window (the data date being the first working day of the second window).

Step 4 Review the results of the time analysis; and carry out a further review, or 'reality check', of remaining work activities to ensure that the time-analysed programme represents the planned intent as known at the time. If necessary, amend activity logic and/or durations to comply with the planned intent, and carry out a second time analysis. This programme is now the 'end of window programme' as at the window end.

Step 5 The 'end of window programme' at the end of window 1, now becomes the 'start of window programme' for the start of window 2. Having carried out a 'reality check' on this programme, no further review or amendment should be necessary.

Step 6 For window 2, input into this 'start of window programme' the 'progress data' for the end of the second window, and carry out a 'time analysis' as at the end of the window. Then repeat steps 4 and 5.

Step 7 For subsequent windows, follow the procedure outlined in step 6.

On completion of the analysis of the final window, the full 'windows' analysis is complete.

Glossary and explanatory notes

Baseline programme The programme covering the totality of the works which has been submitted to the CA for acceptance.

End of window programme The programme as at the end of the window, showing the as-built situation up to the end of the window and the planned intent for the remaining works to project completion.

Reality check A review of the programme's future activities to ensure that they represent the planned intent as known at the time. This is done by reviewing the available contemporaneous project documentation, e.g. correspondence, meeting minutes, change orders/variations, etc.

Reliability exercise A rigorous review of the programme, activity durations and logic relationships.

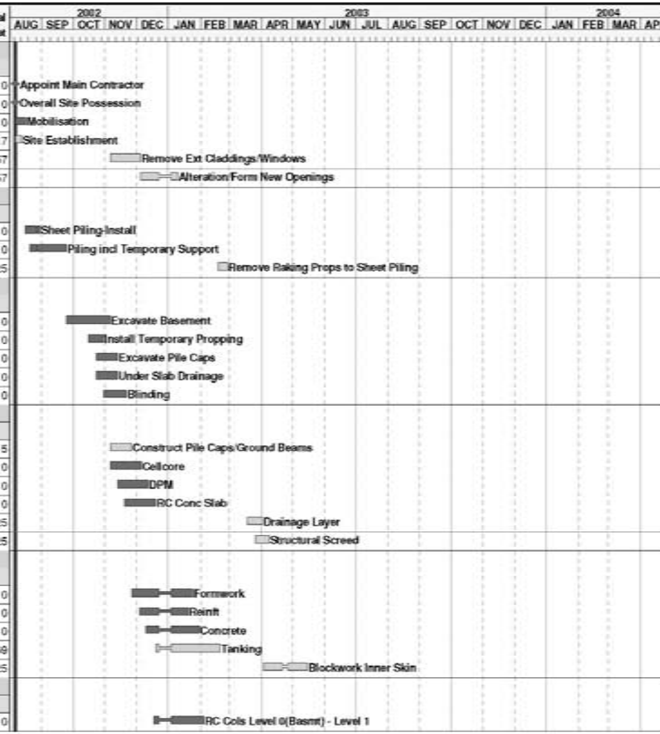
Revised programme Once a revised programme is accepted by the contract administrator, it replaces the 'baseline' programme.

Start of window programme The programme as at the start of the window, showing the planned intent for works both in the window and the remaining works after the window up to project completion.

Appendix 4

Charts for worked example: time impact analysis

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
Appointment / Mobilisation						
9760	Appoint Main Contractor	0	0	06AUG02		0
9770	Overall Site Possession	0	0	06AUG02		0
9780	Mobilisation	9	9	06AUG02	16AUG02	0
9790	Site Establishment	5	5	06AUG02	12AUG02	117
9800	Remove Ext Claddings/Windows	21	21	06NOV02	04DEC02	57
9810	Alteration/Form New Openings	16	16	05DEC02	09JAN03	57
Piling						
9850	Sheet Piling-Install	9	9	16AUG02	29AUG02	0
9860	Piling incl Temporary Support	25	25	20AUG02	24SEP02	0
9890	Remove Raking Props to Sheet Piling	8	8	18FEB03	27FEB03	25
Substructure						
9910	Excavate Basement	30	30	25SEP02	05NOV02	0
9920	Install Temporary Propping	10	10	16OCT02	29OCT02	0
9930	Excavate Pile Caps	15	15	23OCT02	12NOV02	0
9940	Under Slab Drainage	15	15	23OCT02	12NOV02	0
9950	Blinding	17	17	30OCT02	21NOV02	0
Basement						
9970	Construct Pile Caps/Ground Beams	15	15	06NOV02	26NOV02	5
9980	Cellcore	22	22	06NOV02	05DEC02	0
9990	DPM	22	22	13NOV02	12DEC02	0
10000	RC Conc Slab	22	22	20NOV02	19DEC02	0
10010	Drainage Layer	11	11	18MAR03	01APR03	25
10020	Structural Screed	10	10	26MAR03	08APR03	25
RC Retaining Walls						
10040	Formwork	33	33	27NOV02	24JAN03	0
10050	Reinft	24	24	04DEC02	20JAN03	0
10060	Concrete	27	27	11DEC02	30JAN03	0
10090	Tanking	34	34	20DEC02	19FEB03	69
10100	Blockwork Inner Skin	25	25	03APR03	14MAY03	25
Frame/Upper Flrs: Level 0 - Level 1						
10130	RC Cols Level 0(Basmt) - Level 1	24	24	18DEC02	03FEB03	0



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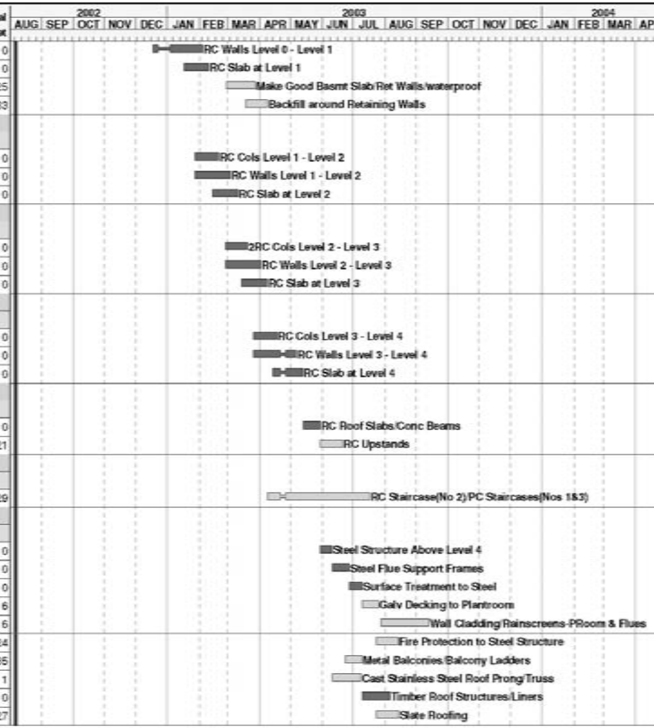
Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
10140	RC Walls Level 0 - Level 1	24	24	18DEC02	03FEB03	0
10150	RC Slab at Level 1	17	17	17JAN03	10FEB03	0
10170	Make Good Basmt Slab/Ret Walls/waterproof	20	20	28FEB03	27MAR03	25
10180	Backfill around Retaining Walls	15	15	18MAR03	07APR03	33
Frame/Upper Flrs: Level 1 - Level 2						
10200	RC Cols Level 1 - Level 2	17	17	28JAN03	19FEB03	0
10210	RC Walls Level 1 - Level 2	25	25	28JAN03	03MAR03	0
10220	RC Slab at Level 2	17	17	14FEB03	10MAR03	0
Frame/Upper Flrs: Level 2 - Level 3						
10250	2RC Cols Level 2 - Level 3	17	17	26FEB03	20MAR03	0
10260	RC Walls Level 2 - Level 3	25	25	26FEB03	01APR03	0
10270	RC Slab at Level 3	17	17	14MAR03	07APR03	0
Frame/Upper Flrs: Level 3 - Level 4						
10300	RC Cols Level 3 - Level 4	17	17	26MAR03	17APR03	0
10310	RC Walls Level 3 - Level 4	25	25	26MAR03	06MAY03	0
10320	RC Slab at Level 4	16	16	14APR03	12MAY03	0
Roof Slab						
10340	RC Roof Slabs/Conc Beams	13	13	13MAY03	29MAY03	0
10350	RC Upstands	16	16	30MAY03	20JUN03	21
Stairs						
10370	RC Staircase(No 2)/PC Staircases(Nos 1&3)	67	67	09APR03	17JUL03	29
Roof						
10390	Steel Structure Above Level 4	8	8	30MAY03	10JUN03	0
10400	Steel Flue Support Frames	12	12	11JUN03	26JUN03	0
10410	Surface Treatment to Steel	9	9	27JUN03	09JUL03	0
10420	Galv Decking to Plantroom	12	12	10JUL03	25JUL03	6
10430	Wall Cladding/Rainscreens-PRoom & Flues	35	35	28JUL03	12SEP03	6
10440	Fire Protection to Steel Structure	15	15	24JUL03	13AUG03	24
10450	Metal Balconies/Balcony Ladders	13	13	23JUN03	09JUL03	35
10460	Cast Stainless Steel Roof Prong/Truss	20	20	11JUN03	08JUL03	1
10470	Timber Roof Structures/Liners	20	20	10JUL03	06AUG03	0
10480	Slate Roofing	16	16	24JUL03	14AUG03	27



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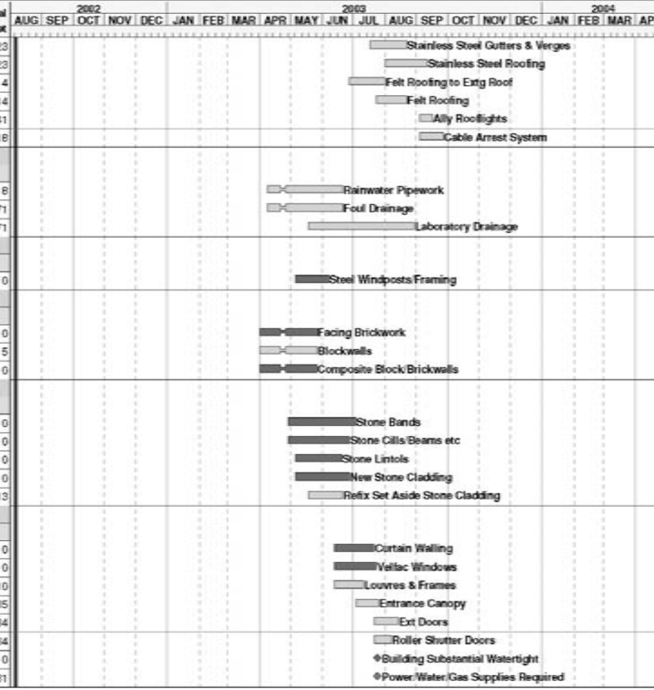
Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
10490	Stainless Steel Gutters & Verges	25	25	18JUL03	21AUG03	23
10500	Stainless Steel Roofing	29	29	01AUG03	10SEP03	23
10510	Felt Roofing to Extg Roof	25	25	27JUN03	31JUL03	4
10520	Felt Roofing	21	21	24JUL03	21AUG03	14
10530	Ally Rooflights	9	9	04SEP03	16SEP03	41
10540	Cable Arrest System	17	17	04SEP03	26SEP03	118
Disposal Instns						
10560	Rainwater Pipework	49	49	08APR03	20JUN03	8
10570	Foul Drainage	49	49	08APR03	20JUN03	71
10580	Laboratory Drainage	75	75	19MAY03	29AUG03	71
External Walls/Glazing						
10600	Steel Windposts/Framing	24	24	06MAY03	06JUN03	0
Brick/Blockwork						
10620	Facing Brickwork	35	35	01APR03	26MAY03	0
10630	Blockwalls	35	35	01APR03	26MAY03	5
10640	Composite Block/Brickwalls	35	35	01APR03	26MAY03	0
Stonework						
10660	Stone Bands	48	48	29APR03	03JUL03	0
10670	Stone Cills/Beams etc	43	43	29APR03	26JUN03	0
10680	Stone Lintols	33	33	06MAY03	19JUN03	0
10690	New Stone Cladding	38	38	06MAY03	26JUN03	0
10700	Refix Set Aside Stone Cladding	25	25	19MAY03	20JUN03	13
Glazing/Louvres/Ext Doors						
10720	Curtain Walling	27	27	13JUN03	21JUL03	0
10730	Velfac Windows	29	29	13JUN03	23JUL03	0
10740	Louvres & Frames	20	20	13JUN03	10JUL03	10
10750	Entrance Canopy	16	16	04JUL03	25JUL03	135
10760	Ext Doors	17	17	22JUL03	13AUG03	134
10770	Roller Shutter Doors	13	13	22JUL03	07AUG03	134
10780	Building Substantial Watertight	0	0		24JUL03	0
10790	Power/Water/Gas Supplies Required	0	0		24JUL03	81



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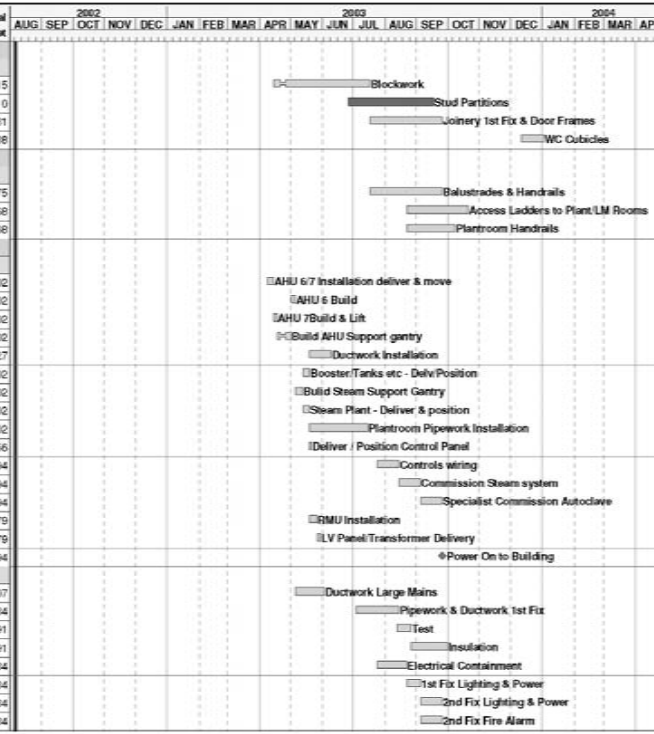
Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
Internal Walls						
10810	Blockwork	63	63	15APR03	17JUL03	15
10820	Stud Partitions	60	60	26JUN03	17SEP03	0
10830	Joinery 1st Fix & Door Frames	51	51	17JUL03	25SEP03	31
10840	WC Cubicles	16	16	12DEC03*	02JAN04	38
Metalwork						
10860	Balustrades & Handrails	50	50	18JUL03	25SEP03	75
10870	Access Ladders to Plant/LM Rooms	42	42	22AUG03	20OCT03	68
10880	Plantroom Handrails	34	34	22AUG03	08OCT03	68
Mech/Elec Services Instns						
Level '0', Plant Room						
2	AHU 6/7 Installation deliver & move	5	5	08APR03*	14APR03	102
3	AHU 6 Build	2	2	02MAY03	05MAY03	102
4	AHU 7Build & Lift	3	3	15APR03	17APR03	102
5	Build AHU Support gantry	5	5	18APR03	01MAY03	102
6	Ductwork Installation	15	15	20MAY03	09JUN03	127
7	Booster/Tanks etc - Delv/Position	5	5	13MAY03	19MAY03	102
8	Build Steam Support Gantry	5	5	06MAY03	12MAY03	102
9	Steam Plant - Deliver & position	5	5	13MAY03	19MAY03	102
10	Plantroom Pipework Installation	40	40	20MAY03*	14JUL03	102
11	Deliver / Position Control Panel	2	2	20MAY03*	21MAY03	156
12	Controls wiring	15	15	25JUL03	14AUG03	94
13	Commission Steam system	15	15	15AUG03	04SEP03	94
14	Specialist Commission Autoclave	15	15	05SEP03	25SEP03	94
15	RMU Installation	5	5	20MAY03*	26MAY03	179
16	LV Panel/Transformer Delivery	3	3	27MAY03	29MAY03	179
17	Power On to Building	0	0		25SEP03*	94
Level '0', High Level						
20	Ductwork Large Mains	20	20	06MAY03*	02JUN03	107
22	Pipework & Ductwork 1st Fix	30	30	04JUL03	14AUG03	84
23	Test	10	10	13AUG03	26AUG03	91
24	Insulation	25	25	27AUG03	30SEP03	91
25	Electrical Containment	20	20	25JUL03	21AUG03	84
26	1st Fix Lighting & Power	10	10	22AUG03	04SEP03	84
28	2nd Fix Lighting & Power	15	15	05SEP03	25SEP03	84
29	2nd Fix Fire Alarm	15	15	05SEP03	25SEP03	84



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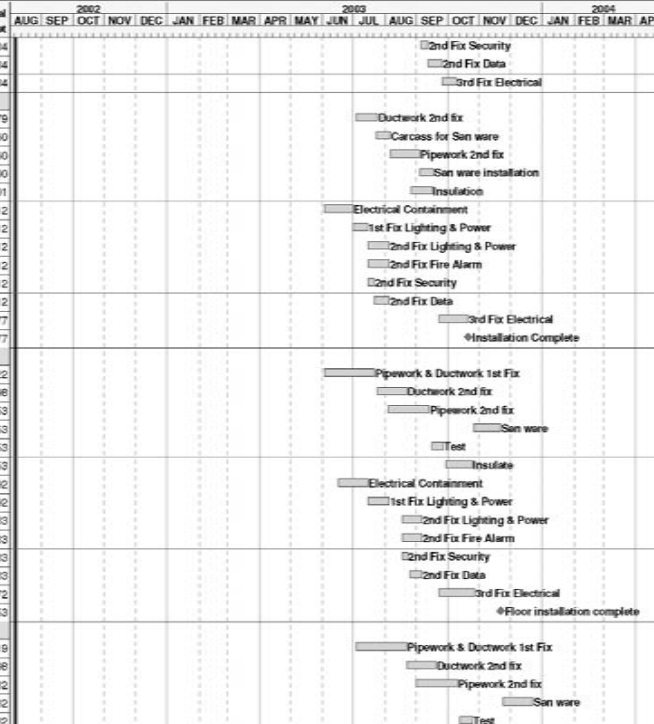
30	2nd Fix Security	5	5	06SEP03	11SEP03	84
31	2nd Fix Data	10	10	12SEP03	25SEP03	84
32	3rd Fix Electrical	10	10	26SEP03	09OCT03	84
Level '0', Low Level						
34	Ductwork 2nd fix	15	15	04JUL03	24JUL03	79
35	Carcass for San ware	10	10	24JUL03*	06AUG03	60
36	Pipework 2nd fix	20	20	07AUG03	03SEP03	60
37	San ware installation	10	10	04SEP03	17SEP03	100
38	Insulation	15	15	27AUG03	16SEP03	101
39	Electrical Containment	20	20	03JUN03	30JUN03	112
40	1st Fix Lighting & Power	10	10	01JUL03	14JUL03	112
41	2nd Fix Lighting & Power	15	15	15JUL03	04AUG03	112
42	2nd Fix Fire Alarm	15	15	15JUL03	04AUG03	112
43	2nd Fix Security	5	5	15JUL03	21JUL03	112
44	2nd Fix Data	10	10	22JUL03	04AUG03	112
45	3rd Fix Electrical	20	20	23SEP03	20OCT03	77
46	Installation Complete	0	0		20OCT03	77
Level '1'						
48	Pipework & Ductwork 1st Fix	35	35	03JUN03*	21JUL03	22
50	Ductwork 2nd fix	20	20	25JUL03*	21AUG03	98
52	Pipework 2nd fix	30	30	04AUG03	12SEP03	53
53	San ware	20	20	27OCT03	21NOV03	53
54	Test	10	10	15SEP03	26SEP03	53
55	Insulate	20	20	29SEP03	24OCT03	53
56	Electrical Containment	20	20	17JUN03	14JUL03	92
57	1st Fix Lighting & Power	15	15	15JUL03	04AUG03	92
58	2nd Fix Lighting & Power	15	15	18AUG03	05SEP03	83
59	2nd Fix Fire Alarm	15	15	18AUG03	05SEP03	83
60	2nd Fix Security	5	5	18AUG03	22AUG03	83
61	2nd Fix Data	10	10	25AUG03	05SEP03	83
62	3rd Fix Electrical	25	25	23SEP03	27OCT03	72
63	Floor installation complete	0	0		21NOV03	53
Level '2'						
65	Pipework & Ductwork 1st Fix	35	35	04JUL03*	21AUG03	19
67	Ductwork 2nd fix	21	21	22AUG03	19SEP03	98
69	Pipework 2nd fix	30	30	01SEP03	10OCT03	32
70	San ware	21	21	24NOV03	22DEC03	32
71	Test	10	10	13OCT03	24OCT03	32



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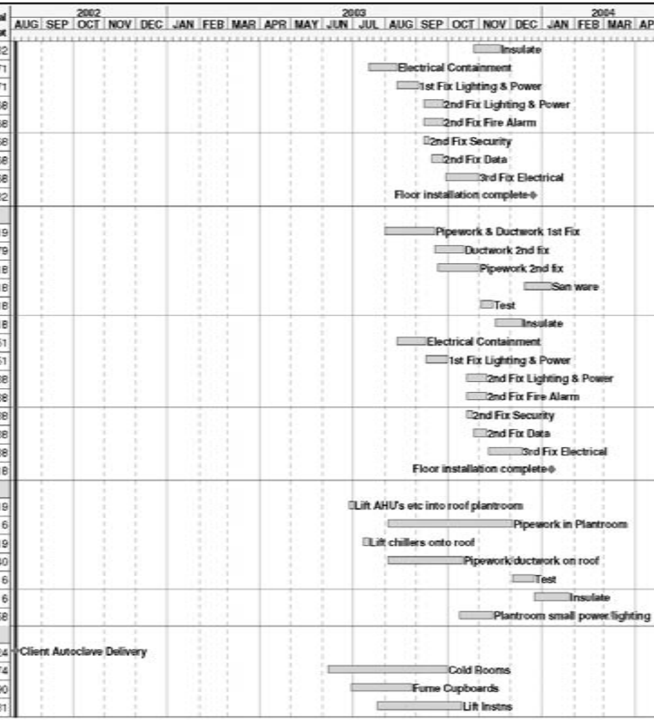
Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
72	Insulate	20	20	27OCT03	21NOV03	32
73	Electrical Containment	20	20	16JUL03	12AUG03	71
74	1st Fix Lighting & Power	15	15	13AUG03	02SEP03	71
75	2nd Fix Lighting & Power	15	15	08SEP03	26SEP03	68
76	2nd Fix Fire Alarm	15	15	08SEP03	26SEP03	68
77	2nd Fix Security	5	5	08SEP03	12SEP03	68
78	2nd Fix Data	10	10	15SEP03	26SEP03	68
79	3rd Fix Electrical	25	25	29SEP03	31OCT03	68
80	Floor installation complete	0	0		22DEC03	32
Level '3'						
82	Pipework & Ductwork 1st Fix	35	35	01AUG03*	18SEP03	19
84	Ductwork 2nd fix	20	20	19SEP03	16OCT03	79
86	Pipework 2nd fix	30	30	22SEP03	31OCT03	18
87	San ware	20	20	15DEC03	09JAN04	18
88	Test	10	10	03NOV03	14NOV03	18
89	Insulate	20	20	17NOV03	12DEC03	18
90	Electrical Containment	20	20	13AUG03	09SEP03	51
91	1st Fix Lighting & Power	15	15	10SEP03	30SEP03	51
92	2nd Fix Lighting & Power	15	15	20OCT03	07NOV03	38
93	2nd Fix Fire Alarm	15	15	20OCT03	07NOV03	38
94	2nd Fix Security	5	5	20OCT03	24OCT03	38
95	2nd Fix Data	10	10	27OCT03	07NOV03	38
96	3rd Fix Electrical	25	25	10NOV03	12DEC03	38
97	Floor installation complete	0	0		09JAN04	18
Level '4'						
99	Lift AHU's etc into roof plantroom	3	3	27JUN03	01JUL03	19
100	Pipework in Plantroom	87	87	04AUG03	02DEC03	6
101	Lift chillers onto roof	3	3	11JUL03*	15JUL03	19
102	Pipework/ductwork on roof	53	53	04AUG03	15OCT03	40
103	Test	15	15	03DEC03	23DEC03	6
104	Insulate	25	25	24DEC03	27JAN04	6
106	Plantroom small power/lighting	25	25	13OCT03	14NOV03	58
Non Haden Young Activities						
10910	Client Autoclave Delivery	0	0		05AUG02*	224
10980	Cold Rooms	83	83	06JUN03	30SEP03	74
10990	Fume Cupboards	43	43	30JUN03	27AUG03	90
11030	Lift Instrs	58	58	25JUL03	14OCT03	81



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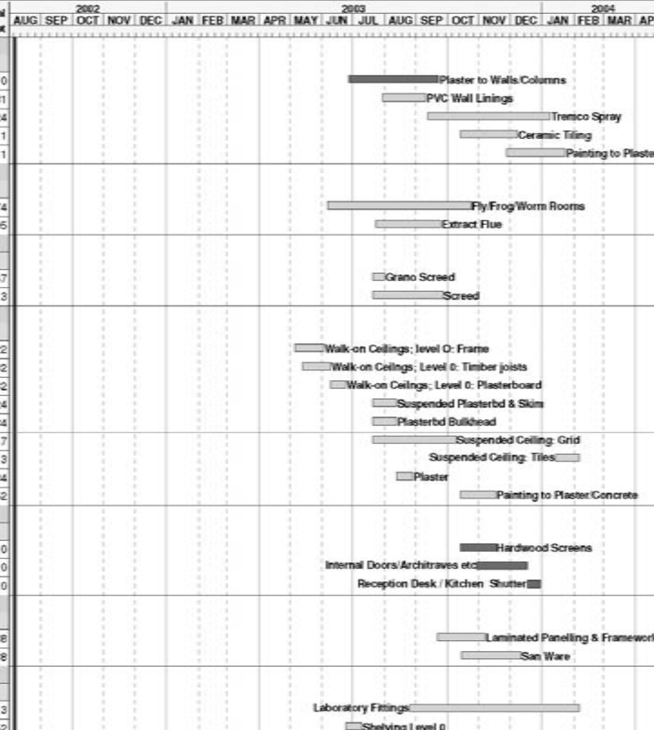
Programme MP01
Sorted by Work Area

APPENDIX 4A a

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
Wall Finishes						
11050	Plaster to Walls/Columns	62	62	27JUN03	22SEP03	0
11070	PVC Wall Linings	30	30	30JUL03	09SEP03	61
11080	Tremco Spray	85	85	12SEP03	08JAN04	24
11090	Ceramic Tiling	40	40	14OCT03	08DEC03	11
11100	Painting to Plaster	41	41	28NOV03	23JAN04	11
Services Equipment						
11120	Fly/Frog/Worm Rooms	100	100	06JUN03	23OCT03	74
11130	Extract Flue	45	45	24JUL03	24SEP03	95
Floor Screed/Grano						
11150	Grano Screed	9	9	21JUL03	31JUL03	47
11160	Screed	50	50	21JUL03	26SEP03	13
Ceiling Finishes						
11180	Walk-on Ceilings; level O: Frame	20	20	06MAY03	02JUN03	22
11190	Walk-on Ceilngs; Level 0: Timber joists	20	20	13MAY03	09JUN03	82
11200	Walk-on Ceilngs; Level 0: Plasterboard	10	10	10JUN03	23JUN03	82
11210	Suspended Plasterbd & Skim	17	17	21JUL03	12AUG03	24
11220	Plasterbd Bulkhead	17	17	21JUL03	12AUG03	84
11230	Suspended Ceiling: Grid	59	59	21JUL03	09OCT03	17
11240	Suspended Ceiling: Tiles	17	17	15JAN04	06FEB04	13
11250	Plaster	12	12	13AUG03	28AUG03	84
11260	Painting to Plaster/Concrete	25	25	14OCT03	17NOV03	52
Internal Doors						
11280	Hardwood Screens	25	25	14OCT03	17NOV03	0
11290	Internal Doors/Architraves etc	35	35	30OCT03	17DEC03	0
11300	Reception Desk / Kitchen Shutter	9	9	18DEC03	30DEC03	0
Sanitary Appliances						
11320	Laminated Panelling & Framework	34	34	22SEP03	06NOV03	38
11330	San Ware	42	42	15OCT03	11DEC03	38
Fittings/Furniture						
11350	Laboratory Fittings	120	120	25AUG03	06FEB04	13
11360	Shelving Level 0	12	12	24JUN03*	09JUL03	152



Start Date 05AUG02
Finish Date 07APR04
Data Date 05AUG02
Run Date 04SEP07 16:25

New Science Block

AS PLANNED
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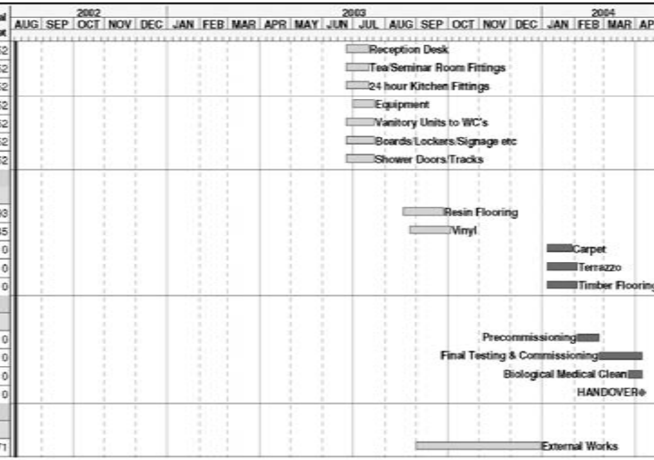
APPENDIX 4A a

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
11370	Reception Desk	16	16	24JUN03	15JUL03	152
11380	Tea/Seminar Room Fittings	16	16	24JUN03	15JUL03	152
11390	24 hour Kitchen Fittings	16	16	24JUN03	15JUL03	152
11400	Equipment	15	15	01JUL03	21JUL03	152
11410	Vanitory Units to WC's	20	20	24JUN03	21JUL03	152
11420	Boards/Lockers/Signage etc	20	20	24JUN03	21JUL03	152
11430	Shower Doors/Tracks	20	20	24JUN03	21JUL03	152
Floor Finishes						
11450	Resin Flooring	29	29	19AUG03	26SEP03	93
11460	Vinyl	30	30	25AUG03	03OCT03	45
11470	Carpet	18	18	06JAN04	29JAN04	0
11480	Terrazzo	22	22	06JAN04	04FEB04	0
11490	Timber Flooring	22	22	06JAN04	04FEB04	0
Final Testing/Commission/Clean						
11510	Precommissioning	15	15	05FEB04	25FEB04	0
11520	Final Testing & Commissioning	30	30	26FEB04	07APR04	0
11530	Biological Medical Clean	10	10	25MAR04	07APR04	0
11540	HANDOVER	0	0		07APR04	0
External Areas						
11560	External Works	87	87	01SEP03*	30DEC03	71



Start Date	06AUG02
Finish Date	07APR04
Data Date	06AUG02
Run Date	04SEP07 16:25

New Science Block

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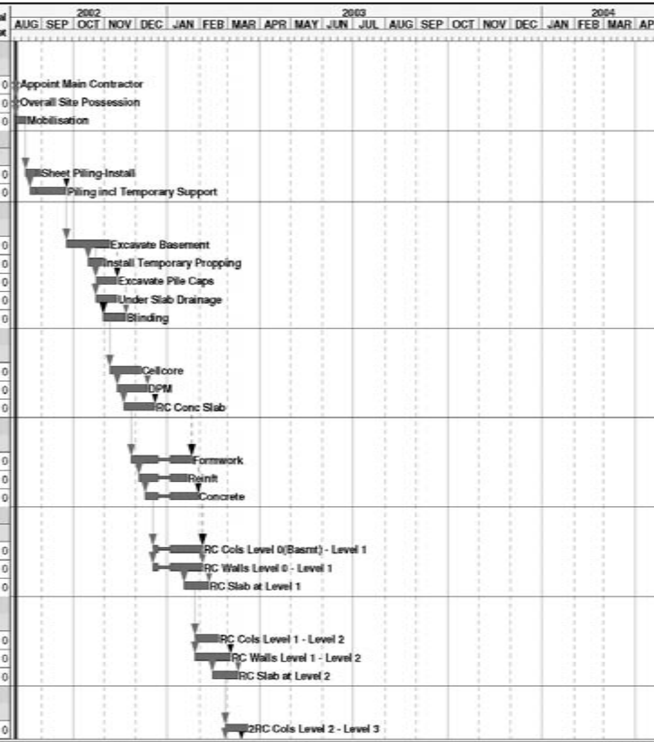
APPENDIX 4A a

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
Appointment / Mobilisation						
9760	Appoint Main Contractor	0	0	06AUG02		0
9770	Overall Site Possession	0	0	06AUG02		0
9780	Mobilisation	9	9	06AUG02	16AUG02	0
Piling						
9850	Sheet Piling-Install	9	9	16AUG02	29AUG02	0
9860	Piling incl Temporary Support	25	25	20AUG02	24SEP02	0
Substructure						
9910	Excavate Basement	30	30	25SEP02	05NOV02	0
9920	Install Temporary Propping	10	10	16OCT02	29OCT02	0
9930	Excavate Pile Caps	15	15	23OCT02	12NOV02	0
9940	Under Slab Drainage	15	15	23OCT02	12NOV02	0
9950	Blinding	17	17	30OCT02	21NOV02	0
Basement						
9980	Cellcore	22	22	06NOV02	05DEC02	0
9990	DPM	22	22	13NOV02	12DEC02	0
10000	RC Conc Slab	22	22	20NOV02	19DEC02	0
RC Retaining Walls						
10040	Formwork	33	33	27NOV02	24JAN03	0
10050	Reinft	24	24	04DEC02	20JAN03	0
10060	Concrete	27	27	11DEC02	30JAN03	0
Frame/Upper Flrs: Level 0 - Level 1						
10130	RC Cols Level 0(Basmt) - Level 1	24	24	18DEC02	03FEB03	0
10140	RC Walls Level 0 - Level 1	24	24	18DEC02	03FEB03	0
10150	RC Slab at Level 1	17	17	17JAN03	10FEB03	0
Frame/Upper Flrs: Level 1 - Level 2						
10200	RC Cols Level 1 - Level 2	17	17	28JAN03	19FEB03	0
10210	RC Walls Level 1 - Level 2	25	25	28JAN03	03MAR03	0
10220	RC Slab at Level 2	17	17	14FEB03	10MAR03	0
Frame/Upper Flrs: Level 2 - Level 3						
10250	2RC Cols Level 2 - Level 3	17	17	26FEB03	20MAR03	0



Start Date 06AUG02
Finish Date 07APR04
Data Date 06AUG02
Run Date 04SEP07 16:30

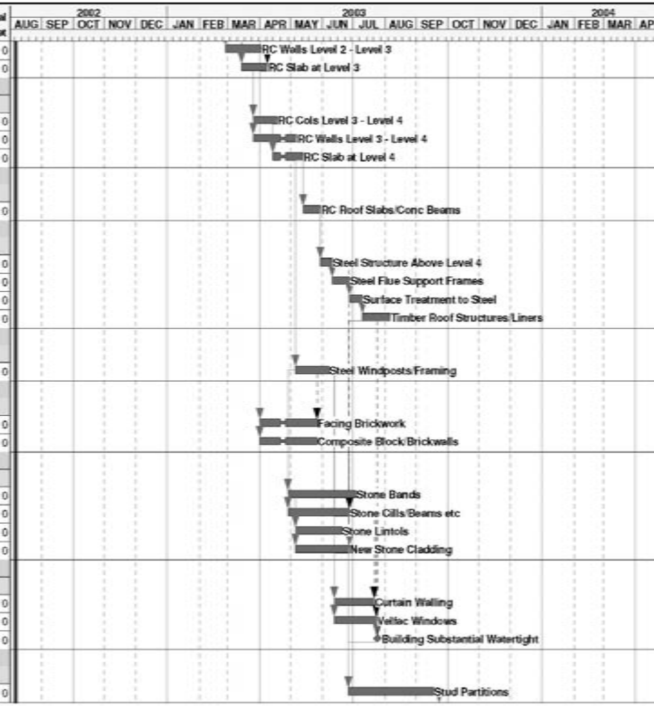
New Science Block

AS PLANNED
Programme MP01
The Critical Path

APPENDIX 4A b

Sheet 1 of 3

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
10260	RC Walls Level 2 - Level 3	25	25	26FEB03	01APR03	0
10270	RC Slab at Level 3	17	17	14MAR03	07APR03	0
Frame/Upper Flrs: Level 3 - Level 4						
10300	RC Cols Level 3 - Level 4	17	17	26MAR03	17APR03	0
10310	RC Walls Level 3 - Level 4	25	25	26MAR03	06MAY03	0
10320	RC Slab at Level 4	16	16	14APR03	12MAY03	0
Roof Slab						
10340	RC Roof Slabs/Conc Beams	13	13	13MAY03	29MAY03	0
Roof						
10390	Steel Structure Above Level 4	8	8	30MAY03	10JUN03	0
10400	Steel Flue Support Frames	12	12	11JUN03	26JUN03	0
10410	Surface Treatment to Steel	9	9	27JUN03	09JUL03	0
10470	Timber Roof Structures/Liners	20	20	10JUL03	06AUG03	0
External Walls/Glazing						
10600	Steel Windposts/Framing	24	24	06MAY03	06JUN03	0
Brick/Blockwork						
10620	Facing Brickwork	35	35	01APR03	26MAY03	0
10640	Composite Block/Brickwalls	35	35	01APR03	26MAY03	0
Stonework						
10660	Stone Bands	48	48	29APR03	03JUL03	0
10670	Stone Cills/Beams etc	43	43	29APR03	26JUN03	0
10680	Stone Lintols	33	33	06MAY03	19JUN03	0
10690	New Stone Cladding	38	38	06MAY03	26JUN03	0
Glazing/Louvres/Ext.Doors						
10720	Curtain Walling	27	27	13JUN03	21JUL03	0
10730	Velfac Windows	29	29	13JUN03	23JUL03	0
10780	Building Substantial Watertight	0	0		24JUL03	0
Internal Walls						
10820	Stud Partitions	60	60	26JUN03	17SEP03	0



Start Date 06AUG02
Finish Date 07APR04
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New Science Block

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Programme MP01
The Critical Path

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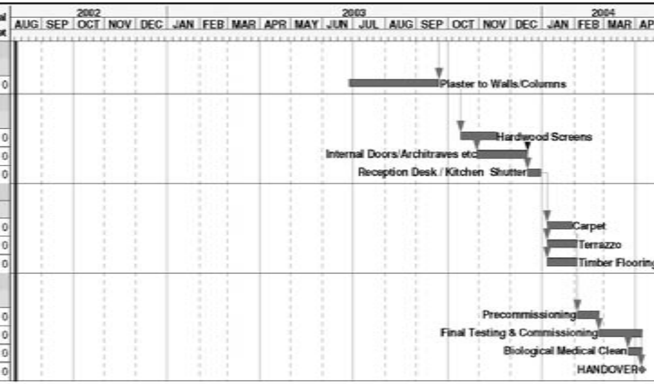
APPENDIX 4A b

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float
Wall Finishes						
11050	Plaster to Walls/Columns	62	62	27JUN03	22SEP03	0
Internal Doors						
11280	Hardwood Screens	25	25	14OCT03	17NOV03	0
11290	Internal Doors/Architraves etc	35	35	30OCT03	17DEC03	0
11300	Reception Desk / Kitchen Shutter	9	9	18DEC03	30DEC03	0
Floor Finishes						
11470	Carpet	18	18	06JAN04	29JAN04	0
11480	Terrazzo	22	22	06JAN04	04FEB04	0
11490	Timber Flooring	22	22	06JAN04	04FEB04	0
Final Testing/Commission/Clean						
11510	Precommissioning	15	15	05FEB04	25FEB04	0
11520	Final Testing & Commissioning	30	30	26FEB04	07APR04	0
11530	Biological Medical Clean	10	10	25MAR04	07APR04	0
11540	HANDOVER	0	0		07APR04	0



Start Date 05AUG02
Finish Date 07APR04
Data Date 05AUG02
Run Date 04SEP07 16:30

New Science Block

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Programme MP01
The Critical Path

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APPENDIX 4A b

New Science Block

Progress Data: relating to Programme MP01

		Actual		2002			2003											
	Progress as of	Start	Finish	20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
9760	Appoint Main Contractor	06-Aug-01	---															
9770	Overall Site Possession	06-Aug-01	---															
9780	Mobilisation	06-Aug-01	16-Aug-01															
9790	Site Establishment	06-Aug-01	13-Aug-01															
9800	Remove Ext Claddings/Windows	05-Nov-01	03-Dec-01		0	100												
9810	Alteration/Form New Openings	04-Dec-01	09-Jan-02		0	55	100											
	Piling																	
9850	Sheet Piling-Install	16-Aug-01	08-Sep-01															
9860	Piling incl Temporary Support	16-Aug-01	24-Sep-01	100														
9890	Sheet Piling-Withdraw	30-Mar-02	11-Apr-02						0	100								
	Substructure																	
9910	Excavate Basement	24-Sep-01	12-Nov-01	44	100													
9920	Install Temporary Propping	16-Oct-01	23-Oct-01	33	100													
9930	Excavate Pile Caps	31-Oct-01	23-Feb-02	0	63	86	94	94	100									
9940	Under Slab Drainage	31-Oct-01	16-Feb-02	0	15	44	80	100										
9950	Blinding	12-Nov-01	01-Mar-02	0	55	60	65	95	100									
	Basement																	
9970	Construct Pile Caps/Ground Beams	12-Nov-01	06-Mar-02	0	11	80	86	86	100									
9980	Cellcore	04-Dec-01	04-May-02		0	19	65	84	91	96	100							
9990	DPM	05-Dec-01	14-May-02		0	20	65	84	90	94	100							
10000	RC Conc Slab	21-Dec-01	07-Jun-02			0	44	80	86	90	96	100						
10010	Drainage Layer	29-Apr-02	23-May-02							0	50	100						
10020	Structural Screed	01-May-02	25-May-02							0	33	100						
	RC Retaining Walls																	
10040	Formwork	09-Jan-02	23-Feb-02			0	12	60	100									
10050	Reinft	07-Jan-02	09-Feb-02			0	11	100										
10060	Concrete	11-Jan-02	12-Mar-02			0	12	59	100									
10090	Tanking	14-Jan-02	23-Mar-02			0	5	14	88	100								
10100	Blockwork Inner Skin	28-May-02	26-Jun-02								0	81	100					
	Frame/Upper Flrs: Level 0 - Level 1																	
10130	RC Cols Level 0(Basmt) - Level 1	24-Jan-02	27-Feb-02			0	5	70	100									
10140	RC Walls Level 0 - Level 1	06-Feb-02	12-Mar-02				0	40	100									
10150	RC Slab at Level 1	13-Mar-02	16-Jul-02					0	48	98	98	99	100					
10170	Make Good Basmt Slab/Ret Walls/waterproof	28-Feb-02	27-Apr-02					0	83	96	100							
10180	Backfill around Retaining Walls	19-Jan-02	13-Apr-02			0	3	13	27	100								
	Frame/Upper Flrs: Level 1 - Level 2																	
10200	RC Cols Level 1 - Level 2	26-Mar-02	29-Apr-02						0	95	100							
10210	RC Walls Level 1 - Level 2	26-Mar-02	07-May-02						0	54	100							
10220	RC Slab at Level 2	19-Apr-02	13-May-02						0	59	100							
	Frame/Upper Flrs: Level 2 - Level 3																	
10250	2RC Cols Level 2 - Level 3	26-Apr-02	20-May-02							0	88	100						
10260	RC Walls Level 2 - Level 3	26-Apr-02	01-Jun-02							0	50	100						
10270	RC Slab at Level 3	14-May-02	06-Jun-02							0	65	100						

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Progress Data: relating to Programme MP01

		Actual		2002			2003											
	Progress as of	Start	Finish	20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
	Frame/Upper Flrs: Level 3 - Level 4																	
10300	RC Cols Level 3 - Level 4	20-May-02	19-Jun-02								0	100						
10310	RC Walls Level 3 - Level 4	20-May-02	19-Jun-02								0	100						
10320	RC Slab at Level 4	14-Jun-02	21-Jun-02								0	84	100					
	Roof Slab																	
10340	RC Roof Slabs/Conc Beams	14-Jun-02	21-Jun-02								0	84	100					
10350	RC Upstands	13-Jun-02	21-Jun-02								0	90	100					
	Stairs																	
10370	RC Staircase(No 2)/PC Staircases(Nos 1&3)	06-Jun-02	22-Jul-02								0	71	100					
	Roof																	
10390	Steel Structure Above Level 4	02-Jul-02	11-Dec-02									0	70	80	90	95	100	
10400	Steel Flue Support Frames	16-Sep-02	09-Dec-02											0	20	80	100	
10410	Surface Treatment to Steel	01-Jul-02	11-Jul-02									0	100					
10420	Galv Decking to Plantroom	07-Jul-02	08-Aug-02									0	65	96	100			
10430	Wall Cladding/Rainscreens-PRoom & Flues	20-Jan-03	01-Sep-03														0	4
10440	Fire Protection to Steel Structure	02-Dec-02	19-Feb-03													0		38
10450	Metal Balconies/Balcony Ladders	16-Jun-02	16-Aug-02								0	11	67	87	100			
10460	Cast Stainless Steel Roof Prong/Truss	22-Oct-02	17-Dec-02												0	50	100	
10470	Timber Roof Structures/Liners	28-Aug-02	10-Feb-03											0	50	65	75	85
10480	Slate Roofing	11-Nov-02	01-Feb-03												0	5	20	95
10490	Stainless Steel Gutters & Verges	02-Dec-02	01-Feb-03													0	80	90
10500	Stainless Steel Roofing	27-Aug-02	06-Mar-03											0	30	60	89	89
10510	Felt Roofing to Extg Roof	23-Oct-02	12-Apr-03												0	80	85	90
10520	Felt Roofing	18-Nov-02	12-Apr-03												0	62	66	80
10530	Ally Rooflights	09-Sep-02	19-Sep-02											0	100			
10540	Cable Arrest System	29-Oct-02	08-Jul-03												0	40	60	80
	Disposal Instns																	
10560	Rainwater Pipework	17-Jun-02	14-Jun-03								0	4	20	25	40	55	70	85
10570	Foul Drainage	17-Jun-02	06-Oct-02								0	4	36	47	100			
10580	Laboratory Drainage	17-Jun-02	20-Dec-02								0	4	24	31	69	94	98	100
	External Walls/Glazing																	
10600	Steel Windposts/Framing	30-Apr-02	28-Nov-02							0	10	76	76	76	85	95	100	
	Brick/Blockwork																	
10620	Facing Brickwork	01-May-02	09-Nov-02							0	1	4	50	61	95	100		
10630	Blockwalls	01-May-02	09-Nov-02							0	1	4	59	61	95	100		
10640	Composite Block/Brickwalls	01-May-02	08-Nov-02							0	1	4	50	61	95	100		
	Stonework																	
10660	Stone Bands	29-May-02	14-Nov-02								0	9	65	68	90	100		
10670	Stone Cills/Beams etc	29-May-02	14-Nov-02								0	9	65	67	91	100		
10680	Stone Lintols	07-Jun-02	13-Nov-02								0	5	65	67	90	100		
10690	New Stone Cladding	07-Jun-02	14-Nov-02								0	5	65	67	92	100		
10700	Refix Set Aside Stone Cladding	07-Jun-02	12-Jul-02								0	40	100					

New Science Block

Progress Data: relating to Programme MP01

		Actual		2002			2003											
	Progress as of	Start	Finish	20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
	Glazing/Louvres/Ext.Doors																	
10720	Curtain Walling	19-Aug-02	25-Jan-03											0	45	80	87	100
10730	Velfac Windows	19-Aug-02	01-Feb-03											0	54	90	95	95
10740	Louvres & Frames	27-Jan-03	19-Feb-03															100
10750	Entrance Canopy	22-Sep-02	06-Oct-02											0	100			
10760	Ext Doors	07-Jul-03	01-Aug-03															
10770	Roller Shutter Doors	07-Jul-03	25-Aug-03															
10780	Building Substantial Watertight	03-Feb-03	03-Feb-03															0
10790	Power/Water/Gas Supplies Required	26-Jul-02	26-Jul-02									0	100					
	Internal Walls																	
10810	Blockwork	13-May-02	30-Jan-03							0	1	20	65	70	92	96	96	
10820	Stud Partitions	27-Aug-02	16-Aug-03											0	9	40	45	47
10830	Joinery 1st Fix & Door Frames	17-Mar-03	21-Nov-03															
10840	WC Cubicles	06-Oct-03	10-Jan-04															
	Metalwork																	
10860	Balustrades & Handrails	31-Mar-03	19-Feb-04															
10870	Access Ladders to Plant/LM Rooms	30-Aug-03	19-Feb-04															
10880	Plantroom Handrails	30-Aug-03	08-Jan-04															
	Mech/Elec Services Instns																	
	Level 0 Plantroom																	
2	AHU 6/7 Installation deliver & move	22-Apr-02	26-Apr-02							0	100							
3	AHU 6 Build	19-Aug-02	20-Aug-02											0	100			
4	AHU 7Build & Lift	19-Aug-02	21-Aug-02											0	100			
5	Build AHU Support gantry (by others)	24-Jun-02	28-Jun-02									0	100					
6	Ductwork Installation	16-Sep-02	11-Dec-02											0	60	80	80	100
7	Booster/Tanks etc - Delv/Position	10-Jul-02	12-Dec-02									0	20	20	25	25	25	100
8	Bulid Steam Support Gantry (by others)	21-Aug-02	11-Dec-02											0	50	50	50	100
9	Steam Plant - Deliver & position	17-May-02	21-Aug-02								0	50	50	50	100			
10	Plantroom Pipework Installation	24-Jan-03	05-Aug-03															0
11	Deliver/Position Control Panel	09-Dec-02	10-Dec-02														0	100
12	Controls wiring	31-Mar-03	13-May-03															
13	Commission Steam system	25-Feb-04	02-Apr-04															
14	Specialist Commission Autoclave	05-Apr-04	27-Apr-04															
15	RMU Installation	19-Aug-02	18-Sep-02											0	100			
16	LV Panel/Transformer Delivery	19-Sep-02	23-Sep-02											0	100			
17	Power On to Building		15-Sep-03															

New Science Block

Progress Data: relating to Programme MP01

		Actual		2002			2003											
	Progress as of	Start	Finish	20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
	Level 0 High Level																	
20	Ductwork Large Mains	19-Aug-02	25-Feb-03											0	45	45	45	45
22	Pipework & Ductwork 1st Fix	11-Sep-02	04-Aug-03											0	25	30	45	55
23	Test	07-Jul-03	22-Sep-03															
24	Insulation	12-Sep-02	02-Dec-03											0	5	5	5	5
25	Electrical Containment	11-Sep-02	04-Aug-03											0	15	60	60	65
26	1st Fix Lighting & Power	04-Feb-03	04-Aug-03															0
28	2nd Fix Lighting & Power	07-May-03	29-Oct-03															
29	2nd Fix Fire Alarm	07-May-03	29-Oct-03															
30	2nd Fix Security	29-Oct-03	28-Jan-04															
31	2nd Fix Data	07-Mar-03	26-Nov-03															
32	3rd Fix Electrical	02-Jul-03	26-Nov-03															
	Level 0 Low Level																	
34	Ductwork 2nd fix	24-Feb-03	28-Jan-04															
35	Carcass for San ware (by others)	09-Dec-02	24-Feb-03														0	45
36	Pipework 2nd fix	26-Nov-03	02-Feb-04															
37	San ware installation	01-Jul-03	28-Nov-03															
38	Insulation	26-Nov-03	06-Feb-04															
39	Electrical Containment	19-Jun-02	28-Apr-03									0	25	50	75	75	80	85
40	1st Fix Lighting & Power	02-Sep-02	04-Aug-03											0	50	60	70	75
41	2nd Fix Lighting & Power	18-Nov-02	29-Oct-03													0	10	20
42	2nd Fix Fire Alarm	29-Apr-03	30-Oct-03															
43	2nd Fix Security	11-Jun-03	29-Oct-03															
44	2nd Fix Data	26-Feb-03	29-Oct-03															
45	3rd Fix Electrical	21-May-03	24-Mar-04															
46	Installation Complete		02-Apr-04															
	Level 1																	
48	Pipework & Ductwork 1st Fix	19-Jun-02	20-Feb-03									0	35	45	75	80	80	90
50	Ductwork 2nd fix	03-Oct-03	29-Mar-04															
52	Pipework 2nd fix	23-Jul-03	25-Mar-04															
53	San ware	12-Jun-03	27-Nov-03															
54	Test	04-Jun-03	27-Nov-03															
55	Insulate	05-Sep-02	27-Nov-03											0	35	35	35	40
56	Electrical Containment	03-Jul-02	28-Apr-03									0	25	50	75	75	80	85
57	1st Fix Lighting & Power	02-Sep-02	04-Aug-03											0	50	60	70	75
58	2nd Fix Lighting & Power	16-Jan-03	26-Nov-03														0	50
59	2nd Fix Fire Alarm	22-Jan-03	26-Nov-03														0	10
60	2nd Fix Security	11-Jun-03	26-Nov-03															
61	2nd Fix Data	26-Feb-03	26-Nov-03															
62	3rd Fix Electrical	10-Jul-03	24-Mar-04															
63	Floor installation complete		29-Mar-04															

New Science Block

Progress Data: relating to Programme MP01

		Actual		2002			2003											
	Progress as of	Start	Finish	20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
	Level 2																	
65	Pipework & Ductwork 1st Fix	17-Jul-02	20-Mar-03									0	20	35	65	70	70	80
67	Ductwork 2nd fix	14-Nov-03	31-Mar-04															
69	Pipework 2nd fix	14-Jul-03	29-Mar-04															
70	San ware	17-Jul-03	02-Dec-03															
71	Test	06-Jun-03	28-Jan-04															
72	Insulate	13-Sep-02	29-Jan-04											0	2	2	2	10
73	Electrical Containment	12-Nov-02	04-Aug-03													0	40	40
74	1st Fix Lighting & Power	05-Mar-03	04-Aug-03															
75	2nd Fix Lighting & Power	28-May-03	27-Nov-03															
76	2nd Fix Fire Alarm	20-Mar-03	27-Nov-03															
77	2nd Fix Security	28-May-03	26-Nov-03															
78	2nd Fix Data	05-Jun-03	26-Nov-03															
79	3rd Fix Electrical	14-Jul-03	26-Mar-04															
80	Floor installation complete		31-Mar-04															
	Level 3																	
82	Pipework & Ductwork 1st Fix	10-Sep-02	25-Apr-03											0	12	20	35	60
84	Ductwork 2nd fix	11-Dec-03	02-Apr-04															
86	Pipework 2nd fix	24-Sep-03	25-Mar-04															
87	San ware	23-Jul-03	02-Dec-03															
88	Test	27-Jun-03	28-Jan-04															
89	Insulate	13-Sep-02	29-Jan-04											0	2	2	2	10
90	Electrical Containment	12-Nov-02	04-Aug-03													0	40	40
91	1st Fix Lighting & Power	05-Mar-03	04-Aug-03															
92	2nd Fix Lighting & Power	30-May-03	04-Aug-03															
93	2nd Fix Fire Alarm	29-May-03	27-Nov-03															
94	2nd Fix Security	09-Jun-03	26-Nov-03															
95	2nd Fix Data	16-Jun-03	27-Nov-03															
96	3rd Fix Electrical	24-Sep-03	26-Mar-04															
97	Floor installation complete		02-Apr-04															
	Level 4																	
99	Lift AHU's etc into roof plantroom	19-Jun-02	14-Oct-02									0	80	80	80	100		
100	Pipework in Plantroom	12-Nov-02	03-Nov-03													0	40	60
101	Lift chillers onto roof	01-Aug-02	05-Aug-02										0	100				
102	Pipework/ductwork on roof	13-Sep-02	04-Nov-03											0	2	50	90	90
103	Test	23-Jun-03	03-Nov-03															
104	Insulate	01-Apr-03	03-Dec-03															
106	Plantroom small power/lighting	05-Dec-02	11-Nov-03													0	10	20
107	Commissioning	08-Nov-03	18-Jun-04															
108	Handover		18-Jun-04															

New Science Block

Progress Data: relating to Programme MP01

				2002			2003											
		Progress as of		20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
		Actual																
		Start	Finish															
	Non-Subcontractor Activities																	
10910	Client Autoclave Delivery	05-Aug-02	05-Aug-02										0	100				
10980	Cold Rooms	13-Jan-03	21-Feb-04														0	5
10990	Fume Cupboards	11-Nov-03	10-Jan-04															
11030	Lift Installation	09-Sep-02	20-Feb-04											0	10	15	25	40
	Wall Finishes																	
11050	Plaster to Walls/Columns	29-Jan-03	15-Aug-03															0
11070	PVC Wall Linings	01-Oct-03	09-Jan-04															
11080	Tremco Spray	21-Jul-03	27-Sep-03															
11090	Ceramic Tiling	15-Sep-03	22-Nov-03															
11100	Painting to Plaster	14-May-03	08-May-04															
	Services Equipment																	
11120	Fly/Frog/Worm Rooms	28-Jun-03	10-Jan-04														0	10
11130	Extract Flue	13-Dec-02	23-Aug-03													0	10	20
	Floor Screed/Grano																	
11150	Grano Screed	18-Jul-02	31-May-03									0	10	20	30	40	50	60
11160	Screed	18-Jul-02	31-May-03									0	50	75	80	83	86	89
	Ceiling Finishes																	
11180	Frame	03-Jul-02	31-Jan-03									0	50	75	95	96	98	99
11190	Walk on Ceilngs Level 0	10-Jul-02	05-Feb-03									0	8	19	62	75	85	95
11200	Walk on Ceilngs Level 0	17-Jul-02	05-Feb-03									0	8	19	62	75	85	95
11210	Suspended Plasterbd & Skim	13-Jan-03	28-Mar-03														0	10
11220	Plasterbd Bulkhead	10-Jul-03	28-Aug-03															
11230	Suspended Grid & Tiles	25-Aug-03	23-Jan-04															
11240	Suspended Grid & Tiles	25-Aug-03	23-Jan-04															
11250	Plaster	13-Jan-03	28-Mar-03														0	25
11260	Painting to Plaster/Concrete	23-May-03	07-May-04															
	Internal Doors																	
11280	Hardwood Screens	19-May-03	21-Jun-03															
11290	Internal Doors/Architraves etc	02-May-03	16-Aug-03															
11300	Reception Desk / Kitchen Shutter	08-Dec-03	21-Feb-04															
	Sanitary Appliances																	
11320	Laminated Panelling & Framework	01-Jul-03	10-Jan-04															
11330	San Ware	01-Jul-03	10-Jan-04															
	Fittings / Furniture																	
11360	Shelving Level 0	10-Nov-03	24-Apr-04															
11370	Reception Desk	22-Nov-03	21-Feb-04															
11380	Tea/Seminar Room Fittings	15-Sep-03	10-Oct-03															
11390	24 hour Kitchen Fittings	31-Jan-04	21-Feb-04															
11400	Equipment	17-Feb-03	17-Feb-03															
11410	Vanitory Units to WC's	01-Jul-03	18-Sep-03															
11420	Boards/Lockers/Signage etc	01-Nov-03	12-Jun-04															
11430	Shower Doors/Tracks	15-Sep-03	10-Jan-04															

New Science Block

Progress Data: relating to Programme MP01

				2002			2003											
		Progress as of		20-Oct	24-Nov	17-Dec	26-Jan	22-Feb	23-Mar	20-Apr	15-May	21-Jun	27-Jul	08-Aug	15-Oct	27-Nov	18-Dec	26-Jan
		Actual																
		Start	Finish															
	Floor Finishes																	
11450	Resin Flooring	03-May-03	09-May-03															
11460	Vinyl	02-Jun-03	20-Dec-03															
11470	Carpet	21-Jul-03	09-Oct-03															
11480	Terrazzo	11-Aug-03	22-Nov-03															
11490	Timber Flooring	15-Jan-03	15-Feb-03														0	33
	Final Testing/Commission/Clean																	
11510	Precommissioning	17-Oct-03	12-Jun-04															
11520	Final Testing & Commissioning	08-Nov-03	18-Jun-04															
11530	Biological Medical Clean	14-Apr-03	14-Apr-03															
	External Areas																	
11560	External Works	29-Jul-02	09-Apr-04										0	15	15	20	23	26
11540	**HANDOVER**	12-Jun-04	12-Jun-04															

'Time Impact Analysis' Results

cat. 1:	Likely delay to contract completion date, and, likely delay to current forecast completion date for the
cat. 2:	Likely delay to current contract completion date for the project.
cat. 3:	Likely delay to activity(s) not started
cat. 4:	Likely delay to activity(s) in progress
cat. 5:	No likely delay

column 1	*col. 2*	*col. 3*	*col. 4*	*col. 5*	*col. 6*	*col. 7*	*col. 8*	*col. 9*	*col. 10*	*col. 11*	*col. 12*	*col. 13*
Event								**No delay**	**Likely delay to progress**		**Likely delay to proj.compl.**	
ref nr.	**date**	**Description**	**Programme MP01 activity number affected**	**Forecast Completion Date PRIOR to Subnet**	**Forecast Completion Date AFTER Subnet**	**Extension of time Entitlement**	**Adjusted' completion date**	**5**	**4**	**3**	**2**	**1**

Tranche 1: Start on Site (6 Aug. 2002) to Start of Superstructure Work on 24 January 2003

ref nr.	date	Description	Programme MP01 activity number affected	Forecast Completion Date PRIOR to Subnet	Forecast Completion Date AFTER Subnet	Extension of time Entitlement	Adjusted' completion date	5	4	3	2	1
T1-001	09-Aug-02	Ground beams added	9970							yes		
T1-002	14-Aug-02	Additional works to Roof steelwork	10390							yes		
T1-003	14-Aug-02	Additional Louvres	10740							yes		
T1-004	15-Aug-02	Additional work to timber Roof structure.	10470							yes		
T1-005	17-Aug-02	RFI response with setting out Info on pile C44	9860					no				
T1-006	22-Aug-02	Additional piles & pile caps	9860, 9970							yes		
T1-007	22-Aug-02	Substructure changes	9970, 10810							yes		
T1-008	24-Aug-02	Revisions to stairs 1, 2 & 3	10000, 10140, 10620, 10810, 10820, 10830	23-Apr-04	04-May-04	**6 workdays**	**04-May-04**					**yes**
T1-009	29-Aug-02	Revisions to Curtain Walling	10720, 10730							yes		
T1-010	29-Aug-02	Additional Brickwork and Stonework	10660, 10670, 10680	23-Apr-04	26-Apr-04	**1 workday**					**yes**	
T1-011	29-Aug-02	Riser 6 shaftwall changes	10820	27-Apr-04	12-May-04	**10 workdays**	**12-May-04**					**yes**
T1-012	29-Aug-02	Changes to Roof	10390, 10440, 10470, 10480, 10490, 10500, 10510, 10520							yes		

'Time Impact Analysis' Results

cat. 1:	Likely delay to contract completion date, and, likely delay to current forecast completion date for the
cat. 2:	Likely delay to current contract completion date for the project.
cat. 3:	Likely delay to activity(s) not started
cat. 4:	Likely delay to activity(s) in progress
cat. 5:	No likely delay

column 1	col. 2	col. 3	col. 4	col. 5	col. 6	col. 7	col. 8	col. 9	col. 10	col. 11	col. 12	col. 13
Event			Programme MP01 activity number affected	Forecast Completion Date PRIOR to Subnet	Forecast Completion Date AFTER Subnet	Extension of time Entitlement	Adjusted' completion date	No delay	Likely delay to progress		Likely delay to proj.compl.	
ref nr.	date	Description						5	4	3	2	1
T1-013	29-Aug-02	Details of screeds/toppings	10020	27-Apr-04	28-Apr-04	**1 workday**					**yes**	
T1-014	03-Sep-02	Details of Aquatic Room finishes	10810, 10820, 11080, 11460					no				
T1-015	04-Sep-02	Additional finishing work to riser 6 & phase 1 interface	10820, 11050, 11210					no				
T1-016	04-Sep-02	Revisions to screens in WC's	11410					no				
T1-017	04-Sep-02	Interface details, junctions of phases 1 & 2	10720, 10730, 10820, 11290	29-Apr-04	17-May-04	**11 workdays**	**17-May-04**					**yes**
T1-018	04-Sep-02	Additional fire-rated shaftwall	10820					no				
T1-019	06-Sep-02	Scope changes to External Works	11560							yes		
T1-020	06-Sep-02	Additional blockwork to level 4	10810							yes		
T1-021	10-Sep-02	Anti-vibration mounts for the roof chillers.	10390					no				
T1-022	11-Sep-02	Revisions to Front Podium; changes to Basement, etc	9910, 9970, 10000, 10140							yes		
T1-023	11-Sep-02	Changes to Level 1 slab & External Works	10150, 11560							yes		
T1-024	11-Sep-02	Changes to Level 3 structural works	10140, 10210, 10260, 10310, 10390							yes		
T1-025	19-Sep-02	Changes to pile locations	9860	05-May-04	14-May-04	**7 workdays**					**yes**	
T1-026	20-Sep-02	Revisions to Underslab Drainage manholes	9940					no				
T1-027	21-Sep-02	Reinforcement revisions to Basement	9970					no				

New Science Block

'Time Impact Analysis' Results

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cat. 4:	Likely delay to activity(s) in progress
cat. 5:	No likely delay

column 1	*col. 2*	*col. 3*	*col. 4*	*col. 5*	*col. 6*	*col. 7*	*col. 8*	*col. 9*	*col. 10*	*col. 11*	*col. 12*	*col. 13*
Event			**Programme MP01 activity number affected**	**Forecast Completion Date PRIOR to Subnet**	**Forecast Completion Date AFTER Subnet**	**Extension of time Entitlement**	**Adjusted' completion date**	**No delay**	**Likely delay to progress**		**Likely delay to proj.compl.**	
ref nr.	**date**	**Description**						**5**	**4**	**3**	**2**	**1**
T1-028	24-Sep-02	Reinforcement drawings & rebar schedules.	9970, 10000, 10130, 10140					no				
T1-029	26-Sep-02	Piling; steelwork to stairs	9860, 9940, 10370					no				
T1-030	26-Sep-02	Changes to External Works	11560					no				
T1-031	26-Sep-02	Changes to partitions at roof level	10820	10-May-04	24-May-04	**10 workdays**	**24-May-04**					**yes**
T1-032	26-Sep-02	Changes to roof details	10470, 10600					no				
T1-033	27-Sep-02	Changes to windows, etc	10730							yes		
T1-034	28-Sep-02	Reinforcement details for Basement slab	10000					no				
T1-035	01-Oct-02	Responses to RFI's re underslab drainage & structural details	9910, 9940, 9970, 9990, 10000, 10050							yes		
T1-036	01-Oct-02	Foul sump chamber changes	9940							yes		
T1-037	02-Oct-02	Response to RFI on autoclave pit reinforcement details	10000					no				
T1-038	02-Oct-02	Steelwork to plant room & water tank support	10000, 10810	13-May-04	01-Jun-04	**12 workdays**	**01-Jun-04**					**yes**
T1-039	03-Oct-02	Structural details for Basement slab	10000, 10050					no				
T1-040	04-Oct-02	Stair 2 smoke vent details	10810	14-May-04	04-Jun-04	**15 workdays**	**04-Jun-04**					**yes**
T1-041	04-Oct-02	Brick/block details, Level O	10620, 10630, 10640							yes		
T1-042	05-Oct-02	Brick/block details, Level O	10810	14-May-04	07-Jun-04	**16 workdays**	**07-Jun-04**					**yes**

New Science Block

'Time Impact Analysis' Results

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cat. 3:	Likely delay to activity(s) not started
cat. 4:	Likely delay to activity(s) in progress
cat. 5:	No likely delay

column 1	*col. 2*	*col. 3*	*col. 4*	*col. 5*	*col. 6*	*col. 7*	*col. 8*	*col. 9*	*col. 10*	*col. 11*	*col. 12*	*col. 13*
Event								**No delay**	**Likely delay to progress**		**Likely delay to proj.compl.**	
ref nr.	**date**	**Description**	**Programme MP01 activity number affected**	**Forecast Completion Date PRIOR to Subnet**	**Forecast Completion Date AFTER Subnet**	**Extension of time Entitlement**	**Adjusted' completion date**	**5**	**4**	**3**	**2**	**1**
T1-043	05-Oct-02	Builders work details, level 0	10620, 10630, 10640					no				
T1-044	09-Oct-02	Information for foul sump chamber	9910, 9940					no				
T1-045	11-Oct-02	Resp. to RFI's on sub-slab drainage & pump discharge pipe details	9940, 10000					no				
T1-046	12-Oct-02	Response to RFI on reinforcement for additional pile cap	9930, 9970							yes		
T1-047	12-Oct-02	Ground beam details	9970, 10000							yes		
T1-048	15-Oct-02	Response to RFI on reinforcement drawings for level 0	10000					no				
T1-049	15-Oct-02	Level 0 slab r.c. details and bar bending schedules	10000					no				
T1-050	18-Oct-02	Sections & details of level 0 slab & retaining wall	10040, 10050					no				
T1-051	18-Oct-02	Revised Basement foundation drawing	9970					no				
T1-052	18-Oct-02	Revised level 0 drawing	10000					no				
T1-053	18-Oct-02	Revised drawing for level 0 to level 1	10130, 10140							yes		
T1-054	18-Oct-02	Revised r.c. details for level 0	10000					no				
T1-055	22-Oct-02	Reconstituted stone information for external works	11560							yes		
T1-056	24-Oct-02	Revisions to pile caps	9970, 10000	17-May-04	27-May-04	**8 workdays**					**yes**	
T1-057	24-Oct-02	R.c. details of level 0 slab	10000, 10050	17-May-04	19-May-04	**2 workdays**					**yes**	

New Science Block

'Time Impact Analysis' Results

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cat. 3:	Likely delay to activity(s) not started
cat. 4:	Likely delay to activity(s) in progress
cat. 5:	No likely delay

column 1	*col. 2*	*col. 3*	*col. 4*	*col. 5*	*col. 6*	*col. 7*	*col. 8*	*col. 9*	*col. 10*	*col. 11*	*col. 12*	*col. 13*
Event			**Programme MP01 activity number affected**	**Forecast Completion Date PRIOR to Subnet**	**Forecast Completion Date AFTER Subnet**	**Extension of time Entitlement**	**Adjusted' completion date**	**No delay**	**Likely delay to progress**		**Likely delay to proj.compl.**	
ref nr.	**date**	**Description**						**5**	**4**	**3**	**2**	**1**
T1-058	26-Oct-02	Revised details of pile caps	9970, 10000	17-May-04	28-May-04	**9 workdays**					**yes**	
T1-059	31-Oct-02	Change to floor slab, level 0	10000							yes		
T1-060												
T1-061	02-Nov-02	Waterproofing details	9990							yes		
T1-062	05-Nov-02	Waterproofing details	9990					no				
T1-063	05-Nov-02	Reinforcement detailing	10000, 10050, 10140, 10150					no				
T1-064												
T1-065	06-Nov-02	R.c. details to level 0 slab	10000	18-May-04	02-Jun-04	**10 workdays**					**yes**	
T1-066	06-Nov-02	R.c. details to lift shaft 1	10140, 10210, 10260, 10310	18-May-04	20-May-04	**2 workdays**					**yes**	
T1-067												
T1-068	08-Nov-02	Request for info on windows / cladding	10720, 10730					no				
T1-069	08-Nov-02	Response to RFI on waterproofing details.	10040, 10060					no				
T1-070	09-Nov-02	Doors & hatches	10000					no				
T1-071	09-Nov-02	Internal walls	10820					no				

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Piling							
9850	Sheet Piling-Install	9	41	5	16AUG02A	02SEP02	-6
9860	Piling incl Temporary Support	25	25	19	16AUG02A	20SEP02	-6
9890	Remove Raking Props to Sheet Piling	8	0	8	20FEB03	03MAR03	-6
Substructure							
9910	Excavate Basement	30	0	30	23SEP02	01NOV02	-6
9920	Install Temporary Propping	10	0	10	14OCT02	25OCT02	-6
9930	Excavate Pile Caps	15	0	15	21OCT02	08NOV02	-6
9940	Under Slab Drainage	15	0	15	21OCT02	08NOV02	-6
9950	Blinding	17	0	17	28OCT02	19NOV02	-6
Basement							
9980	Cellcore	22	0	22	04NOV02	03DEC02	-6
9990	DPM	22	0	22	11NOV02	10DEC02	-6
10000	RC Conc Slab	22	0	22	18NOV02	17DEC02	-6
10010	Drainage Layer	11	0	11	20MAR03	03APR03	-6
10020	Structural Screed	10	0	10	28MAR03	10APR03	-6
RC Retaining Walls							
10040	Formwork	33	0	33	25NOV02	22JAN03	-6
10050	Reinft	24	0	24	02DEC02	16JAN03	-6
10060	Concrete	27	0	27	09DEC02	28JAN03	-6
Frame/Upper Flrs: Level 0 - Level 1							
10130	RC Cols Level 0(Basmt) - Level 1	24	0	24	16DEC02	30JAN03	-6
10140	RC Walls Level 0 - Level 1	24	0	24	16DEC02	30JAN03	-6
10150	RC Slab at Level 1	17	0	17	15JAN03	06FEB03	-6
10170	Make Good Basmt Slab/Ret Walls/waterproof	20	0	20	04MAR03	31MAR03	-6
Frame/Upper Flrs: Level 1 - Level 2							
10200	RC Cols Level 1 - Level 2	17	0	17	24JAN03	17FEB03	-6
10210	RC Walls Level 1 - Level 2	25	0	25	24JAN03	27FEB03	-6
10220	RC Slab at Level 2	17	0	17	12FEB03	06MAR03	-6
Frame/Upper Flrs: Level 2 - Level 3							
10250	2RC Cols Level 2 - Level 3	17	0	17	24FEB03	18MAR03	-6
10260	RC Walls Level 2 - Level 3	25	0	25	24FEB03	28MAR03	-6

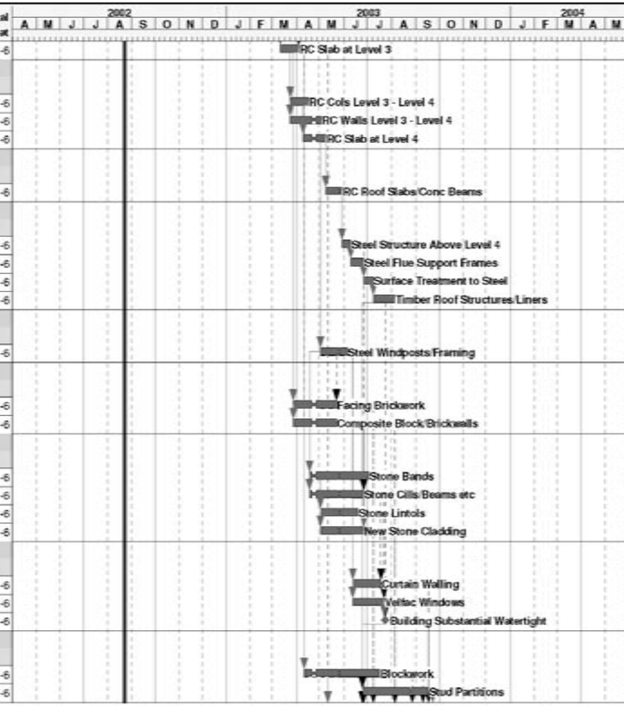
Start Date 06AUG02
Finish Date 23APR04
Data Date 24AUG02
Run Date 05OCT07 09:05

New Science Block

EVENT T1-008
Chart A
The Critical Path; Prior to Event

APPENDIX 4D a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
10270	RC Slab at Level 3	17	0	17	12MAR03	03APR03	-6
Frame/Upper Flrs: Level 3 - Level 4							
10300	RC Cols Level 3 - Level 4	17	0	17	24MAR03	15APR03	-6
10310	RC Walls Level 3 - Level 4	25	0	25	24MAR03	02MAY03	-6
10320	RC Slab at Level 4	16	0	16	10APR03	06MAY03	-6
Roof Slab							
10340	RC Roof Slabs/Conc Beams	13	0	13	09MAY03	28MAY03	-6
Roof							
10390	Steel Structure Above Level 4	8	0	8	29MAY03	09JUN03	-6
10400	Steel Flue Support Frames	12	0	12	10JUN03	25JUN03	-6
10410	Surface Treatment to Steel	9	0	9	26JUN03	08JUL03	-6
10470	Timber Roof Structures/Liners	20	0	20	09JUL03	05AUG03	-6
External Walls/Glazing							
10600	Steel Windposts/Framing	24	0	24	02MAY03	05JUN03	-6
Brick/Blockwork							
10620	Facing Brickwork	35	0	35	28MAR03	22MAY03	-6
10640	Composite Block/Brickwalls	35	0	35	28MAR03	22MAY03	-6
Stonework							
10660	Stone Bands	48	0	48	18APR03	02JUL03	-6
10670	Stone Cills/Beams etc	43	0	43	18APR03	25JUN03	-6
10680	Stone Lintols	33	0	33	02MAY03	18JUN03	-6
10690	New Stone Cladding	38	0	38	02MAY03	25JUN03	-6
Glazing/Louvres/Ext.Doors							
10720	Curtain Walling	27	0	27	12JUN03	18JUL03	-6
10730	Velfac Windows	29	0	29	12JUN03	22JUL03	-6
10780	Building Substantial Watertight	0	0	0		23JUL03	-6
Internal Walls							
10810	Blockwork	63	0	63	11APR03	16JUL03	-6
10820	Stud Partitions	60	0	60	25JUN03	17SEP03	-6



Start Date 06AUG02
Finish Date 23APR04
Data Date 24AUG02
Run Date 05OCT07 09:05

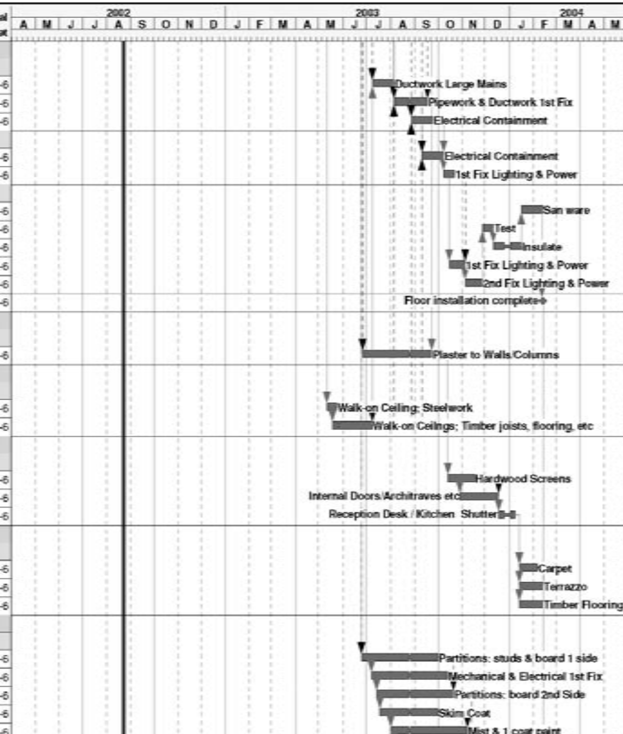
New Science Block

EVENT T1-008
Chart A
The Critical Path; Prior to Event

APPENDIX 4D a

Sheet 2 of 4

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Mech/Elec Services Instns							
Level '0', High Level							
20	Ductwork Large Mains	20	0	20	09JUL03*	05AUG03	-6
22	Pipework & Ductwork 1st Fix	30	0	30	06AUG03	17SEP03	-6
25	Electrical Containment	20	0	20	28AUG03	24SEP03	-6
Level '0', Low Level							
39	Electrical Containment	20	0	20	11SEP03	08OCT03	-6
40	1st Fix Lighting & Power	10	0	10	09OCT03	22OCT03	-6
Level '1'							
53	San ware	20	0	20	16JAN04	12FEB04	-6
54	Test	10	0	10	27NOV03	10DEC03	-6
55	Insulate	20	0	20	11DEC03	15JAN04	-6
57	1st Fix Lighting & Power	15	0	15	16OCT03	05NOV03	-6
58	2nd Fix Lighting & Power	15	0	15	06NOV03	26NOV03	-6
63	Floor installation complete	0	0	0		12FEB04	-6
Wall Finishes							
11050	Plaster to Walls/Columns	62	0	62	26JUN03	22SEP03	-6
Ceiling Finishes							
11180	Walk-on Ceiling; Steelwork	10	0	10	12MAY03	23MAY03	-6
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	19MAY03	08JUL03	-6
Internal Doors							
11280	Hardwood Screens	25	0	25	14OCT03	17NOV03	-6
11290	Internal Doors/Architraves etc	35	0	35	30OCT03	17DEC03	-6
11300	Reception Desk / Kitchen Shutter	9	0	9	18DEC03	07JAN04	-6
Floor Finishes							
11470	Carpet	18	0	18	14JAN04	06FEB04	-6
11480	Terrazzo	22	0	22	14JAN04	12FEB04	-6
11490	Timber Flooring	22	0	22	14JAN04	12FEB04	-6
Laboratory Fit-Out							
L01	Partitions: studs & board 1 side	70	0	70	25JUN03	01OCT03	-6
L02	Mechanical & Electrical 1st Fix	70	0	70	07JUL03	13OCT03	-6
L03	Partitions: board 2nd Side	70	0	70	14JUL03	20OCT03	-6
L04	Skim Coat	53	0	53	18JUL03	01OCT03	-6
L05	Mist & 1 coat paint	70	0	70	01AUG03	07NOV03	-6



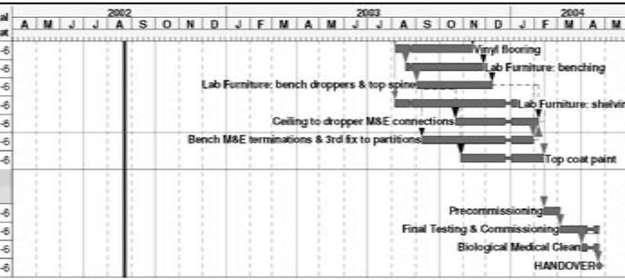
Start Date 05AUG02
Finish Date 23APR04
Data Date 24AUG02
Run Date 05OCT07 09:05

New Science Block

EVENT T1-008
Chart A
The Critical Path; Prior to Event

APPENDIX 4D a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
L06	Vinyl flooring	70	0	70	06AUG03	12NOV03	-6
L07	Lab Furniture: benching	70	0	70	20AUG03	26NOV03	-6
L08	Lab Furniture: bench droppers & top spine	70	0	70	02SEP03	08DEC03	-6
L09	Lab Furniture: shelving	105	0	105	06AUG03	08JAN04	-6
L11	Ceiling to dropper M&E connections	70	0	70	23OCT03	05FEB04	-6
L13	Bench M&E terminations & 3rd fix to partitions	97	0	97	09SEP03	29JAN04	-6
L17	Top coat paint	70	0	70	30OCT03	12FEB04	-6
Final Testing/Commission/Clean							
11510	Precommissioning	15	0	15	13FEB04	04MAR04	-6
11520	Final Testing & Commissioning	30	0	30	05MAR04	23APR04	-6
11530	Biological Medical Clean	10	0	10	02APR04	23APR04	-6
11540	HANDOVER	0	0	0		23APR04	-6



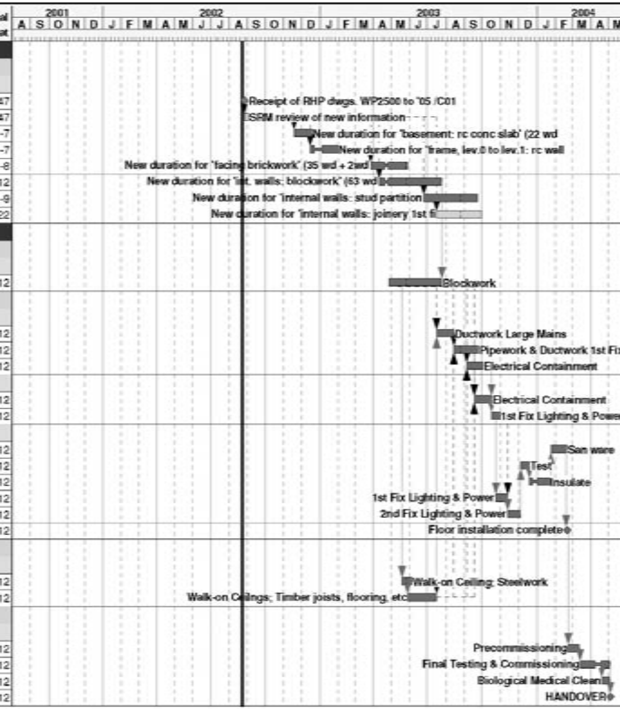
Start Date 06AUG02
Finish Date 23APR04
Data Date 24AUG02
Run Date 05OCT07 09:05

New Science Block

EVENT T1-008
Chart A
The Critical Path; Prior to Event

APPENDIX 4D a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Subnet T1-008							
T1-008.01	Receipt of RHP dwgs. WP2500 to '05 /C01	0	0	0	27AUG02*		47
T1-008.02	SRM review of new information	5	0	5	27AUG02	02SEP02	47
T1-008.03	New duration for 'basement: rc conc slab' (22	23	0	23	18NOV02*	18DEC02	-7
T1-008.04	New duration for 'frame, lev.0 to lev.1: rc wall	25	0	25	16DEC02*	31JAN03	-7
T1-008.05	New duration for 'facing brickwork' (35 wd +	37	0	37	28MAR03*	27MAY03	-8
T1-008.06	New duration for 'int. walls: blockwork' (63 wd	69	0	69	11APR03*	24JUL03	-12
T1-008.07	New duration for 'internal walls: stud partition	63	0	63	25JUN03*	22SEP03	-9
T1-008.08	New duration for 'internal walls: joinery 1st fi	54	0	54	16JUL03*	30SEP03	22
Internal Walls							
10810	Blockwork	63	0	63	28APR03	24JUL03	-12
Mech/Elec Services Instns							
Level '0', High Level							
20	Ductwork Large Mains	20	0	20	17JUL03*	13AUG03	-12
22	Pipework & Ductwork 1st Fix	30	0	30	14AUG03	25SEP03	-12
25	Electrical Containment	20	0	20	05SEP03	02OCT03	-12
Level '0', Low Level							
39	Electrical Containment	20	0	20	19SEP03	16OCT03	-12
40	1st Fix Lighting & Power	10	0	10	17OCT03	30OCT03	-12
Level '1'							
53	San ware	20	0	20	26JAN04	20FEB04	-12
54	Test	10	0	10	05DEC03	18DEC03	-12
55	Insulate	20	0	20	19DEC03	23JAN04	-12
57	1st Fix Lighting & Power	15	0	15	24OCT03	13NOV03	-12
58	2nd Fix Lighting & Power	15	0	15	14NOV03	04DEC03	-12
63	Floor installation complete	0	0	0		20FEB04	-12
Ceiling Finishes							
11180	Walk-on Ceiling; Steelwork	10	0	10	20MAY03	03JUN03	-12
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	28MAY03	16JUL03	-12
Final Testing/Commissioning/Clean							
11510	Precommissioning	15	0	15	23FEB04	12MAR04	-12
11520	Final Testing & Commissioning	30	0	30	15MAR04	04MAY04	-12
11530	Biological Medical Clean	10	0	10	20APR04	04MAY04	-12
11540	HANDOVER	0	0	0		04MAY04	-12



Start Date 06AUG02
Finish Date 04MAY04
Data Date 24AUG02
Run Date 05OCT07 09:03

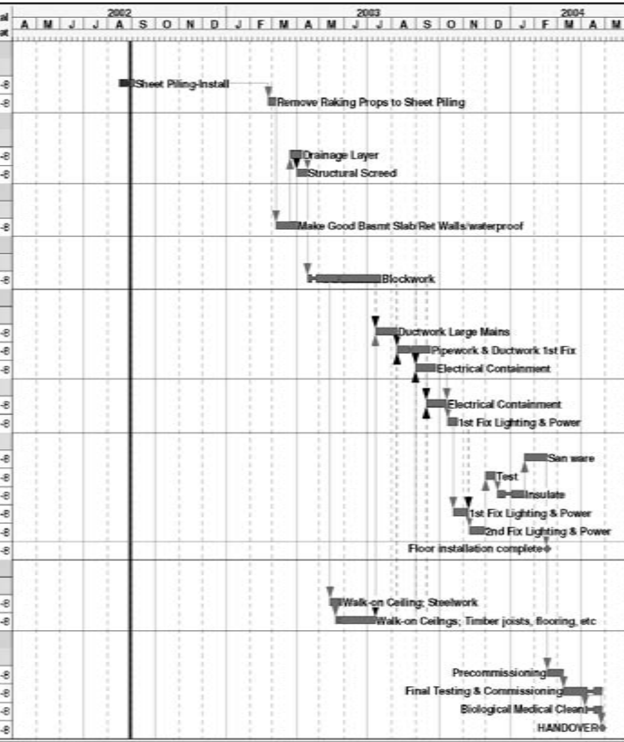
New Science Block

EVENT T1-008
Chart B
Subnet and New Critical Path

Sheet 1 of 1

APPENDIX 4D b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Piling							
9650	Sheet Piling-Install	9	59	4	16AUG02A	04SEP02	-8
9690	Remove Raking Props to Sheet Piling	8	0	8	24FEB03	05MAR03	-8
Basement							
10010	Drainage Layer	11	0	11	24MAR03	07APR03	-8
10020	Structural Screed	10	0	10	01APR03	14APR03	-8
Frame/Upper Flrs: Level 0 - Level 1							
10170	Make Good Basmt Slab/Ret Walls/waterproof	20	0	20	06MAR03	02APR03	-8
Internal Walls							
10810	Blockwork	63	0	63	15APR03	16JUL03	-8
Mech/Elec Services Instns							
Level '0', High Level							
20	Ductwork Large Mains	20	0	20	11JUL03*	07AUG03	-8
22	Pipework & Ductwork 1st Fix	30	0	30	08AUG03	19SEP03	-8
25	Electrical Containment	20	0	20	01SEP03	26SEP03	-8
Level '0', Low Level							
39	Electrical Containment	20	0	20	15SEP03	10OCT03	-8
40	1st Fix Lighting & Power	10	0	10	13OCT03	24OCT03	-8
Level '1'							
53	San ware	20	0	20	20JAN04	16FEB04	-8
54	Test	10	0	10	01DEC03	12DEC03	-8
55	Insulate	20	0	20	15DEC03	19JAN04	-8
57	1st Fix Lighting & Power	15	0	15	20OCT03	07NOV03	-8
58	2nd Fix Lighting & Power	15	0	15	10NOV03	28NOV03	-8
63	Floor installation complete	0	0	0		16FEB04	-8
Ceiling Finishes							
11180	Walk-on Ceiling; Steelwork	10	0	10	14MAY03	28MAY03	-8
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	21MAY03	10JUL03	-8
Final Testing/Commission/Clean							
11510	Precommissioning	15	0	15	17FEB04	08MAR04	-8
11520	Final Testing & Commissioning	30	0	30	09MAR04	27APR04	-8
11530	Biological Medical Clean	10	0	10	06APR04	27APR04	-8
11540	HANDOVER	0	0	0		27APR04	-8



Start Date 05AUG02
Finish Date 27APR04
Data Date 30AUG02
Run Date 05OCT07 09:59

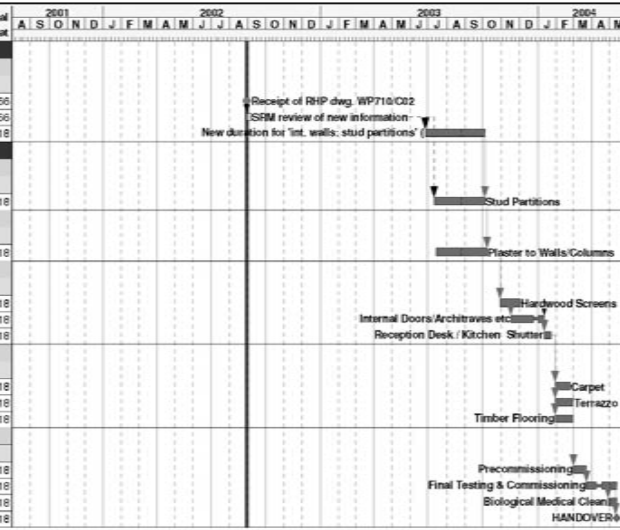
New Science Block

EVENT T1-011
Chart A
The Critical Path; Prior to Event

APPENDIX 4D c

Sheet 1 of 1

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Subnet T1-011							
T1-011.01	Receipt of RHP dwg. WP710/C02	0	0	0	30AUG02*		166
T1-011.02	SRM review of new information	5	0	5	30AUG02	05SEP02	166
T1-011.03	New duration for 'int. walls: stud partitions' (	71	0	71	26JUN03*	03OCT03	-18
Internal Walls							
10820	Stud Partitions	60	0	60	11JUL03	03OCT03	-18
Wall Finishes							
11050	Plaster to Walls/Columns	62	0	62	14JUL03	08OCT03	-18
Internal Doors							
11280	Hardwood Screens	25	0	25	30OCT03	03DEC03	-18
11290	Internal Doors/Architraves etc	35	0	35	17NOV03	12JAN04	-18
11300	Reception Desk / Kitchen Shutter	9	0	9	13JAN04	23JAN04	-18
Floor Finishes							
11470	Carpet	18	0	18	30JAN04	24FEB04	-18
11480	Terrazzo	22	0	22	30JAN04	01MAR04	-18
11490	Timber Flooring	22	0	22	30JAN04	01MAR04	-18
Final Testing/Commissioning/Clean							
11510	Precommissioning	15	0	15	02MAR04	22MAR04	-18
11520	Final Testing & Commissioning	30	0	30	23MAR04	12MAY04	-18
11530	Biological Medical Clean	10	0	10	28APR04	12MAY04	-18
11540	HANDOVER	0	0	0		12MAY04	-18



Start Date 06AUG02
Finish Date 12MAY04
Data Date 30AUG02
Run Date 05OCT07 10:07

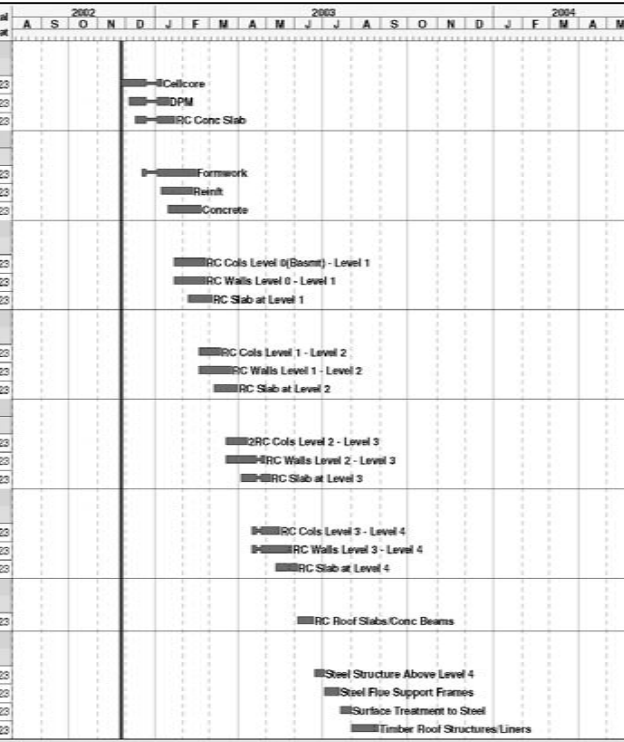
New Science Block

EVENT T1-011
Chart B
Subnet and New Critical Path

Sheet 1 of 1

APPENDIX 4D d

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Basement							
9980	Cellcore	22	0	22	27NOV02	09JAN03	-23
9990	DPM	22	0	22	04DEC02	16JAN03	-23
10000	RC Conc Slab	22	0	22	11DEC02	23JAN03	-23
RC Retaining Walls							
10040	Formwork	33	0	33	18DEC02	14FEB03	-23
10050	Reinft	24	0	24	08JAN03	10FEB03	-23
10060	Concrete	27	0	27	15JAN03	20FEB03	-23
Frame/Upper Flrs: Level 0 - Level 1							
10130	RC Cols Level 0(Basmt) - Level 1	24	0	24	22JAN03	24FEB03	-23
10140	RC Walls Level 0 - Level 1	24	0	24	22JAN03	24FEB03	-23
10150	RC Slab at Level 1	17	0	17	07FEB03	03MAR03	-23
Frame/Upper Flrs: Level 1 - Level 2							
10200	RC Cols Level 1 - Level 2	17	0	17	18FEB03	12MAR03	-23
10210	RC Walls Level 1 - Level 2	25	0	25	18FEB03	24MAR03	-23
10220	RC Slab at Level 2	17	0	17	07MAR03	31MAR03	-23
Frame/Upper Flrs: Level 2 - Level 3							
10250	2RC Cols Level 2 - Level 3	17	0	17	19MAR03	10APR03	-23
10260	RC Walls Level 2 - Level 3	25	0	25	19MAR03	29APR03	-23
10270	RC Slab at Level 3	17	0	17	04APR03	05MAY03	-23
Frame/Upper Flrs: Level 3 - Level 4							
10300	RC Cols Level 3 - Level 4	17	0	17	16APR03	15MAY03	-23
10310	RC Walls Level 3 - Level 4	25	0	25	16APR03	28MAY03	-23
10320	RC Slab at Level 4	16	0	16	12MAY03	03JUN03	-23
Roof Slab							
10340	RC Roof Slabs/Conc Beams	13	0	13	04JUN03	20JUN03	-23
Roof							
10390	Steel Structure Above Level 4	8	0	8	23JUN03	02JUL03	-23
10400	Steel Flue Support Frames	12	0	12	03JUL03	18JUL03	-23
10410	Surface Treatment to Steel	9	0	9	21JUL03	31JUL03	-23
10470	Timber Roof Structures/Liners	20	0	20	01AUG03	29AUG03	-23



Start Date 05AUG02
Finish Date 19MAY04
Data Date 27NOV02
Run Date 05OCT07 10:25

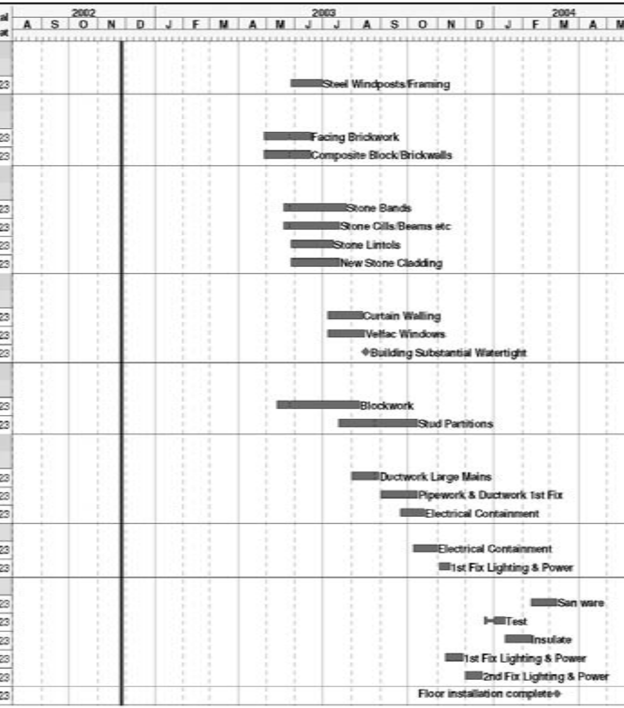
New Science Block

EVENT T1-102
Chart A
Progress Update; at date of Event

Sheet 1 of 3

APPENDIX 4D e

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
External Walls/Glazing							
10600	Steel Windposts/Framing	24	0	24	28MAY03	30JUN03	-23
Brick/Blockwork							
10620	Facing Brickwork	35	0	35	29APR03	17JUN03	-23
10640	Composite Block/Brickwalls	35	0	35	29APR03	17JUN03	-23
Stonework							
10660	Stone Bands	48	0	48	20MAY03	25JUL03	-23
10670	Stone Cills/Beams etc	43	0	43	20MAY03	18JUL03	-23
10680	Stone Lintols	33	0	33	28MAY03	11JUL03	-23
10690	New Stone Cladding	38	0	38	28MAY03	18JUL03	-23
Glazing/Louvres/Ext.Doors							
10720	Curtain Walling	27	0	27	07JUL03	12AUG03	-23
10730	Velfac Windows	29	0	29	07JUL03	14AUG03	-23
10780	Building Substantial Watertight	0	0	0		15AUG03	-23
Internal Walls							
10810	Blockwork	63	0	63	13MAY03	08AUG03	-23
10820	Stud Partitions	60	0	60	18JUL03	10OCT03	-23
Mech/Elec Services Instns							
Level '0', High Level							
20	Ductwork Large Mains	20	0	20	01AUG03*	29AUG03	-23
22	Pipework & Ductwork 1st Fix	30	0	30	01SEP03	10OCT03	-23
25	Electrical Containment	20	0	20	22SEP03	17OCT03	-23
Level '0', Low Level							
39	Electrical Containment	20	0	20	06OCT03	31OCT03	-23
40	1st Fix Lighting & Power	10	0	10	03NOV03	14NOV03	-23
Level '1'							
53	San ware	20	0	20	10FEB04	08MAR04	-23
54	Test	10	0	10	22DEC03	12JAN04	-23
55	Insulate	20	0	20	13JAN04	09FEB04	-23
57	1st Fix Lighting & Power	15	0	15	10NOV03	28NOV03	-23
58	2nd Fix Lighting & Power	15	0	15	01DEC03	19DEC03	-23
63	Floor installation complete	0	0	0		08MAR04	-23



Start Date 06AUG02
Finish Date 19MAY04
Data Date 27NOV02
Run Date 05OCT07 10:25

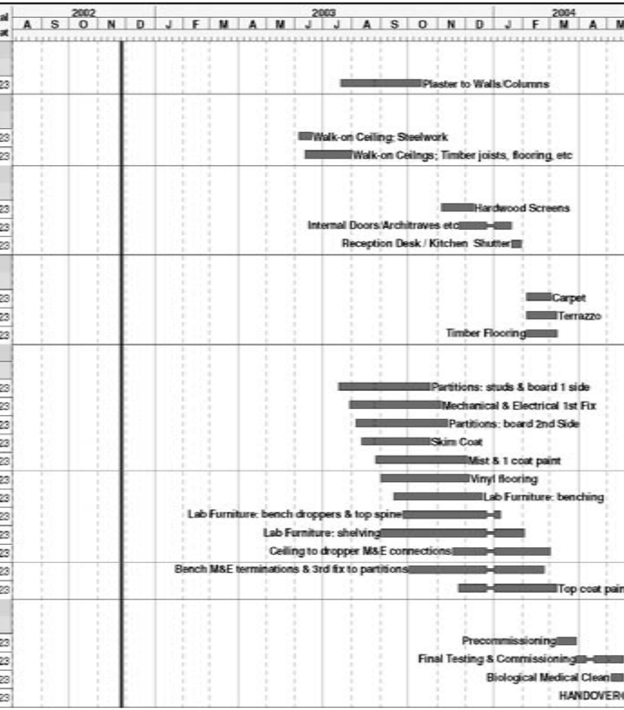
New Science Block

EVENT T1-102
Chart A
Progress Update; at date of Event

APPENDIX 4D e

Sheet 2 of 3

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Wall Finishes							
11050	Plaster to Walls/Columns	62	0	62	21JUL03	15OCT03	-23
Ceiling Finishes							
11180	Walk-on Ceiling: Steelwork	10	0	10	05JUN03	18JUN03	-23
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	12JUN03	31JUL03	-23
Internal Doors							
11280	Hardwood Screens	25	0	25	06NOV03	10DEC03	-23
11290	Internal Doors/Architraves etc	35	0	35	24NOV03	19JAN04	-23
11300	Reception Desk / Kitchen Shutter	9	0	9	20JAN04	30JAN04	-23
Floor Finishes							
11470	Carpet	18	0	18	06FEB04	02MAR04	-23
11480	Terrazzo	22	0	22	06FEB04	08MAR04	-23
11490	Timber Flooring	22	0	22	06FEB04	08MAR04	-23
Laboratory Fit-Out							
L01	Partitions: studs & board 1 side	70	0	70	18JUL03	24OCT03	-23
L02	Mechanical & Electrical 1st Fix	70	0	70	30JUL03	05NOV03	-23
L03	Partitions: board 2nd Side	70	0	70	06AUG03	12NOV03	-23
L04	Skim Coat	53	0	53	12AUG03	24OCT03	-23
L05	Mist & 1 coat paint	70	0	70	27AUG03	02DEC03	-23
L06	Vinyl flooring	70	0	70	01SEP03	05DEC03	-23
L07	Lab Furniture: benching	70	0	70	15SEP03	19DEC03	-23
L08	Lab Furniture: bench droppers & top spine	70	0	70	25SEP03	08JAN04	-23
L09	Lab Furniture: shelving	105	0	105	01SEP03	02FEB04	-23
L11	Ceiling to dropper M&E connections	70	0	70	17NOV03	01MAR04	-23
L13	Bench M&E terminations & 3rd fix to partitions	97	0	97	02OCT03	23FEB04	-23
L17	Top coat paint	70	0	70	24NOV03	08MAR04	-23
Final Testing/Commission/Clean							
11510	Precommissioning	15	0	15	09MAR04	29MAR04	-23
11520	Final Testing & Commissioning	30	0	30	30MAR04	19MAY04	-23
11530	Biological Medical Clean	10	0	10	06MAY04	19MAY04	-23
11540	HANDOVER	0	0	0		19MAY04	-23



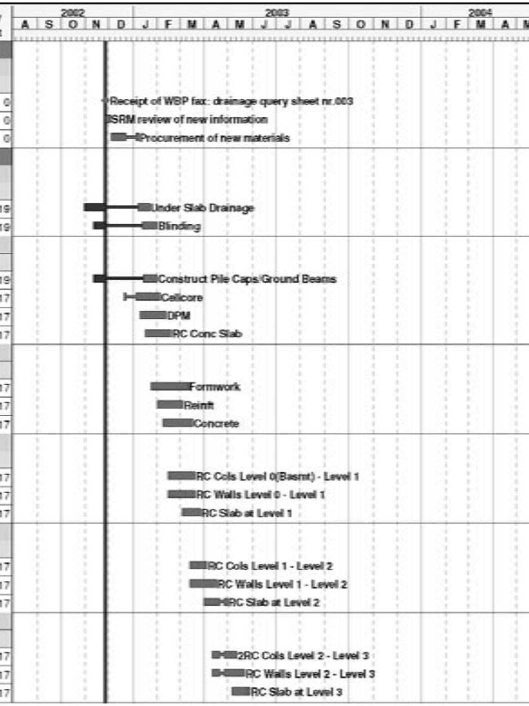
Start Date	05AUG02
Finish Date	19MAY04
Data Date	27NOV02
Run Date	05OCT07 10:25

New Science Block

EVENT T1-102
Chart A
Progress Update; at date of Event

APPENDIX 4D e

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
Subnet T1-102								
T1-102.01	Receipt of WBP fax: drainage query sheet	0	0	0	27NOV02*		-46	0
T1-102.02	SRM review of new information	5	0	5	27NOV02	03DEC02	-46	0
T1-102.03	Procurement of new materials	15	0	15	04DEC02	07JAN03	-46	0
Substructure								
9940	Under Slab Drainage	15	28	11	31OCT02A	21JAN03	-46	-19
9950	Binding	17	16	14	12NOV02A	30JAN03	-46	-19
Basement								
9970	Construct Pile Caps/Ground Beams	15	15	13	12NOV02A	30JAN03	-40	-19
9980	Cellcore	22	0	22	20DEC02	03FEB03	-40	-17
9990	DPM	22	0	22	10JAN03	10FEB03	-40	-17
10000	RC Conc Slab	22	0	22	17JAN03	17FEB03	-40	-17
RC Retaining Walls								
10040	Formwork	33	0	33	24JAN03	11MAR03	-40	-17
10050	Reinft	24	0	24	31JAN03	05MAR03	-40	-17
10060	Concrete	27	0	27	07FEB03	17MAR03	-40	-17
Frame/Upper Flrs: Level 0 - Level 1								
10130	RC Cols Level 0(Basmt) - Level 1	24	0	24	14FEB03	19MAR03	-40	-17
10140	RC Walls Level 0 - Level 1	24	0	24	14FEB03	19MAR03	-40	-17
10150	RC Slab at Level 1	17	0	17	04MAR03	26MAR03	-40	-17
Frame/Upper Flrs: Level 1 - Level 2								
10200	RC Cols Level 1 - Level 2	17	0	17	13MAR03	04APR03	-40	-17
10210	RC Walls Level 1 - Level 2	25	0	25	13MAR03	16APR03	-40	-17
10220	RC Slab at Level 2	17	0	17	01APR03	30APR03	-40	-17
Frame/Upper Flrs: Level 2 - Level 3								
10250	2RC Cols Level 2 - Level 3	17	0	17	11APR03	12MAY03	-40	-17
10260	RC Walls Level 2 - Level 3	25	0	25	11APR03	22MAY03	-40	-17
10270	RC Slab at Level 3	17	0	17	06MAY03	29MAY03	-40	-17



Start Date	05AUG02
Finish Date	14JUN04
Data Date	27NOV02
Run Date	05OCT07 10:32

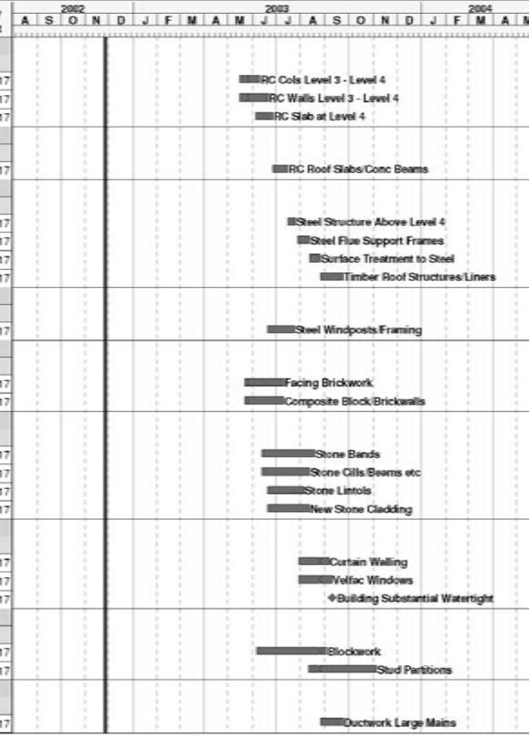
New Science Block

EVENT T1-102
Chart B
Progress Update with Subnet

Sheet 1 of 4

APPENDIX 4D f

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
Frame/Upper Flrs: Level 3 - Level 4								
10300	RC Cols Level 3 - Level 4	17	0	17	16MAY03	10JUN03	-40	-17
10310	RC Walls Level 3 - Level 4	25	0	25	16MAY03	20JUN03	-40	-17
10320	RC Slab at Level 4	16	0	16	05JUN03	26JUN03	-40	-17
Roof Slab								
10340	RC Roof Slabs/Conc Beams	13	0	13	27JUN03	15JUL03	-40	-17
Roof								
10390	Steel Structure Above Level 4	8	0	8	16JUL03	25JUL03	-40	-17
10400	Steel Flue Support Frames	12	0	12	28JUL03	12AUG03	-40	-17
10410	Surface Treatment to Steel	9	0	9	13AUG03	26AUG03	-40	-17
10470	Timber Roof Structures/Liners	20	0	20	27AUG03	23SEP03	-40	-17
External Walls/Glazing								
10600	Steel Windposts/Framing	24	0	24	20JUN03	23JUL03	-40	-17
Brick/Blockwork								
10620	Facing Brickwork	35	0	35	22MAY03	10JUL03	-40	-17
10640	Composite Block/Brickwalls	35	0	35	22MAY03	10JUL03	-40	-17
Stonework								
10660	Stone Bands	48	0	48	13JUN03	19AUG03	-40	-17
10670	Stone Cills/Beams etc	43	0	43	13JUN03	12AUG03	-40	-17
10680	Stone Lintols	33	0	33	20JUN03	05AUG03	-40	-17
10690	New Stone Cladding	38	0	38	20JUN03	12AUG03	-40	-17
Glazing/Louvres/Ext.Doors								
10720	Curtain Walling	27	0	27	30JUL03	05SEP03	-40	-17
10730	Velfac Windows	29	0	29	30JUL03	09SEP03	-40	-17
10780	Building Substantial Watertight	0	0	0		10SEP03	-40	-17
Internal Walls								
10810	Blockwork	63	0	63	06JUN03	03SEP03	-40	-17
10820	Stud Partitions	60	0	60	12AUG03	04NOV03	-40	-17
Mech/Elec Services Instns								
Level '0', High Level								
20	Ductwork Large Mains	20	0	20	27AUG03*	23SEP03	-40	-17



Start Date 06AUG02
Finish Date 14JUN04
Data Date 27NOV02
Run Date 05OCT07 10:32

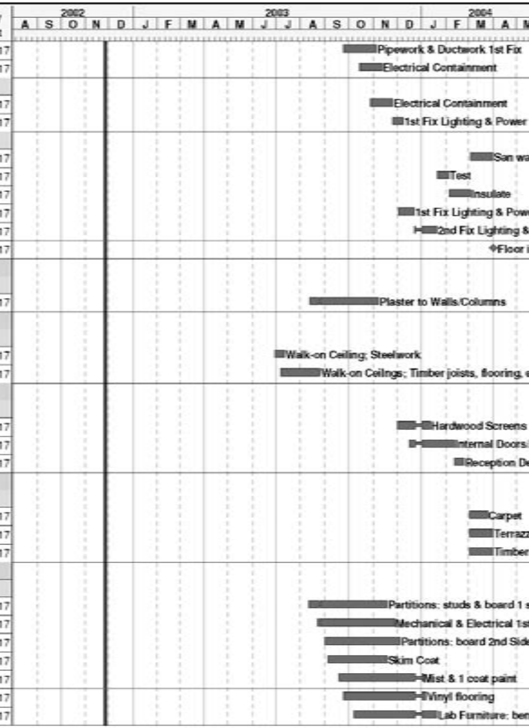
New Science Block

EVENT T1-102
Chart B
Progress Update with Subnet

Sheet 2 of 4

APPENDIX 4D f

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
22	Pipework & Ductwork 1st Fix	30	0	30	24SEP03	04NOV03	-40	-17
25	Electrical Containment	20	0	20	15OCT03	11NOV03	-40	-17
Level '0', Low Level								
39	Electrical Containment	20	0	20	29OCT03	25NOV03	-40	-17
40	1st Fix Lighting & Power	10	0	10	26NOV03	08DEC03	-40	-17
Level '1'								
53	San ware	20	0	20	04MAR04	31MAR04	-40	-17
54	Test	10	0	10	22JAN04	04FEB04	-40	-17
55	Insulate	20	0	20	05FEB04	03MAR04	-40	-17
57	1st Fix Lighting & Power	15	0	15	03DEC03	23DEC03	-40	-17
58	2nd Fix Lighting & Power	15	0	15	24DEC03	21JAN04	-40	-17
63	Floor installation complete	0	0	0		31MAR04	-40	-17
Wall Finishes								
11050	Plaster to Walls/Columns	62	0	62	13AUG03	07NOV03	-40	-17
Ceiling Finishes								
11180	Walk-on Ceiling; Steelwork	10	0	10	30JUN03	11JUL03	-40	-17
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	07JUL03	26AUG03	-40	-17
Internal Doors								
11280	Hardwood Screens	25	0	25	01DEC03	12JAN04	-40	-17
11290	Internal Doors/Architraves etc	35	0	35	17DEC03	11FEB04	-40	-17
11300	Reception Desk / Kitchen Shutter	9	0	9	12FEB04	24FEB04	-40	-17
Floor Finishes								
11470	Carpet	18	0	18	02MAR04	25MAR04	-40	-17
11480	Terrazzo	22	0	22	02MAR04	31MAR04	-40	-17
11490	Timber Flooring	22	0	22	02MAR04	31MAR04	-40	-17
Laboratory Fit-out								
L01	Partitions: studs & board 1 side	70	0	70	12AUG03	18NOV03	-40	-17
L02	Mechanical & Electrical 1st Fix	70	0	70	22AUG03	28NOV03	-40	-17
L03	Partitions: board 2nd Side	70	0	70	01SEP03	05DEC03	-40	-17
L04	Skim Coat	53	0	53	05SEP03	18NOV03	-40	-17
L05	Mist & 1 coat paint	70	0	70	19SEP03	02JAN04	-40	-17
L06	Vinyl flooring	70	0	70	24SEP03	07JAN04	-40	-17
L07	Lab Furniture: benching	70	0	70	08OCT03	21JAN04	-40	-17



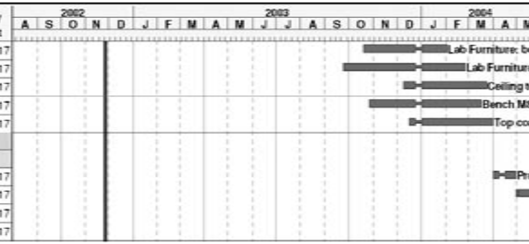
Start Date	05AUG02
Finish Date	14JUN04
Data Date	27NOV02
Run Date	05OCT07 10:32

New Science Block

EVENT T1-102
Chart B
Progress Update with Subnet

APPENDIX 4D f

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
L08	Lab Furniture: bench droppers & top spine	70	0	70	20OCT03	02FEB04	-40	-17
L09	Lab Furniture: shelving	105	0	105	24SEP03	25FEB04	-40	-17
L11	Ceiling to dropper M&E connections	70	0	70	10DEC03	24MAR04	-40	-17
L13	Bench M&E terminations & 3rd fix to partitions	97	0	97	27OCT03	17MAR04	-40	-17
L17	Top coat paint	70	0	70	17DEC03	31MAR04	-40	-17
Final Testing/Commissioning/Clean								
11510	Precommissioning	15	0	15	01APR04	29APR04	-40	-17
11520	Final Testing & Commissioning	30	0	30	30APR04	14JUN04	-40	-17
11530	Biological Medical Clean	10	0	10	01JUN04	14JUN04	-40	-17
11540	HANDOVER	0	0	0		14JUN04	-40	-17



Start Date 05AUG02
Finish Date 14JUN04
Data Date 27NOV02
Run Date 05OCT07 10:32

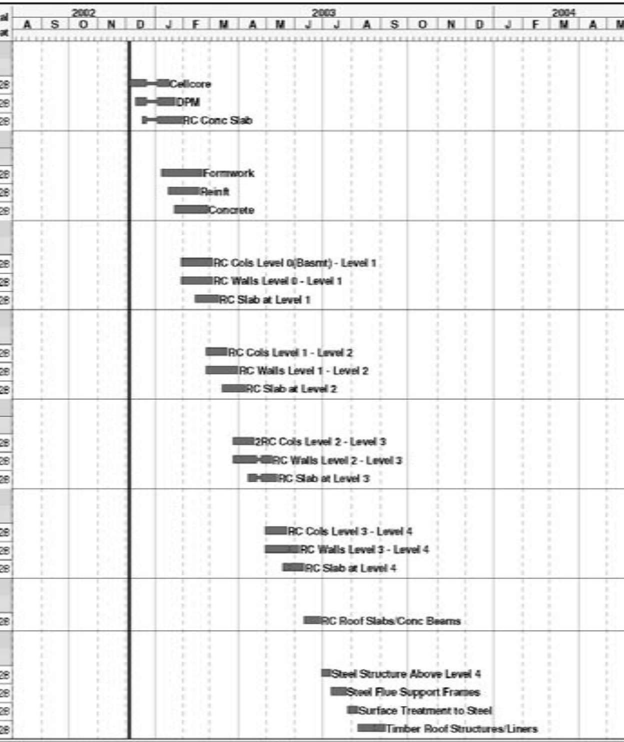
New Science Block

EVENT T1-102
Chart B
Progress Update with Subnet

Sheet 4 of 4

APPENDIX 4D f

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Basement							
9980	Cellcore	22	0	22	04DEC02	16JAN03	-28
9990	DPM	22	0	22	11DEC02	23JAN03	-28
10000	RC Conc Slab	22	0	22	18DEC02	30JAN03	-28
RC Retaining Walls							
10040	Formwork	33	0	33	08JAN03	21FEB03	-28
10050	Reinft	24	0	24	15JAN03	17FEB03	-28
10060	Concrete	27	0	27	22JAN03	27FEB03	-28
Frame/Upper Flrs: Level 0 - Level 1							
10130	RC Cols Level 0(Basmt) - Level 1	24	0	24	29JAN03	03MAR03	-28
10140	RC Walls Level 0 - Level 1	24	0	24	29JAN03	03MAR03	-28
10150	RC Slab at Level 1	17	0	17	14FEB03	10MAR03	-28
Frame/Upper Flrs: Level 1 - Level 2							
10200	RC Cols Level 1 - Level 2	17	0	17	25FEB03	19MAR03	-28
10210	RC Walls Level 1 - Level 2	25	0	25	25FEB03	31MAR03	-28
10220	RC Slab at Level 2	17	0	17	14MAR03	07APR03	-28
Frame/Upper Flrs: Level 2 - Level 3							
10250	2RC Cols Level 2 - Level 3	17	0	17	26MAR03	17APR03	-28
10260	RC Walls Level 2 - Level 3	25	0	25	26MAR03	06MAY03	-28
10270	RC Slab at Level 3	17	0	17	11APR03	12MAY03	-28
Frame/Upper Flrs: Level 3 - Level 4							
10300	RC Cols Level 3 - Level 4	17	0	17	30APR03	22MAY03	-28
10310	RC Walls Level 3 - Level 4	25	0	25	30APR03	04JUN03	-28
10320	RC Slab at Level 4	16	0	16	19MAY03	10JUN03	-28
Roof Slab							
10340	RC Roof Slabs/Conc Beams	13	0	13	11JUN03	27JUN03	-28
Roof							
10390	Steel Structure Above Level 4	8	0	8	30JUN03	09JUL03	-28
10400	Steel Flue Support Frames	12	0	12	10JUL03	25JUL03	-28
10410	Surface Treatment to Steel	9	0	9	28JUL03	07AUG03	-28
10470	Timber Roof Structures/Liners	20	0	20	08AUG03	05SEP03	-28



Start Date 05AUG02
Finish Date 26MAY04
Data Date 04DEC02
Run Date 05OCT07 11:15

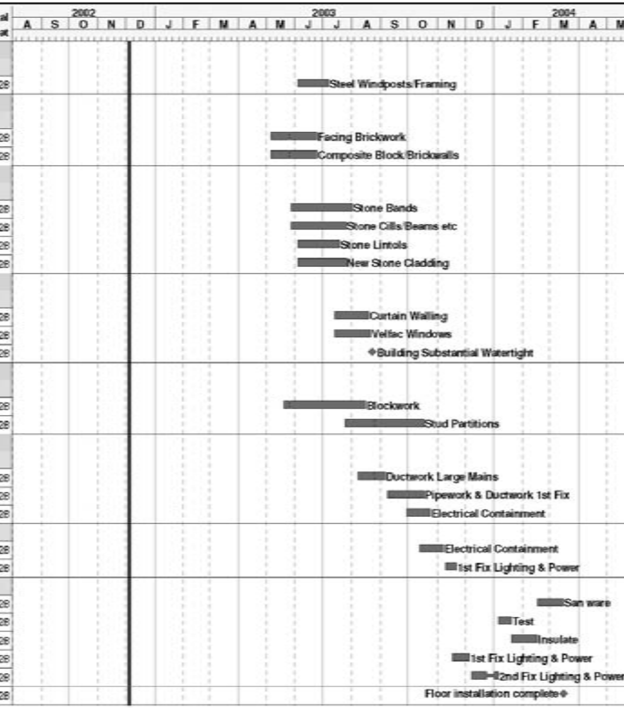
New Science Block

EVENT T1-108
Chart A
Progress Update; at date of Event

Sheet 1 of 3

APPENDIX 4D g

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
External Walls/Glazing							
10600	Steel Windposts/Framing	24	0	24	04JUN03	07JUL03	-28
Brick/Blockwork							
10620	Facing Brickwork	35	0	35	06MAY03	24JUN03	-28
10640	Composite Block/Brickwalls	35	0	35	06MAY03	24JUN03	-28
Stonework							
10660	Stone Bands	48	0	48	28MAY03	01AUG03	-28
10670	Stone Cills/Beams etc	43	0	43	28MAY03	25JUL03	-28
10680	Stone Lintols	33	0	33	04JUN03	18JUL03	-28
10690	New Stone Cladding	38	0	38	04JUN03	25JUL03	-28
Glazing/Louvres/Ext.Doors							
10720	Curtain Walling	27	0	27	14JUL03	19AUG03	-28
10730	Velfac Windows	29	0	29	14JUL03	21AUG03	-28
10780	Building Substantial Watertight	0	0	0		22AUG03	-28
Internal Walls							
10810	Blockwork	63	0	63	20MAY03	15AUG03	-28
10820	Stud Partitions	60	0	60	25JUL03	17OCT03	-28
Mech/Elec Services Instns							
Level '0', High Level							
20	Ductwork Large Mains	20	0	20	08AUG03*	05SEP03	-28
22	Pipework & Ductwork 1st Fix	30	0	30	08SEP03	17OCT03	-28
25	Electrical Containment	20	0	20	29SEP03	24OCT03	-28
Level '0', Low Level							
39	Electrical Containment	20	0	20	13OCT03	07NOV03	-28
40	1st Fix Lighting & Power	10	0	10	10NOV03	21NOV03	-28
Level '1'							
53	San ware	20	0	20	17FEB04	15MAR04	-28
54	Test	10	0	10	06JAN04	19JAN04	-28
55	Insulate	20	0	20	20JAN04	16FEB04	-28
57	1st Fix Lighting & Power	15	0	15	17NOV03	05DEC03	-28
58	2nd Fix Lighting & Power	15	0	15	08DEC03	05JAN04	-28
63	Floor installation complete	0	0	0		15MAR04	-28



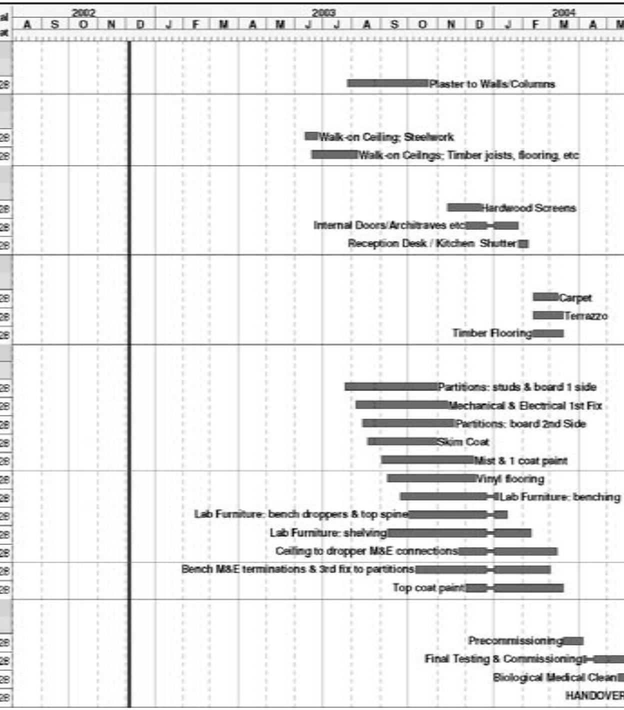
Start Date	05AUG02
Finish Date	29MAY04
Data Date	04DEC02
Run Date	05OCT07 11:15

New Science Block

EVENT T1-108
Chart A
Progress Update; at date of Event

APPENDIX 4D g

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
Wall Finishes							
11050	Plaster to Walls/Columns	62	0	62	28JUL03	22OCT03	-28
Ceiling Finishes							
11180	Walk-on Ceiling; Steelwork	10	0	10	12JUN03	25JUN03	-28
11190	Walk-on Ceilings; Timber joists, flooring, etc	36	0	36	19JUN03	07AUG03	-28
Internal Doors							
11280	Hardwood Screens	25	0	25	13NOV03	17DEC03	-28
11290	Internal Doors/Architraves etc	35	0	35	01DEC03	26JAN04	-28
11300	Reception Desk / Kitchen Shutter	9	0	9	27JAN04	06FEB04	-28
Floor Finishes							
11470	Carpet	18	0	18	13FEB04	09MAR04	-28
11480	Terrazzo	22	0	22	13FEB04	15MAR04	-28
11490	Timber Flooring	22	0	22	13FEB04	15MAR04	-28
Laboratory Fit-Out							
L01	Partitions: studs & board 1 side	70	0	70	25JUL03	31OCT03	-28
L02	Mechanical & Electrical 1st Fix	70	0	70	06AUG03	12NOV03	-28
L03	Partitions: board 2nd Side	70	0	70	13AUG03	19NOV03	-28
L04	Skim Coat	53	0	53	19AUG03	31OCT03	-28
L05	Mist & 1 coat paint	70	0	70	03SEP03	09DEC03	-28
L06	Vinyl flooring	70	0	70	08SEP03	12DEC03	-28
L07	Lab Furniture: benching	70	0	70	22SEP03	05JAN04	-28
L08	Lab Furniture: bench droppers & top spine	70	0	70	02OCT03	15JAN04	-28
L09	Lab Furniture: shelving	105	0	105	08SEP03	09FEB04	-28
L11	Ceiling to dropper M&E connections	70	0	70	24NOV03	08MAR04	-28
L13	Bench M&E terminations & 3rd fix to partitions	97	0	97	09OCT03	01MAR04	-28
L17	Top coat paint	70	0	70	01DEC03	15MAR04	-28
Final Testing/Commission/Clean							
11510	Precommissioning	15	0	15	16MAR04	05APR04	-28
11520	Final Testing & Commissioning	30	0	30	06APR04	26MAY04	-28
11530	Biological Medical Clean	10	0	10	13MAY04	26MAY04	-28
11540	HANDOVER	0	0	0		26MAY04	-28



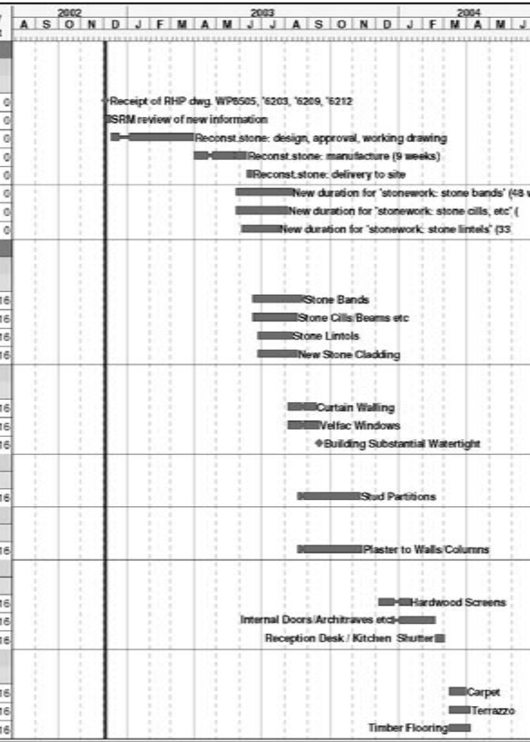
Start Date	06AUG02
Finish Date	26MAY04
Data Date	04DEC02
Run Date	05OCT07 11:15

New Science Block

EVENT T1-108
Chart A
Progress Update; at date of Event

APPENDIX 4D g

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
Subnet T1-108								
T1-108.01	Receipt of RHP dwg. WP8505, '6203, '6209,	0	0	0	04DEC02*		-44	0
T1-108.02	SRM review of new information	5	0	5	04DEC02	10DEC02	-44	0
T1-108.03	Reconst.stone: design, approval, working	70	0	70	11DEC02	01APR03	-44	0
T1-108.04	Reconst.stone: manufacture (9 weeks)	45	0	45	02APR03	11JUN03	-44	0
T1-108.05	Reconst.stone: delivery to site	5	0	5	12JUN03	18JUN03	-44	0
T1-108.06	New duration for 'stonework: stone bands' (48	54	0	54	28MAY03*	11AUG03	-34	0
T1-108.07	New duration for 'stonework: stone cills, etc' (	49	0	49	28MAY03*	04AUG03	-34	0
T1-108.08	New duration for 'stonework: stone lintels' (33	37	0	37	04JUN03*	24JUL03	-32	0
Stonework								
10660	Stone Bands	48	0	48	19JUN03	26AUG03	-44	-16
10670	Stone Cills/Beams etc	43	0	43	19JUN03	18AUG03	-44	-16
10680	Stone Lintols	33	0	33	26JUN03	11AUG03	-44	-16
10690	New Stone Cladding	38	0	38	26JUN03	18AUG03	-44	-16
Glazing/Louvres/Ext Doors								
10720	Curtain Walling	27	0	27	05AUG03	11SEP03	-44	-16
10730	Velfac Windows	29	0	29	05AUG03	15SEP03	-44	-16
10780	Building Substantial Watertight	0	0	0		16SEP03	-44	-16
Internal Walls								
10820	Stud Partitions	60	0	60	18AUG03	10NOV03	-44	-16
Wall Finishes								
11050	Plaster to Walls/Columns	62	0	62	19AUG03	13NOV03	-44	-16
Internal Doors								
11280	Hardwood Screens	25	0	25	05DEC03	16JAN04	-44	-16
11290	Internal Doors/Architraves etc	35	0	35	23DEC03	17FEB04	-44	-16
11300	Reception Desk / Kitchen Shutter	9	0	9	18FEB04	01MAR04	-44	-16
Floor Finishes								
11470	Carpet	18	0	18	08MAR04	31MAR04	-44	-16
11480	Terrazzo	22	0	22	08MAR04	06APR04	-44	-16
11490	Timber Flooring	22	0	22	08MAR04	06APR04	-44	-16



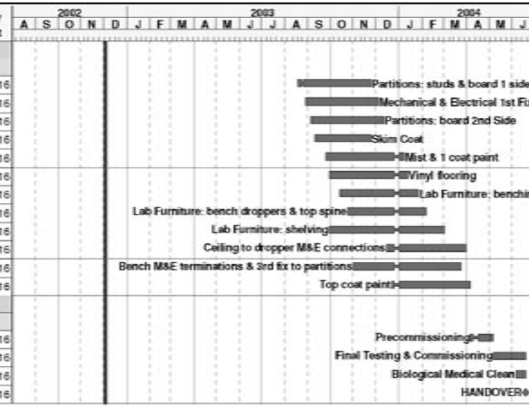
Start Date 05AUG02
Finish Date 16JUN04
Data Date 04DEC02
Run Date 05OCT07 11:23

New Science Block

EVENT T1-108
Chart B
Progress Update with Subnet

APPENDIX 4D h

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Likely Delay due to Event
Laboratory Fit-out								
L01	Partitions: studs & board 1 side	70	0	70	18AUG03	24NOV03	-44	-16
L02	Mechanical & Electrical 1st Fix	70	0	70	29AUG03	04DEC03	-44	-16
L03	Partitions: board 2nd Side	70	0	70	05SEP03	11DEC03	-44	-16
L04	Skim Coat	53	0	53	11SEP03	24NOV03	-44	-16
L05	Mist & 1 coat paint	70	0	70	25SEP03	08JAN04	-44	-16
L06	Vinyl flooring	70	0	70	30SEP03	13JAN04	-44	-16
L07	Lab Furniture: benching	70	0	70	14OCT03	27JAN04	-44	-16
L08	Lab Furniture: bench droppers & top spine	70	0	70	24OCT03	06FEB04	-44	-16
L09	Lab Furniture: shelving	105	0	105	30SEP03	02MAR04	-44	-16
L11	Ceiling to dropper M&E connections	70	0	70	16DEC03	30MAR04	-44	-16
L13	Bench M&E terminations & 3rd fix to partitions	97	0	97	31OCT03	23MAR04	-44	-16
L17	Top coat paint	70	0	70	23DEC03	06APR04	-44	-16
Final Testing/Commissioning/Clean								
11510	Precommissioning	15	0	15	07APR04	06MAY04	-44	-16
11520	Final Testing & Commissioning	30	0	30	07MAY04	18JUN04	-44	-16
11530	Biological Medical Clean	10	0	10	07JUN04	18JUN04	-44	-16
11540	HANDOVER	0	0	0		18JUN04	-44	-16



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Finish Date	18JUN04
Data Date	04DEC02
Run Date	05OCT07 11:23

New Science Block

EVENT T1-108
Chart B
Progress Update with Subnet

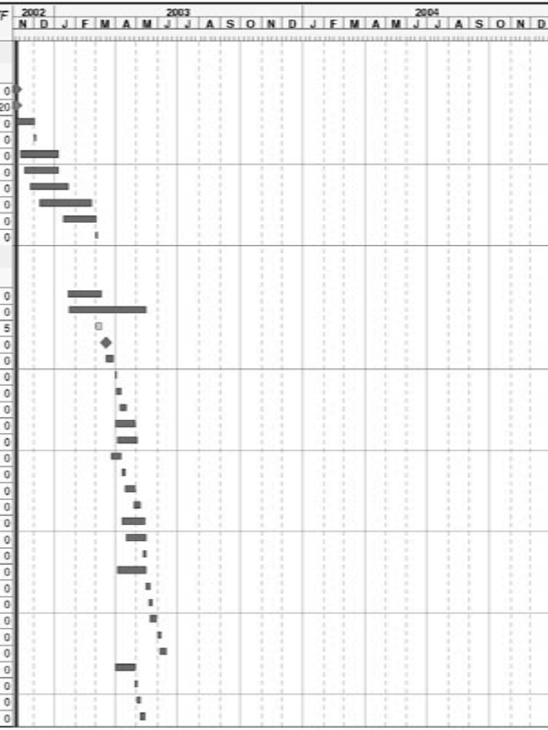
APPENDIX 4D h

Sheet 2 of 2

Appendix 5

Charts for worked example: windows analysis

Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
PRELIMINARY WORKS							
0010	Commence Preparatory Activity	05NOV02*		0	0	0	0
0020	Commence On Site	05NOV02*		0	0	0	20
0030	General Site Mobilisation	05NOV02	02DEC02	20	0	20	0
0040	Commence Main Works	03DEC02	03DEC02	1	0	1	0
0050	Site Establishment	12NOV02	06JAN03	30	0	30	0
0060	Pile Probing	19NOV02	06JAN03	25	0	25	0
0070	Guide Walls	26NOV02	20JAN03	30	0	30	0
0080	Install Secant Piles	10DEC02	24FEB03	45	0	45	0
0090	Cut Down Piles	14JAN03	03MAR03	35	0	35	0
0100	Preliminary Works Complete	04MAR03	04MAR03	1	0	1	0
APARTMENT BLOCK							
SUBSTRUCTURE							
0110	FRC CAPPING BEAM	21JAN03	10MAR03	35	0	35	0
0120	BULK DIG LEAVING SUPPORTING BERMS	23JAN03	15MAY03	74	0	74	0
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	04MAR03	10MAR03	5	0	5	5
0140	ERECT TOWER CRANE	18MAR03		0	0	0	0
0150	FRC BASEMENT SLAB AREA 1	18MAR03	28MAR03	9	0	9	0
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	31MAR03	02APR03	3	0	3	0
0170	REMOVE SIDE BERMS AREA 1	02APR03	07APR03	4	0	4	0
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	07APR03	15APR03	7	0	7	0
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	31MAR03	29APR03	16	0	16	0
0210	FRC UPPER BASEMENT SLAB AREA 1	04APR03	01MAY03	14	0	14	0
0220	FRC BASEMENT SLAB AREA 2	26MAR03	08APR03	10	0	10	0
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	10APR03	14APR03	3	0	3	0
0240	REMOVE SIDE BERMS AREA 2	15APR03	28APR03	4	0	4	0
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	28APR03	06MAY03	6	0	6	0
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	10APR03	12MAY03	16	0	16	0
0280	FRC UPPER BASEMENT SLAB AREA 2	16APR03	15MAY03	15	0	15	0
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	12MAY03	14MAY03	3	0	3	0
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	04APR03	14MAY03	22	0	22	0
0370	REMOVE BERM	15MAY03	21MAY03	5	0	5	0
0380	BREAK BACK FEMALE PILES	20MAY03	23MAY03	4	0	4	0
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	22MAY03	30MAY03	6	0	6	0
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	02JUN03	06JUN03	5	0	5	0
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	05JUN03	13JUN03	7	0	7	0
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	01APR03*	28APR03	14	0	14	0
0470	REMOVE BERM	29APR03	02MAY03	4	0	4	0
0480	BREAK BACK FEMALE PILES	02MAY03	07MAY03	3	0	3	0
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	07MAY03	13MAY03	5	0	5	0



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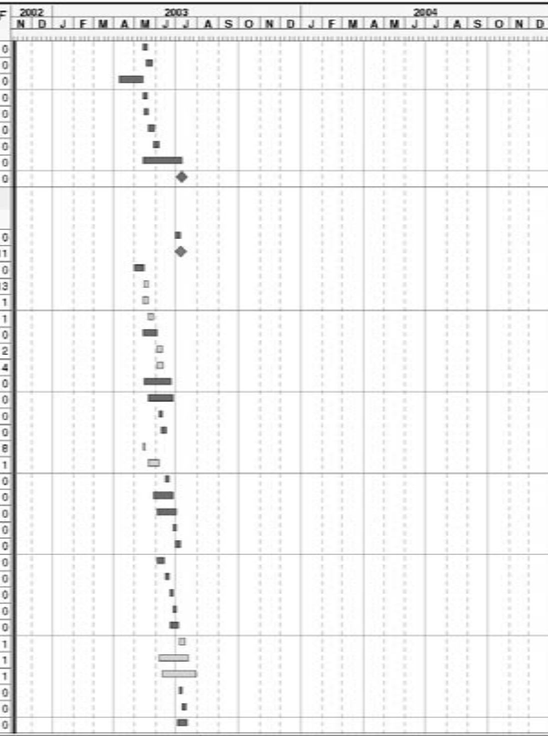
Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	14MAY03	19MAY03	4	0	4	0
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	19MAY03	27MAY03	6	0	6	0
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	09APR03*	13MAY03	18	0	18	0
0580	REMOVE BERM	14MAY03	19MAY03	4	0	4	0
0590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	15MAY03	21MAY03	5	0	5	0
0600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	22MAY03	30MAY03	6	0	6	0
0610	FRC UPPER BASEMENT SLAB GL 1/J-M	30MAY03	06JUN03	6	0	6	0
0620	FRC Walls/Columns Upper Basement- Ground Floor	13MAY03	08JUL03	40	0	40	0
0630	Substructure Residential Complete	09JUL03		0	0	0	0
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	01JUL03	07JUL03	5	0	5	0
0650	Tower Crane 2	08JUL03*		0	0	0	11
0660	FRC BASEMENT SLAB AREA 3	01MAY03	15MAY03	10	0	10	0
0670	RELOCATE TEMPORARY WORKS JIGS 1 & 2	16MAY03*	20MAY03	3	0	3	13
0680	FRC LOW LEVEL BASEMENT SLAB AREA 4	14MAY03	21MAY03	6	0	6	1
0690	FRC WALLS LOW - HIGH LEVEL AREA 4 GL 8-9/P-M	22MAY03	28MAY03	4	0	4	1
0700	FRC BASEMENT SLAB AREA 4	13MAY03	02JUN03	14	0	14	0
0720	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 3	03JUN03*	10JUN03	6	0	6	2
0730	FRC LIFT PITS IN CLOSING SECT. OF B3 GL Q-P/7-8	04JUN03*	12JUN03	7	0	7	4
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	16MAY03	23JUN03	26	0	26	0
0760	FRC UPPER BASEMENT SLAB AREA 3	21MAY03	26JUN03	26	0	26	0
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	06JUN03	10JUN03	3	0	3	0
0780	REMOVE SIDE BERMS AREA 4	10JUN03	16JUN03	5	0	5	0
0790	FRC RAMP & WALLS BASEM'T SLAB AREA 5 GL 9-10/H-E	13MAY03*	16MAY03	4	0	4	8
0800	FRC BASEMENT SLAB AREA 5	22MAY03	06JUN03	11	0	11	1
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	16JUN03	20JUN03	5	0	5	0
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	29MAY03	26JUN03	21	0	21	0
0840	FRC UPPER BASEMENT SLAB 4	04JUN03	01JUL03	20	0	20	0
0850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	27JUN03	01JUL03	3	0	3	0
0860	REMOVE SIDE BERMS AREA 5	01JUL03	07JUL03	5	0	5	0
0870	FRC LOW SECTION OF BASEM'T SLAB AREA 6	04JUN03	13JUN03	8	0	8	0
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	16JUN03	20JUN03	5	0	5	0
0890	FRC INTERMEDIATE SLAB AREA 6	23JUN03	26JUN03	4	0	4	0
0900	FRC WALLS FROM INTERMEDIATE TO HIGH LVL SLAB A6	27JUN03	01JUL03	3	0	3	0
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	23JUN03	04JUL03	10	0	10	0
0920	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 5	07JUL03	14JUL03	6	0	6	1
0930	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 5	06JUN03	18JUL03	31	0	31	1
0950	FRC UPPER BASEMENT SLAB 5	12JUN03	29JUL03	34	0	34	1
0960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	07JUL03	09JUL03	3	0	3	0
0970	REMOVE SIDE BERMS AREA 6	09JUL03	15JUL03	5	0	5	0
0980	FRC BASEMENT SLAB SECTION 7	03JUL03	16JUL03	10	0	10	0



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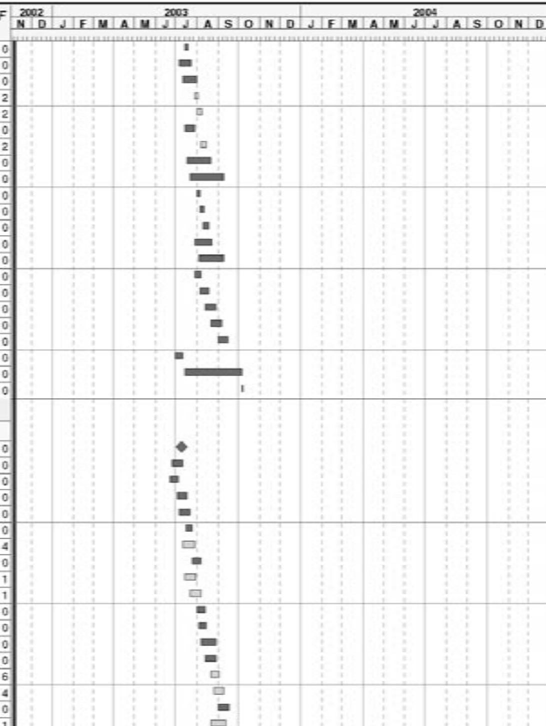
Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
0990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	15JUL03	18JUL03	4	0	4	0
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	07JUL03	23JUL03	13	0	13	0
1010	FRC UPPER BASEMENT SLAB 6	11JUL03	31JUL03	15	0	15	0
1020	RELOCATE TEMPORARY WORKS JIGS 1 & 2	29JUL03	01AUG03	4	0	4	2
1030	REMOVE SIDE BERMS AREA 7	01AUG03	08AUG03	6	0	6	2
1040	FRC BASEMENT SLAB SECTION 8	15JUL03	28JUL03	10	0	10	0
1050	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 7	07AUG03	15AUG03	7	0	7	2
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	17JUL03	21AUG03	26	0	26	0
1080	FRC UPPER BASEMENT SLAB 7	23JUL03	08SEP03	33	0	33	0
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	01AUG03	05AUG03	3	0	3	0
1100	REMOVE SIDE BERMS AREA 8	05AUG03	11AUG03	5	0	5	0
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	11AUG03	18AUG03	6	0	6	0
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	29JUL03	22AUG03	19	0	19	0
1140	FRC UPPER BASEMENT SLAB AREA 8	04AUG03	08SEP03	25	0	25	0
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	29JUL03	06AUG03	7	0	7	0
1160	REMOVE SUPPORTING BERM	05AUG03	18AUG03	10	0	10	0
1170	FRC CLOSING SECTION OF BASEMENT SLAB	13AUG03	29AUG03	12	0	12	0
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	21AUG03	05SEP03	11	0	11	0
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	01SEP03	15SEP03	11	0	11	0
1200	2 Week Allowance For Breaking Back Female Piles	30JUN03	11JUL03	10	0	10	0
1210	FRC Columns / Walls Upper Basement - Ground	14JUL03	06OCT03	60	0	60	0
1220	Substructure Arts Centre Complete	07OCT03	07OCT03	1	0	1	0
APARTMENT BLOCK							
SUPERSTRUCTURE							
1230	Substructure Residential Complete	09JUL03		0	0	0	0
1240	FRC GF Slab Incl Part Sect. Of Area 3 GL 1-7/A-H	25JUN03	11JUL03	13	0	13	0
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	23JUN03	04JUL03	10	0	10	0
1260	FRC Remaining High Level Section Of GF SLAB	03JUL03	17JUL03	11	0	11	0
1270	FRC Walls / Columns Ground - Mezz	07JUL03	21JUL03	11	0	11	0
1280	FRC Mezz Floor Grid Lines 1-7/A-D	16JUL03	24JUL03	7	0	7	0
1290	FRC Mezz Floor Grid Lines 1-7/M-R	11JUL03	28JUL03	12	0	12	4
1300	FRC Walls / Columns Mezz- 2nd Floor	25JUL03	07AUG03	10	0	10	0
1310	FRC Walls / Columns Ground - 2nd Floor	14JUL03	30JUL03	13	0	13	1
1320	FRC 2nd Floor Slab GL 1-7/F-M	22JUL03	06AUG03	12	0	12	1
1330	FRC 2nd Floor Slab GL 1-7/M-R	01AUG03	12AUG03	8	0	8	0
1340	FRC 2nd Floor Slab 1-7/A-F	04AUG03	15AUG03	10	0	10	0
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	08AUG03	29AUG03	15	0	15	0
1360	FRC 3rd Floor Slab GL 1-7/F-M	14AUG03	29AUG03	11	0	11	0
1370	FRC 3rd Floor Slab GL 1-7/M-R	22AUG03	02SEP03	7	0	7	6
1380	FRC 3rd Floor Slab GL 1-7/A-F	26AUG03	08SEP03	10	0	10	4
1390	FRC Walls / Columns 3rd - 4th Floor	01SEP03	17SEP03	13	0	13	0
1400	FRC 4th Foor Slab GL 4-7/A-L	22AUG03	12SEP03	15	0	15	1



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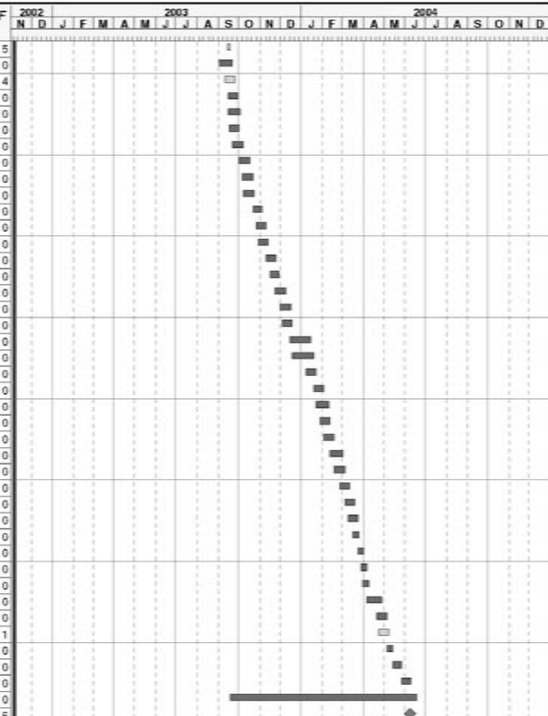
Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
1410	FRC Walls 4th Floor Low - 4th Floor High Level	15SEP03	18SEP03	4	0	4	5
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	04SEP03	22SEP03	13	0	13	0
1430	FRC 4th Floor Slab GL A-J/1-3	11SEP03	24SEP03	10	0	10	4
1440	FRC 4th Floor Slab GL 6-7/M-R	16SEP03	29SEP03	10	0	10	0
1450	FRC Walls / Columns 4th - 5th Floor	16SEP03	03OCT03	14	0	14	0
1460	FRC 5th Floor Slab GL 1-6/K-R	17SEP03	01OCT03	11	0	11	0
1470	FRC 5th Floor Slab GL 1-6/A-K	23SEP03	08OCT03	12	0	12	0
1480	FRC Walls/ Columns 5th - 6th Floor	02OCT03	17OCT03	12	0	12	0
1490	FRC 6th Floor Slab GL 1-6/K-R	07OCT03	21OCT03	11	0	11	0
1500	FRC 6th Floor Slab GL 1-6/A-K	09OCT03	23OCT03	11	0	11	0
1510	FRC Walls / Columns 6th - 7th Floor	22OCT03	04NOV03	10	0	10	0
1520	FRC 7th Floor Slab GL 1-6/K-R	27OCT03	10NOV03	11	0	11	0
1530	FRC 7th Floor Slab GL 1-6/A-K	30OCT03	13NOV03	11	0	11	0
1540	FRC Walls/ Columns 7th - 8th Floor	11NOV03	24NOV03	10	0	10	0
1550	FRC 8th Floor Slab GL 1-6/K-R	17NOV03	28NOV03	10	0	10	0
1560	FRC 8th Floor Slab GL 1-6/A-K	24NOV03	08DEC03	11	0	11	0
1570	FRC Walls / Column 8th - 9th Floor	01DEC03	16DEC03	12	0	12	0
1580	FRC 9th Floor Slab GL 1-6/K-R	05DEC03	18DEC03	10	0	10	0
1590	FRC 9th Floor Slab GL 1-6/A-K	16DEC03	13JAN04	11	0	11	0
1600	FRC Walls / Columns 9th - 10th Floor	19DEC03	19JAN04	12	0	12	0
1610	FRC 10th Floor Slab GL 1-6/K-R	08JAN04	22JAN04	11	0	11	0
1620	FRC 10th Floor SlabGL 1-6/A-K	19JAN04	02FEB04	11	0	11	0
1630	FRC Walls / Columns 10th - 11th Floor	23JAN04	09FEB04	12	0	12	0
1640	FRC 11th Floor Slab GL 1-6/K-R	29JAN04	12FEB04	11	0	11	0
1650	FRC 11th Floor Slab GL 1-6/A-K	03FEB04	18FEB04	12	0	12	0
1660	FRC Walls / Columns 11th - 12th Floor	13FEB04	01MAR04	12	0	12	0
1670	FRC 12th Floor Slab GL 1-6/K-R	19FEB04	04MAR04	11	0	11	0
1680	FRC 12th Floor Slab GL 1-6/A-K	26FEB04	11MAR04	11	0	11	0
1690	FRC Walls / Columns 12th - 13th Floor	05MAR04	19MAR04	11	0	11	0
1700	FRC 13th Floor Slab GL 1-6/K-R	11MAR04	23MAR04	9	0	9	0
1710	FRC 13th Floor Slab GL 1-6/A-K	16MAR04	25MAR04	8	0	8	0
1720	FRC Walls / Columns 13th - 14th Floor	24MAR04	01APR04	7	0	7	0
1730	FRC 14th Floor Slab GL 1-6/K-R	29MAR04	06APR04	7	0	7	0
1740	FRC 14th Floor Slab GL 1-6/A-K	31MAR04	08APR04	7	0	7	0
1750	FRC Walls/ Columns 14th - 15th Floor	07APR04	27APR04	9	0	9	0
1760	FRC 15th Floor Slab GL 1-6/K-R	20APR04	05MAY04	11	0	11	0
1770	FRC 15th Floor Slab GL 1-6/A-K	23APR04	07MAY04	10	0	10	1
1780	FRC Core Walls Level 15-16 GL A-B/2-5	06MAY04	13MAY04	6	0	6	0
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	14MAY04	26MAY04	9	0	9	0
1800	FRC Cover Slab To Core	27MAY04	09JUN04	9	0	9	0
1810	Progressive Erection of Precast Stairs	19SEP03	17JUN04	177	0	177	0
1820	Main Concrete Frame Complete	09JUN04*		0	0	0	5



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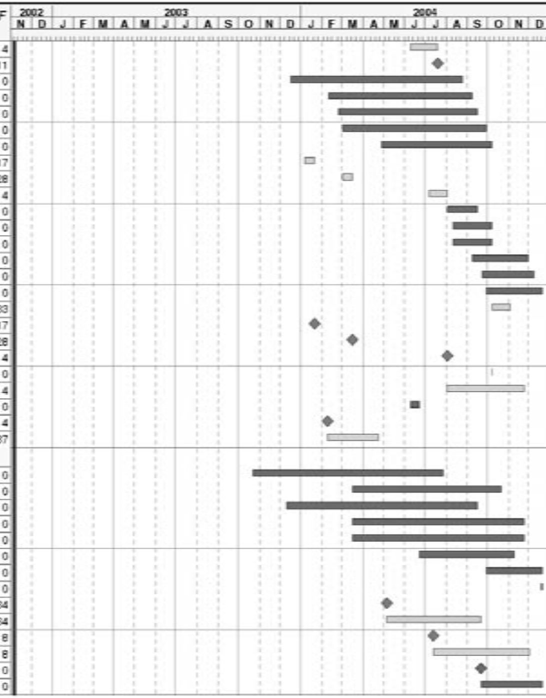
Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
1830	Penthouse Steelwork	10JUN04	19JUL04	28	0	28	4
1840	Total Frame Completion	20JUL04		0	0	0	11
1860	Timber Grounds Windows & Doors	17DEC03	24AUG04	162	0	162	0
1870	Render Insulation & First Coat	11FEB04	08SEP04	142	0	142	0
1880	Terracotta Cladding Frame Work	25FEB04	15SEP04	137	0	137	0
1890	Metal Cladding	03MAR04	29SEP04	142	0	142	0
1910	Terracotta Panels	29APR04	06OCT04	112	0	112	0
1920	Weather Storey 5 Slab	07JAN04	20JAN04	10	0	10	17
1930	Weather Storey 8 Slab	03MAR04	16MAR04	10	0	10	28
1940	Roof Finishes Main Lift/Stair Core	08JUL04	03AUG04	19	0	19	4
1950	Penthouse Brise Soleil	04AUG04	15SEP04	30	0	30	0
1960	Penthouse Curtain Walling	11AUG04	06OCT04	40	0	40	0
1970	Penthouse Roof Cladding/Roof Lights	11AUG04	06OCT04	40	0	40	0
1980	Render Final Coat Top Down	09SEP04	30NOV04	59	0	59	0
1990	Bolt On Balconies	23SEP04	07DEC04	54	0	54	0
2000	Dismatle Scaffolds	29SEP04	20DEC04	59	0	59	0
2010	Penthouse Terrace Finishes	07OCT04	02NOV04	19	0	19	33
2020	Weather Storey 5 Slab	21JAN04		0	0	0	17
2030	Weather Storey 8 Slab	17MAR04		0	0	0	28
2040	Main Core Roof Weathered	04AUG04		0	0	0	4
2050	Penthouse Roof Weathered	07OCT04	07OCT04	1	0	1	0
2090	Roof Plant Room Installations	04AUG04	23NOV04	79	0	79	4
2100	Lift Shaft Temporary Weathered	10JUN04	22JUN04	9	0	9	0
2140	Access For Show Flat Fit Out	09FEB04		0	0	0	4
2150	Show Flat Fit out	09FEB04	23APR04	49	0	49	87
INTERNAL FINISHES							
1850	Blockwork	23OCT03	27JUL04	181	0	181	0
1900	Balcony/Balustrades & Finishes	17MAR04	20OCT04	147	0	147	0
2060	Internal Blockwork to Cores	10DEC03	15SEP04	182	0	182	0
2070	M & E Services to Cores & Risers	17MAR04	23NOV04	171	0	171	0
2080	Staircase Lobbies & Common Areas	17MAR04	23NOV04	171	0	171	0
2110	Lift installations	23JUN04	08NOV04	98	0	98	0
2120	Final Commision Clean & Snag	30SEP04	20DEC04	58	0	58	0
2130	Shell & Core Completion	20DEC04	20DEC04	1	0	1	0
2160	Access For First Fit Out Phase	06MAY04		0	0	0	34
2170	First Phase Notional Fit Out Period	06MAY04	21SEP04	97	0	97	34
2180	Access For Second Fit Out Phase	14JUL04		0	0	0	8
2190	Second Phase Notional Fit Out Period	14JUL04	01DEC04	100	0	100	8
2200	Access For Third Fit Out Phase	22SEP04		0	0	0	0
2210	Third Phase Notional Fit Out Period	22SEP04	20DEC04	64	0	64	0



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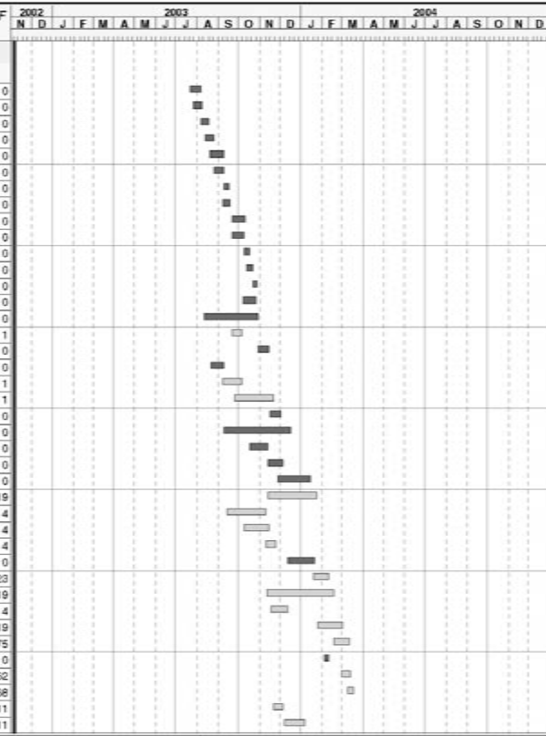
APPENDIX 5A a

Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	23JUL03	07AUG03	12	0	12	0
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	28JUL03	08AUG03	10	0	10	0
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	08AUG03	18AUG03	7	0	7	0
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	13AUG03	26AUG03	9	0	9	0
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	20AUG03	09SEP03	14	0	14	0
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	26AUG03	08SEP03	10	0	10	0
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	09SEP03	16SEP03	6	0	6	0
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	08SEP03	19SEP03	10	0	10	0
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	22SEP03	10OCT03	15	0	15	0
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	22SEP03	09OCT03	14	0	14	0
2320	FRC Walls From Low - High Lvl GF Slab GL 12,14&K	10OCT03	17OCT03	6	0	6	0
2330	FRC High Level Slab GL 11-14/A-K	13OCT03	22OCT03	8	0	8	0
2340	FRC High Level Slab GL 11-12/K-M	22OCT03	28OCT03	5	0	5	0
2350	FRC Ground Floor Slab GL 15-17/F-R	08OCT03	27OCT03	14	0	14	0
2360	FRC Walls / Columns Ground - 2nd Floor	12AUG03	30OCT03	57	0	57	0
2370	FRC Mezzanine Slab GL 8-12/K-R	23SEP03	06OCT03	10	0	10	1
2380	FRC Mezzanine Slab GL 13-17/C-R	31OCT03	14NOV03	11	0	11	0
2390	FRC 2nd Floor Slab GL 7-9/A-J	21AUG03	08SEP03	12	0	12	0
2400	FRC 2nd Floor Sla GbL 7-9/J-R	08SEP03	06OCT03	21	0	21	1
2410	FRC 2nd Floor Transfer Slab GL 9-15/H-R	25SEP03	20NOV03	41	0	41	1
2420	FRC Remainder Of 2nd Floor Slab	17NOV03	02DEC03	12	0	12	0
2430	FRC Walls / Columns 2nd - 3rd Floor	09SEP03	16DEC03	71	0	71	0
2440	FRC 3rd Floor Slab GL 7-9/L-R	17OCT03	13NOV03	20	0	20	0
2450	FRC 3rd Floor Slab GL 9-14/H-R	13NOV03	05DEC03	17	0	17	0
2460	FRC 3rd Floor Slab GL 14-17/F-R	28NOV03	14JAN04	24	0	24	0
2470	FRC Walls / Columns 3rd - 4th Floor	14NOV03	23JAN04	41	0	41	19
2480	FRC 4th FLoor Slab GL 7-9/A-L	15SEP03	10NOV03	41	0	41	4
2490	FRC 4th Floor Slab GL 7-9/L-M	10OCT03	14NOV03	26	0	26	4
2500	FRC 4th Floor Slab GL 7-9/M-R	11NOV03	24NOV03	10	0	10	4
2510	FRC 4th Floor Slab GL 9-15/F-R	12DEC03	20JAN04	18	0	18	0
2520	FRC 4th Floor Slab GL 15-17/G-R	20JAN04	10FEB04	16	0	16	23
2530	FRC Walls/ Columns 4th -5th Floor	12NOV03	17FEB04	60	0	60	19
2540	FRC 5th Floor Slab GL 7-9/A-N	19NOV03	12DEC03	18	0	18	4
2550	FRC 5th Floor E-N/12-17	26JAN04	02MAR04	27	0	27	19
2560	FRC Walls 5th - 6th Floor	18FEB04	11MAR04	17	0	17	75
2570	Concrete Studio Theater Roof	04FEB04	10FEB04	5	0	5	0
2580	Conc.Decks - Art Centre Lvl 5 & Lvl 7	01MAR04	12MAR04	10	0	10	62
2590	Concrete - Escape Stairs & Fly Tower	11MAR04	17MAR04	5	0	5	68
2600	Steelwork Level 2	21NOV03	05DEC03	11	0	11	11
2610	Steelwork Level 3	08DEC03	05JAN04	11	0	11	11



Start Date 05NOV02
Finish Date 20DEC04
Data Date 05NOV02

MIXED-USE DEVELOPMENT

AS PLANNED
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All Activities

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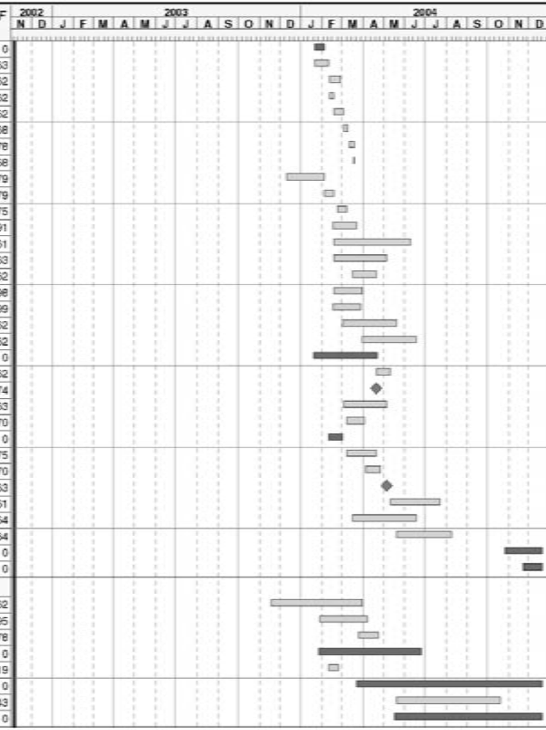
APPENDIX 5A a

Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
2620	Steelwork & Decking Level 4	21JAN04	03FEB04	10	0	10	0
2630	Steelwork - Theatre balcony	21JAN04	10FEB04	15	0	15	63
2640	Steelwork & Decking Level 5 - Arts Centre	12FEB04	27FEB04	12	0	12	62
2650	Secondary Steel - Level 5	12FEB04	18FEB04	5	0	5	62
2660	Steelwork & Decking - Level 7	19FEB04	03MAR04	10	0	10	62
2670	Steelwork & Decking - Level 8	04MAR04*	10MAR04	5	0	5	68
2680	Roof Slab to Escape Staircores 04 to 02	12MAR04	19MAR04	6	0	6	78
2690	Frame Complete	18MAR04	18MAR04	1	0	1	68
2700	Granite Panels Ground/Mezzanine Level	11DEC03	04FEB04	30	0	30	79
2710	Office Elev	04FEB04	17FEB04	10	0	10	79
2720	Stair Tower	24FEB04	08MAR04	10	0	10	75
2750	Other	17FEB04	22MAR04	25	0	25	91
2760	Theatre Ent	18FEB04	09JUN04	73	0	73	61
2770	Curtain Wal	18FEB04	06MAY04	50	0	50	63
2780	Stair Tower	16MAR04	20APR04	20	0	20	62
2790	Offices	18FEB04	30MAR04	30	0	30	98
2800	Metal Cladding Storey 3 to 5	17FEB04	29MAR04	30	0	30	99
2810	Theatre	02MAR04	19MAY04	50	0	50	62
2820	Render	31MAR04	18JUN04	50	0	50	62
2830	Roofing Roof Finishes Lvl 4 & 5	20JAN04	21APR04	61	0	61	0
2840	Stairs	21APR04	10MAY04	13	0	13	62
2850	Main Levels 4 & 5 Roof Areas Weathered	21APR04		0	0	0	74
2860	Auditorium	04MAR04	06MAY04	39	0	39	63
2870	Theatre Roof	08MAR04	02APR04	20	0	20	70
2880	Rooflights Fitness Centre	11FEB04	02MAR04	15	0	15	0
2890	Art Centre Lvl 5	09MAR04	20APR04	25	0	25	75
2910	Smoke Vents Fly Tower	05APR04	26APR04	10	0	10	70
2920	Arts Centre Roofs Weathered	07MAY04		0	0	0	63
2930	Dismantle External Scaffolds	11MAY04	22JUL04	52	0	52	61
3030	Car Park (Early Handovers) Walls/Finishes & Serv	17MAR04	18JUN04	60	0	60	64
3040	Barriers/Markings & Commission	20MAY04	09AUG04	57	0	57	64
3060	Barriers/Markings	26OCT04	20DEC04	40	0	40	0
3110	Barriers & Marking	23NOV04	20DEC04	20	0	20	0
INTERNAL FINISHES							
2730	Blockwork	19NOV03	30MAR04	85	0	85	62
2740	Curtain Walling Shop Fronts	29JAN04	07APR04	50	0	50	95
2900	Theatre	26MAR04	22APR04	14	0	14	78
2940	Blockwork Partitions/Builders Work	28JAN04	25JUN04	100	0	100	0
2950	Lift In Special Plant/Equipment Prior to Roof	11FEB04	24FEB04	10	0	10	19
2960	Service Installations/Commission	23MAR04	20DEC04	186	0	186	0
2970	Lifts & Escalator Installations	20MAY04	19OCT04	107	0	107	43
2980	Specialist Fit Out Works	18MAY04	20DEC04	153	0	153	0



Start Date 05NOV02
Finish Date 20DEC04
Data Date 05NOV02

MIXED-USE DEVELOPMENT

AS PLANNED
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All Activities

APPENDIX 5A a

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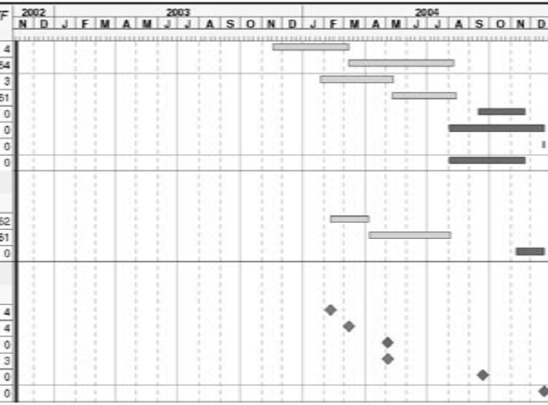
Activity ID	Activity Description	Early Start	Early Finish	Orig Dur	% Comp	Rem Dur	TF
2990	Fitness Centre Shell Only Finishes	18NOV03	08MAR04	70	0	70	4
3000	Specialist Fit Out	09MAR04	09AUG04	102	0	102	64
3010	Shops Shell Only Finishes	28JAN04	12MAY04	69	0	69	3
3020	Specialist Fit Out	11MAY04	12AUG04	67	0	67	61
3050	Walls/Finishes & S	15SEP04	22NOV04	49	0	49	0
3070	Office Area Fit Out	03AUG04	20DEC04	99	0	99	0
3080	Remaining Retail Areas	20DEC04	20DEC04	1	0	1	0
3100	Finishes & Service	03AUG04	22NOV04	79	0	79	0
EXTERNAL WORKS							
3120	Statutory Service Connections	11FEB04	06APR04	40	0	40	62
3130	External Pavings Early Handovers (By Others)	08APR04	04AUG04	77	0	77	61
3140	External Pavings Remainder (By Others)	09NOV04	20DEC04	30	0	30	0
SECTIONAL COMPLETIONS							
SECT01	Show Flat (floor 03)		09FEB04	0	0	0	4
SECT02	Arts Complex (partial)		08MAR04	0	0	0	4
SECT03	Residential Floors 04 to 07(incl.)		04MAY04	0	0	0	0
SECT04	Shops		04MAY04	0	0	0	3
SECT07	Remaining Residential		20SEP04	0	0	0	0
SECT08	All Others Areas		20DEC04	0	0	0	0



Start Date 05NOV02
Finish Date 20DEC04
Data Date 05NOV02

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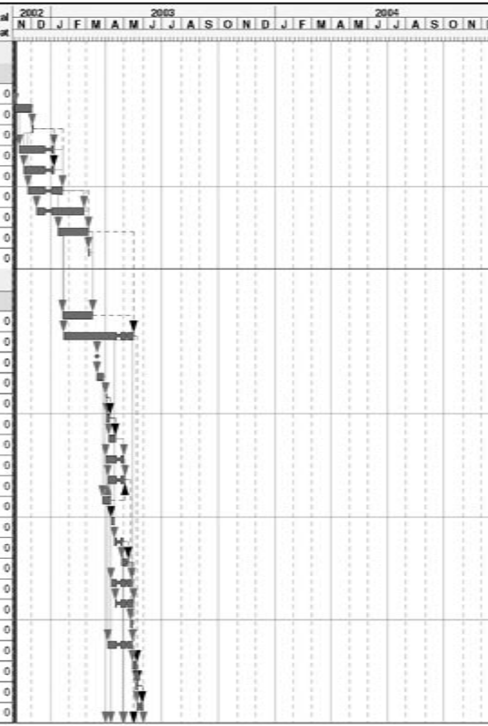
APPENDIX 5A a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
PRELIMINARY WORKS							
0010	Commence Preparatory Activity	0	0	0	05.NOV.02*		0
0030	General Site Mobilisation	20	0	20	05.NOV.02	02.DEC.02	0
0040	Commence Main Works	1	0	1	03.DEC.02	03.DEC.02	0
0050	Site Establishment	30	0	30	12.NOV.02	06.JAN.03	0
0060	Pile Probing	25	0	25	19.NOV.02	06.JAN.03	0
0070	Guide Walls	30	0	30	26.NOV.02	20.JAN.03	0
0080	Install Secant Piles	45	0	45	10.DEC.02	24.FEB.03	0
0090	Cut Down Piles	35	0	35	14.JAN.03	03.MAR.03	0
0100	Preliminary Works Complete	1	0	1	04.MAR.03	04.MAR.03	0
APARTMENT BLOCK							
SUBSTRUCTURE							
0110	FRC CAPPING BEAM	35	0	35	21.JAN.03	10.MAR.03	0
0120	BULK DIG LEAVING SUPPORTING BERMS	74	0	74	23.JAN.03	15.MAY.03	0
0140	ERECT TOWER CRANE	0	0	0	18.MAR.03		0
0150	FRC BASEMENT SLAB AREA 1	9	0	9	18.MAR.03	28.MAR.03	0
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	0	3	31.MAR.03	02.APR.03	0
0170	REMOVE SIDE BERMS AREA 1	4	0	4	02.APR.03	07.APR.03	0
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	07.APR.03	15.APR.03	0
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	0	16	31.MAR.03	29.APR.03	0
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	04.APR.03	01.MAY.03	0
0220	FRC BASEMENT SLAB AREA 2	10	0	10	26.MAR.03	08.APR.03	0
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	10.APR.03	14.APR.03	0
0240	REMOVE SIDE BERMS AREA 2	4	0	4	15.APR.03	28.APR.03	0
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	28.APR.03	06.MAY.03	0
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	10.APR.03	12.MAY.03	0
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	16.APR.03	15.MAY.03	0
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	12.MAY.03	14.MAY.03	0
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	04.APR.03	14.MAY.03	0
0370	REMOVE BERM	5	0	5	15.MAY.03	21.MAY.03	0
0380	BREAK BACK FEMALE PILES	4	0	4	20.MAY.03	23.MAY.03	0
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	22.MAY.03	30.MAY.03	0



The critical path
Progress Bar
Critical Activity

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TheCritical Path

APPENDIX 5A b

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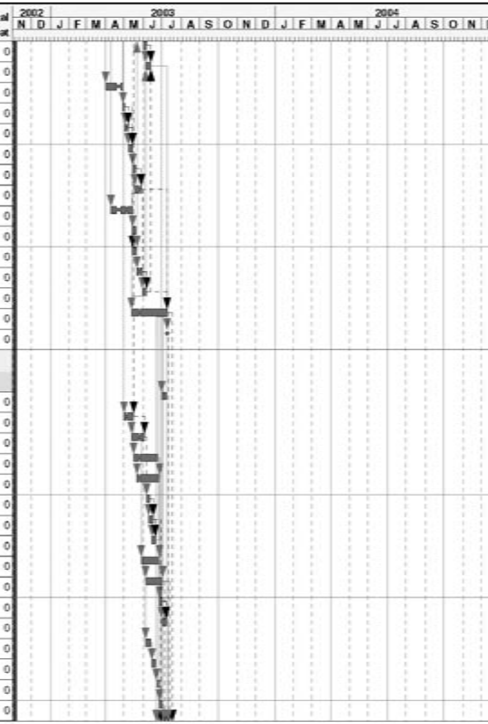
Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	02.JUN.03	06.JUN.03	0
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	05.JUN.03	13.JUN.03	0
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	01.APR.03*	28.APR.03	0
0470	REMOVE BERM	4	0	4	29.APR.03	02.MAY.03	0
0480	BREAK BACK FEMALE PILES	3	0	3	02.MAY.03	07.MAY.03	0
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	07.MAY.03	13.MAY.03	0
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	14.MAY.03	19.MAY.03	0
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	19.MAY.03	27.MAY.03	0
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	09.APR.03*	13.MAY.03	0
0580	REMOVE BERM	4	0	4	14.MAY.03	19.MAY.03	0
0590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	5	0	5	15.MAY.03	21.MAY.03	0
0600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	6	0	6	22.MAY.03	30.MAY.03	0
0610	FRC UPPER BASEMENT SLAB GL 1/J-M	6	0	6	30.MAY.03	06.JUN.03	0
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	13.MAY.03	08.JUL.03	0
0630	Substructure Residential Complete	0	0	0	09.JUL.03		0
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	5	0	5	01.JUL.03	07.JUL.03	0
0660	FRC BASEMENT SLAB AREA 3	10	0	10	01.MAY.03	15.MAY.03	0
0700	FRC BASEMENT SLAB AREA 4	14	0	14	13.MAY.03	02.JUN.03	0
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	26	0	26	16.MAY.03	23.JUN.03	0
0760	FRC UPPER BASEMENT SLAB AREA 3	26	0	26	21.MAY.03	26.JUN.03	0
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	06.JUN.03	10.JUN.03	0
0780	REMOVE SIDE BERMS AREA 4	5	0	5	10.JUN.03	16.JUN.03	0
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	5	0	5	16.JUN.03	20.JUN.03	0
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	21	0	21	29.MAY.03	26.JUN.03	0
0840	FRC UPPER BASEMENT SLAB 4	20	0	20	04.JUN.03	01.JUL.03	0
0850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	27.JUN.03	01.JUL.03	0
0860	REMOVE SIDE BERMS AREA 5	5	0	5	01.JUL.03	07.JUL.03	0
0870	FRC LOW SECTION OF BASEM'T SLAB AREA 6	8	0	8	04.JUN.03	13.JUN.03	0
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	5	0	5	16.JUN.03	20.JUN.03	0
0890	FRC INTERMEDIATE SLAB AREA 6	4	0	4	23.JUN.03	26.JUN.03	0
0900	FRC WALLS FROM INTERMEDIATE TO HIGH LVL SLAB A6	3	0	3	27.JUN.03	01.JUL.03	0



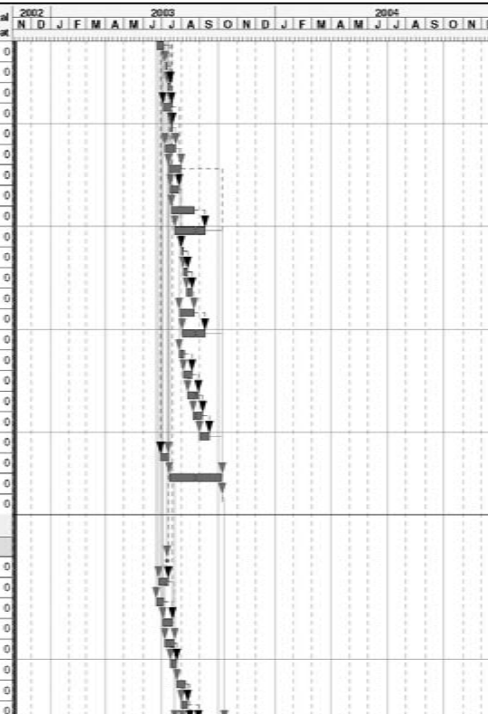
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

AS PLANNED
TheCritical Path

APPENDIX 5A b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	10	0	10	23.JUN.03	04.JUL.03	0
0960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	07.JUL.03	09.JUL.03	0
0970	REMOVE SIDE BERMS AREA 6	5	0	5	09.JUL.03	15.JUL.03	0
0980	FRC BASEMENT SLAB SECTION 7	10	0	10	03.JUL.03	16.JUL.03	0
0990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	4	0	4	15.JUL.03	18.JUL.03	0
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	13	0	13	07.JUL.03	23.JUL.03	0
1010	FRC UPPER BASEMENT SLAB 6	15	0	15	11.JUL.03	31.JUL.03	0
1040	FRC BASEMENT SLAB SECTION 8	10	0	10	15.JUL.03	28.JUL.03	0
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	26	0	26	17.JUL.03	21.AUG.03	0
1080	FRC UPPER BASEMENT SLAB 7	33	0	33	23.JUL.03	08.SEP.03	0
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	01.AUG.03	05.AUG.03	0
1100	REMOVE SIDE BERMS AREA 8	5	0	5	05.AUG.03	11.AUG.03	0
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	6	0	6	11.AUG.03	18.AUG.03	0
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	19	0	19	29.JUL.03	22.AUG.03	0
1140	FRC UPPER BASEMENT SLAB AREA 8	25	0	25	04.AUG.03	08.SEP.03	0
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	7	0	7	29.JUL.03	06.AUG.03	0
1160	REMOVE SUPPORTING BERM	10	0	10	05.AUG.03	18.AUG.03	0
1170	FRC CLOSING SECTION OF BASEMENT SLAB	12	0	12	13.AUG.03	29.AUG.03	0
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	11	0	11	21.AUG.03	05.SEP.03	0
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	11	0	11	01.SEP.03	15.SEP.03	0
1200	2 Week Allowance For Breaking Back Female Piles	10	0	10	30.JUN.03	11.JUL.03	0
1210	FRC Columns / Walls Upper Basement - Ground	60	0	60	14.JUL.03	06.OCT.03	0
1220	Substructure Arts Centre Complete	1	0	1	07.OCT.03	07.OCT.03	0
APARTMENT BLOCK							
SUPERSTRUCTURE							
1230	Substructure Residential Complete	0	0	0	09.JUL.03		0
1240	FRC GF Slab Incl Part Sect. Of Area 3 GL 1-7/A-H	13	0	13	25.JUN.03	11.JUL.03	0
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	10	0	10	23.JUN.03	04.JUL.03	0
1260	FRC Remaining High Level Section Of GF SLAB	11	0	11	03.JUL.03	17.JUL.03	0
1270	FRC Walls / Columns Ground - Mezz	11	0	11	07.JUL.03	21.JUL.03	0
1280	FRC Mezz Floor Grid Lines 1-7/A-D	7	0	7	16.JUL.03	24.JUL.03	0
1300	FRC Walls / Columns Mezz- 2nd Floor	10	0	10	25.JUL.03	07.AUG.03	0
1330	FRC 2nd Floor Slab GL 1-7/M-R	8	0	8	01.AUG.03	12.AUG.03	0



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

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APPENDIX 5A b

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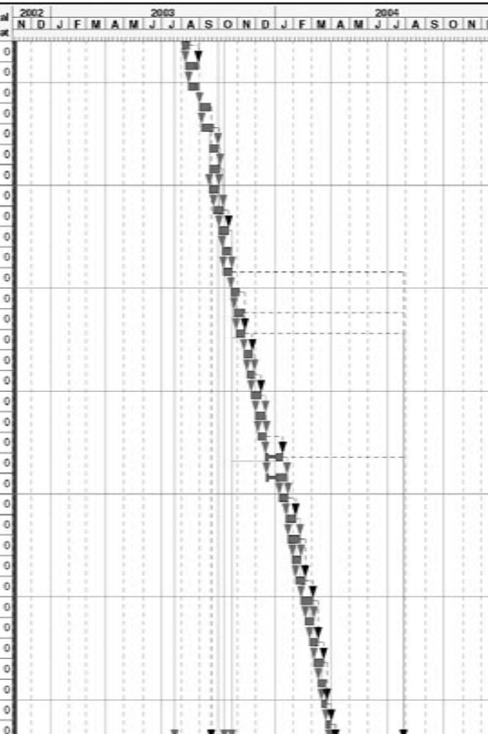
Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1340	FRC 2nd Floor Slab 1-7/A-F	10	0	10	04.AUG.03	15.AUG.03	0
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	15	0	15	08.AUG.03	29.AUG.03	0
1360	FRC 3rd Floor Slab GL 1-7/F-M	11	0	11	14.AUG.03	29.AUG.03	0
1390	FRC Walls / Columns 3rd - 4th Floor	13	0	13	01.SEP.03	17.SEP.03	0
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	13	0	13	04.SEP.03	22.SEP.03	0
1440	FRC 4th Floor Slab GL 6-7/M-R	10	0	10	16.SEP.03	29.SEP.03	0
1450	FRC Walls / Columns 4th - 5th Floor	14	0	14	16.SEP.03	03.OCT.03	0
1460	FRC 5th Floor Slab GL 1-6/K-R	11	0	11	17.SEP.03	01.OCT.03	0
1470	FRC 5th Floor Slab GL 1-6/A-K	12	0	12	23.SEP.03	08.OCT.03	0
1480	FRC Walls/ Columns 5th - 6th Floor	12	0	12	02.OCT.03	17.OCT.03	0
1490	FRC 6th Floor Slab GL 1-6/K-R	11	0	11	07.OCT.03	21.OCT.03	0
1500	FRC 6th Floor Slab GL 1-6/A-K	11	0	11	09.OCT.03	23.OCT.03	0
1510	FRC Walls / Columns 6th - 7th Floor	10	0	10	22.OCT.03	04.NOV.03	0
1520	FRC 7th Floor Slab GL 1-6/K-R	11	0	11	27.OCT.03	10.NOV.03	0
1530	FRC 7th Floor Slab GL 1-6/A-K	11	0	11	30.OCT.03	13.NOV.03	0
1540	FRC Walls/ Columns 7th - 8th Floor	10	0	10	11.NOV.03	24.NOV.03	0
1550	FRC 8th Floor Slab GL 1-6/K-R	10	0	10	17.NOV.03	28.NOV.03	0
1560	FRC 8th Floor Slab GL 1-6/A-K	11	0	11	24.NOV.03	08.DEC.03	0
1570	FRC Walls / Column 8th - 9th Floor	12	0	12	01.DEC.03	16.DEC.03	0
1580	FRC 9th Floor Slab GL 1-6/K-R	10	0	10	05.DEC.03	18.DEC.03	0
1590	FRC 9th Floor Slab GL 1-6/A-K	11	0	11	16.DEC.03	13.JAN.04	0
1600	FRC Walls / Columns 9th - 10th Floor	12	0	12	19.DEC.03	19.JAN.04	0
1610	FRC 10th Floor Slab GL 1-6/K-R	11	0	11	08.JAN.04	22.JAN.04	0
1620	FRC 10th Floor SlabGL 1-6/A-K	11	0	11	19.JAN.04	02.FEB.04	0
1630	FRC Walls / Columns 10th - 11th Floor	12	0	12	23.JAN.04	09.FEB.04	0
1640	FRC 11th Floor Slab GL 1-6/K-R	11	0	11	29.JAN.04	12.FEB.04	0
1650	FRC 11th Floor Slab GL 1-6/A-K	12	0	12	03.FEB.04	18.FEB.04	0
1660	FRC Walls / Columns 11th - 12th Floor	12	0	12	13.FEB.04	01.MAR.04	0
1670	FRC 12th Floor Slab GL 1-6/K-R	11	0	11	19.FEB.04	04.MAR.04	0
1680	FRC 12th Floor Slab GL 1-6/A-K	11	0	11	26.FEB.04	11.MAR.04	0
1690	FRC Walls / Columns 12th - 13th Floor	11	0	11	05.MAR.04	19.MAR.04	0
1700	FRC 13th Floor Slab GL 1-6/K-R	9	0	9	11.MAR.04	23.MAR.04	0
1710	FRC 13th Floor Slab GL 1-6/A-K	8	0	8	16.MAR.04	25.MAR.04	0
1720	FRC Walls / Columns 13th - 14th Floor	7	0	7	24.MAR.04	01.APR.04	0



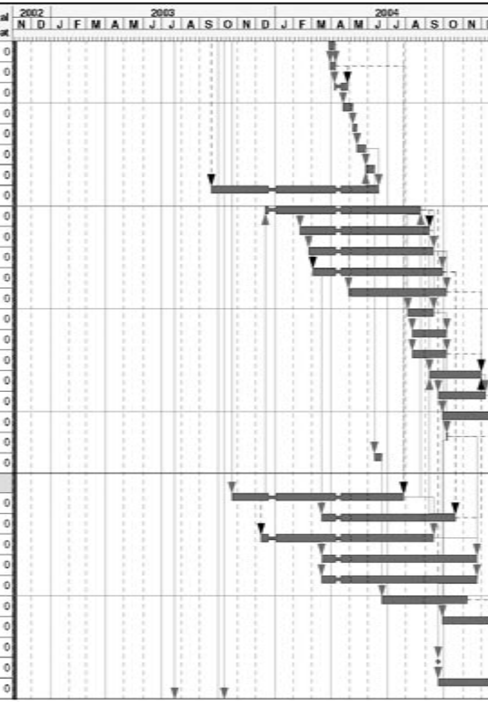
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

AS PLANNED
TheCritical Path

APPENDIX 5A b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1730	FRC 14th Floor Slab GL 1-6/K-R	7	0	7	29.MAR.04	06.APR.04	0
1740	FRC 14th Floor Slab GL 1-6/A-K	7	0	7	31.MAR.04	08.APR.04	0
1750	FRC Walls/ Columns 14th - 15th Floor	9	0	9	07.APR.04	27.APR.04	0
1760	FRC 15th Floor Slab GL 1-6/K-R	11	0	11	20.APR.04	05.MAY.04	0
1780	FRC Core Walls Level 15-16 GL A-B/2-5	6	0	6	06.MAY.04	13.MAY.04	0
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	9	0	9	14.MAY.04	26.MAY.04	0
1800	FRC Cover Slab To Core	9	0	9	27.MAY.04	09.JUN.04	0
1810	Progressive Erection of Precast Stairs	177	0	177	19.SEP.03	17.JUN.04	0
1860	Timber Grounds Windows & Doors	162	0	162	17.DEC.03	24.AUG.04	0
1870	Render Insulation & First Coat	142	0	142	11.FEB.04	08.SEP.04	0
1880	Terracotta Cladding Frame Work	137	0	137	25.FEB.04	15.SEP.04	0
1890	Metal Cladding	142	0	142	03.MAR.04	29.SEP.04	0
1910	Terracotta Panels	112	0	112	29.APR.04	06.OCT.04	0
1950	Penthouse Brise Soleil	30	0	30	04.AUG.04	15.SEP.04	0
1960	Penthouse Curtain Walling	40	0	40	11.AUG.04	06.OCT.04	0
1970	Penthouse Roof Cladding/Roof Lights	40	0	40	11.AUG.04	06.OCT.04	0
1980	Render Final Coat Top Down	59	0	59	09.SEP.04	30.NOV.04	0
1990	Bolt On Balconies	54	0	54	23.SEP.04	07.DEC.04	0
2000	Dismatle Scaffolds	59	0	59	29.SEP.04	20.DEC.04	0
2050	Penthouse Roof Weathered	1	0	1	07.OCT.04	07.OCT.04	0
2100	Lift Shaft Temporary Weathered	9	0	9	10.JUN.04	22.JUN.04	0
INTERNAL FINISHES							
1850	Blockwork	181	0	181	23.OCT.03	27.JUL.04	0
1900	Balcony/Balustrades & Finishes	147	0	147	17.MAR.04	20.OCT.04	0
2060	Internal Blockwork to Cores	182	0	182	10.DEC.03	15.SEP.04	0
2070	M & E Services to Cores & Risers	171	0	171	17.MAR.04	23.NOV.04	0
2080	Staircase Lobbies & Common Areas	171	0	171	17.MAR.04	23.NOV.04	0
2110	Lift installations	98	0	98	23.JUN.04	08.NOV.04	0
2120	Final Commision Clean & Snag	58	0	58	30.SEP.04	20.DEC.04	0
2130	Shell & Core Completion	1	0	1	20.DEC.04	20.DEC.04	0
2200	Access For Third Fit Out Phase	0	0	0	22.SEP.04		0
2210	Third Phase Notional Fit Out Period	64	0	64	22.SEP.04	20.DEC.04	0



The critical path
Progress Bar
Critical Activity

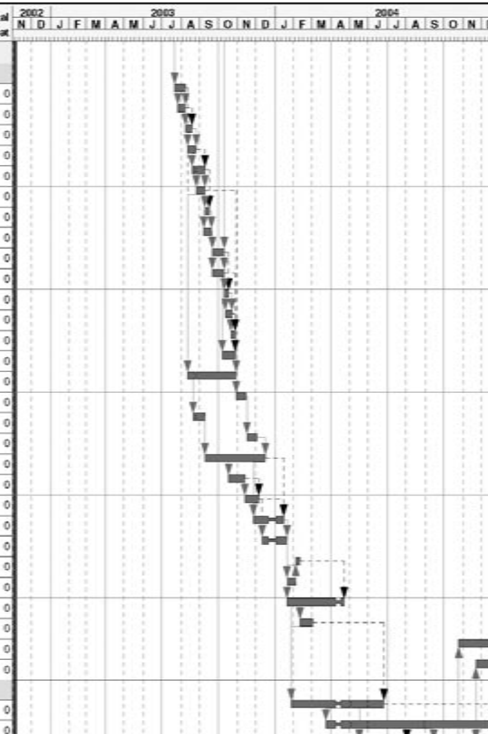
MIXED-USE DEVELOPMENT

AS PLANNED
TheCritical Path

Sheet 5 of 7

APPENDIX 5A b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12	0	12	23.JUL.03	07.AUG.03	0
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	10	0	10	28.JUL.03	08.AUG.03	0
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	7	0	7	08.AUG.03	18.AUG.03	0
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	9	0	9	13.AUG.03	26.AUG.03	0
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	14	0	14	20.AUG.03	09.SEP.03	0
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	10	0	10	26.AUG.03	08.SEP.03	0
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	6	0	6	09.SEP.03	16.SEP.03	0
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	10	0	10	08.SEP.03	19.SEP.03	0
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	15	0	15	22.SEP.03	10.OCT.03	0
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14	0	14	22.SEP.03	09.OCT.03	0
2320	FRC Walls From Low - High Lvl GF Slab GL 12.14&K	6	0	6	10.OCT.03	17.OCT.03	0
2330	FRC High Level Slab GL 11-14/A-K	8	0	8	13.OCT.03	22.OCT.03	0
2340	FRC High Level Slab GL 11-12/K-M	5	0	5	22.OCT.03	28.OCT.03	0
2350	FRC Ground Floor Slab GL 15-17/F-R	14	0	14	08.OCT.03	27.OCT.03	0
2360	FRC Walls / Columns Ground - 2nd Floor	57	0	57	12.AUG.03	30.OCT.03	0
2380	FRC Mezzanine Slab GL 13-17/C-R	11	0	11	31.OCT.03	14.NOV.03	0
2390	FRC 2nd Floor Slab GL 7-9/A-J	12	0	12	21.AUG.03	08.SEP.03	0
2420	FRC Remainder Of 2nd Floor Slab	12	0	12	17.NOV.03	02.DEC.03	0
2430	FRC Walls / Columns 2nd - 3rd Floor	71	0	71	09.SEP.03	16.DEC.03	0
2440	FRC 3rd Floor Slab GL 7-9/L-R	20	0	20	17.OCT.03	13.NOV.03	0
2450	FRC 3rd Floor Slab GL 9-14/H-R	17	0	17	13.NOV.03	05.DEC.03	0
2460	FRC 3rd Floor Slab GL 14-17/F-R	24	0	24	28.NOV.03	14.JAN.04	0
2510	FRC 4th Floor Slab GL 9-15/F-R	18	0	18	12.DEC.03	20.JAN.04	0
2570	Concrete Studio Theater Roof	5	0	5	04.FEB.04	10.FEB.04	0
2620	Steelwork & Decking Level 4	10	0	10	21.JAN.04	03.FEB.04	0
2830	Roofing Roof Finishes Lvl 4 & 5	61	0	61	20.JAN.04	21.APR.04	0
2880	Rooflights Fitness Centre	15	0	15	11.FEB.04	02.MAR.04	0
3060	Barriers/Markings	40	0	40	26.OCT.04	20.DEC.04	0
3110	Barriers & Marking	20	0	20	23.NOV.04	20.DEC.04	0
INTERNAL FINISHES							
2940	Blockwork Partitions/Builders Work	100	0	100	28.JAN.04	25.JUN.04	0
2960	Service Installations/Commission	186	0	186	23.MAR.04	20.DEC.04	0



The critical path
Progress Bar
Critical Activity

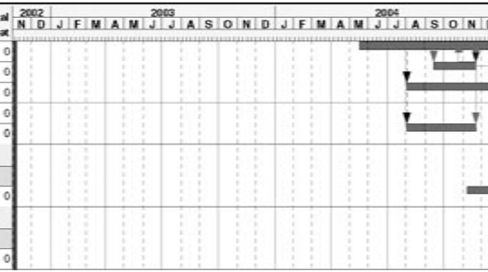
MIXED-USE DEVELOPMENT

AS PLANNED
TheCritical Path

Sheet 6 of 7

APPENDIX 5A b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2980	Specialist Fit Out Works	153	0	153	18.MAY.04	20.DEC.04	0
3050	Walls/Finishes & S	49	0	49	15.SEP.04	22.NOV.04	0
3070	Office Area Fit Out	99	0	99	03.AUG.04	20.DEC.04	0
3080	Remaining Retail Areas	1	0	1	20.DEC.04	20.DEC.04	0
3100	Finishes & Service	79	0	79	03.AUG.04	22.NOV.04	0
EXTERNAL WORKS							
3140	External Pavings Remainder (By Others)	30	0	30	09.NOV.04	20.DEC.04	0
SECTIONAL COMPLETIONS							
SECT08	All Others Areas	0	0	0		20.DEC.04	0



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

AS PLANNED
TheCritical Path

APPENDIX 5A b

Sheet 7 of 7

Mixed-use Development
Progress Schedule

Activit ID	Activity Description	Actual Start	Actual Finish	2003									
				05-Jan	02-Feb	02-Mar	30-Mar	04-May	08-Jun	29-Jun	03-Aug	05-Oct	02-Nov
				End Wk 5	End Wk 9	End Wk 13	End Wk 17	End Wk 22	End Wk 27	End Wk 30	End Wk 35	End Wk 44	End Wk 48
				Wind.1	Wind.2	Wind.3	Wind.4	Wind.5	Wind.6	Wind.7	Wind.8	Wind.9	Wind.10
10	Commence Preparatory Activity	05-Nov-02	-----	100									
20	Commence On Site	03-Dec-02	-----	100									
	PRELIMINARY WORKS												
30	General Site Mobilisation	06-Nov-02	04-Dec-02	100									
40	Commence Main Works	05-Dec-02	05-Dec-02	100									
50	Site Establishment	06-Nov-02	29-Nov-02	100									
60	Pile Probing	13-Nov-02	14-Feb-03	70	90	100							
70	Guide Walls	05-Dec-02	01-Mar-03	50	90	100							
80	Install Secant Piles	11-Dec-02	20-Mar-03	14	60	85	100						
90	Cut Down Piles	16-Dec-02	17-May-03	10	18	25	70	88	100				
100	Preliminary Works Complete	-----	17-May-03					0	100				
	APARTMENT BLOCK												
	Substructure												
110	FRC CAPPING BEAM (ALL AREAS)	18-Feb-03	14-Jun-03		0	15	40	40	85	100			
120	BULK DIG LEAVING SUPPORTING BERMS	20-Feb-03	16-May-03		0	10	30	70	100				
130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	06-Mar-03	05-Apr-03			0	25	100					
140	ERECT TOWER CRANE	15-Apr-03	15-Apr-03				0	100					
150	FRC BASEMENT SLAB AREA 1	10-Apr-03	29-Apr-03				0	100					
160	INSTALL TEMPORARY WORKS JIGS 1 & 2	08-Apr-03	01-May-03				0	100					
170	REMOVE SIDE BERMS AREA 1	02-Jun-03	19-Jun-03					0	50	100			
180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	12-Jun-03	10-Jul-03						0	70	100		
190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	01-May-03	15-May-03				0	10	100				
210	FRC UPPER BASEMENT SLAB AREA 1	08-May-03	28-May-03					0	100				
220	FRC BASEMENT SLAB AREA 2	03-Apr-03	03-May-03				0	100					
230	INSTALL TEMPORARY WORKS JIGS 3 & 4	06-May-03	15-May-03					0	100				
240	REMOVE SIDE BERMS AREA 2	19-May-03	26-Jun-03					0	50	100			
250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	16-Jun-03	17-Jul-03						0	75	100		
260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	08-May-03	22-May-03					0	100				
280	FRC UPPER BASEMENT SLAB AREA 2	08-May-03	22-May-03					0	100				
290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	23-Jun-03	25-Sep-03						0	50	68	100	
300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	23-Jun-03	24-Jul-03						0	27	100		
370	REMOVE BERM	21-May-03	23-Jun-03					0	50	100			
380	BREAK BACK FEMALE PILES	10-Jun-03	14-Jun-03						0	100			
390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	12-Jun-03	26-Jun-03						0	100			
400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	03-Jul-03	17-Jul-03							0	100		
410	FRC UPPER BASEMENT SLAB GL 1/A-J	03-Jul-03	31-Jul-03							0	100		
420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	10-Jul-03	24-Jul-03							0	100		
470	REMOVE BERM	12-Jun-03	18-Jun-03						0	100			
480	BREAK BACK FEMALE PILES	12-Jun-03	26-Jun-03						0	100			
490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	01-Jul-03	05-Jul-03							0	100		
500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	01-Jul-03	24-Jul-03							0	100		
510	FRC UPPER BASEMENT SLAB GL 1/M-R	01-Jul-03	31-Jul-03							0	100		
520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	17-Jul-03	31-Jul-03							0	100		
580	REMOVE BERM	12-Jun-03	26-Jun-03						0	100			
590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	01-Jul-03	10-Jul-03							0	100		
600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	01-Jul-03	27-Jul-03							0	100		
610	FRC UPPER BASEMENT SLAB GL 1/J-M	01-Jul-03	05-Aug-03							0	83	100	
620	FRC Walls/Columns Upper Basement- Ground Floor	05-Jun-03	04-Oct-03						0	23	62	100	
	Superstructure												
1240	FRC GF Slab Incl Part Section Of Area 3 GL 1-7/A-H	03-Jul-02	24-Jul-02							0	100		
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	29-May-02	19-Jun-02					0	60	100			
1260	FRC Remaining High Level Section Of GF SLAB	14-Aug-02	11-Sep-02								0	100	
1270	FRC Walls / Columns Ground - Mezz	21-Aug-02	04-Sep-02								0	100	
1280	FRC Mezz Floor Grid Lines 1-7/A-D	03-Sep-02	24-Oct-03								0	79	100
1290	FRC Mezz Floor Grid Lines 1-7/M-R	03-Sep-02	02-Oct-02								0	100	
1300	FRC Walls / Columns Mezz- 2nd Floor	11-Sep-02	11-Oct-02								0	75	100
1310	FRC Walls / Columns Ground - 2nd Floor	31-Jul-02	30-Oct-02							0	62	77	100
1320	FRC 2nd Floor Slab GL 1-7/F-M	06-Sep-02	25-Oct-02								0	25	100
1330	FRC 2nd Floor Slab GL 1-7/M-R	06-Sep-02	25-Oct-02								0	69	100
1340	FRC 2nd Floor Slab 1-7/A-F	06-Sep-02	25-Oct-02								0	1	100
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	02-Oct-02									0	7	97
1360	FRC 3rd Floor Slab GL 1-7/F-M	21-Oct-02										0	32
1370	FRC 3rd Floor Slab GL 1-7/M-R	21-Oct-02										0	23
1380	FRC 3rd Floor Slab GL 1-7/A-F	21-Oct-02										0	5

No other Apartment Block activities progressed in 'Time Period One'

Mixed-use Development
Progress Schedule

Activi D	Activity Description	Actual Start	Actual Finish	2003									
				05-Jan	02-Feb	02-Mar	30-Mar	04-May	08-Jun	29-Jun	03-Aug	05-Oct	02-Nov
				End Wk 5	End Wk 9	End Wk 13	End Wk 17	End Wk 22	End Wk 27	End Wk 30	End Wk 35	End Wk 44	End Wk 48
				Wind.1	Wind.2	Wind.3	Wind.4	Wind.5	Wind.6	Wind.7	Wind.8	Wind.9	Wind.10

ARTS CENTRE

Substructure

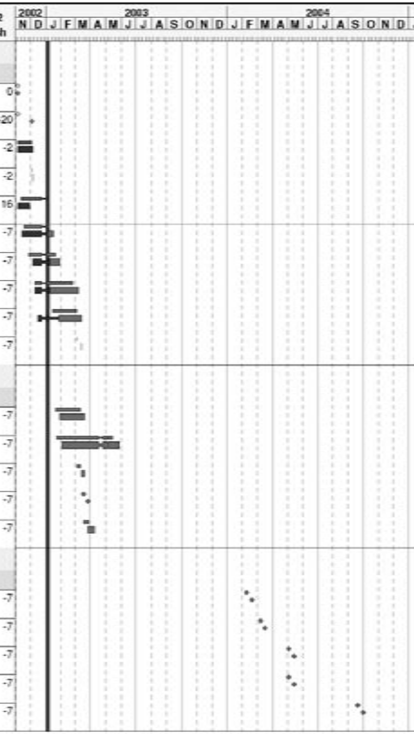
Activi D	Activity Description	Actual Start	Actual Finish	Wind.1	Wind.2	Wind.3	Wind.4	Wind.5	Wind.6	Wind.7	Wind.8	Wind.9	Wind.10
660	FRC BASEMENT SLAB AREA 3	28-Apr-03	15-May-02				0	60	100				
670	RELOCATE TEMPORARY WORKS JIGS 1 & 2	02-May-03	22-May-02				0	70	100				
680	FRC LOW LEVEL BASEMENT SLAB AREA 4	29-May-02	05-Jun-02					0	100				
690	FRC WALLS LOW - HIGH LEVEL AREA 4 GL 8-9/P-M	12-Jun-02	26-Jun-02						0	100			
700	FRC BASEMENT SLAB AREA 4	02-May-03	22-May-02				0	40	100				
720	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 3	12-Jun-02	24-Jul-02						0	50	100		
730	FRC LIFT PITS IN CLOSING SECTION OF B3 GL Q-P/7-8	29-May-02	05-Jun-02					0	100				
740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	05-Jun-02	30-Jul-02					0	25	80	100		
760	FRC UPPER BASEMENT SLAB AREA 3	22-May-02	26-Jun-02					0	70	100			
770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	03-Jul-02	31-Jul-02							0	100		
780	REMOVE SIDE BERMS AREA 4	12-Jun-02	26-Jun-02						0	100			
790	FRC RAMP AND WALLS BASEM'T SLAB AREA 5 GL 9-10/H-E	12-Jun-02	04-Sep-02						0	60	88	100	
800	FRC BASEMENT SLAB AREA 5	05-Jun-02	12-Jun-02					0	50	100			
810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	07-Aug-02	01-Oct-02								0	100	
820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	29-May-02	26-Jun-02					0	40	100			
840	FRC UPPER BASEMENT SLAB 4	19-Jun-02	03-Jul-02						0	80	100		
850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	03-Jul-02	31-Jul-02							0	100		
860	REMOVE SIDE BERMS AREA 5	22-May-02	05-Jun-02					0	100				
870	FRC LOW SECTION OF BASEM'T SLAB AREA 6	26-Jun-02	03-Jul-02						0	80	100		
880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	03-Jun-02	07-Jun-02					0	100				
890	FRC INTERMEDIATE SLAB AREA 6	03-Jul-02	17-Jul-02							0	100		
900	FRC WALLS FROM INTERMEDIATE TO HIGH LEVEL SLAB A6	03-Jul-02	02-Oct-02							0	36	100	
910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	19-Jun-02	26-Jun-02						0	100			
920	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 5	12-Jun-02	17-Jul-02						0	50	100		
930	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 5	24-Jul-02	07-Aug-02							0	50	100	
950	FRC UPPER BASEMENT SLAB 5	07-Aug-02	14-Aug-02								0	100	
960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	29-Jul-02	02-Aug-02							0	100		
970	REMOVE SIDE BERMS AREA 6	03-Jul-02	31-Jul-02							0	100		
980	FRC BASEMENT SLAB SECTION 7	31-Jul-02	14-Aug-02							0	30	100	
990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	31-Jul-02	14-Aug-02							0	30	100	
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	14-Aug-02	21-Aug-02								0	100	
1010	FRC UPPER BASEMENT SLAB 6	27-Aug-02	04-Sep-02								0	100	
1020	RELOCATE TEMPORARY WORKS JIGS 1 & 2	27-Jul-02	02-Aug-02							0	100		
1030	REMOVE SIDE BERMS AREA 7	17-Jul-02	31-Jul-02							0	100		
1040	FRC BASEMENT SLAB SECTION 8	07-Aug-02	21-Aug-02								0	100	
1050	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 7	31-Jul-02	14-Aug-02							0	30	100	
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	21-Aug-02	04-Sep-02								0	100	
1080	FRC UPPER BASEMENT SLAB 7	07-Aug-02	18-Sep-02								0	100	
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	29-Jul-02	02-Aug-02							0	100		
1100	REMOVE SIDE BERMS AREA 8	24-Jul-02	07-Aug-02							0	70	100	
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	07-Aug-02	21-Aug-02								0	100	
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	27-Aug-02	11-Sep-02								0	100	
1140	FRC UPPER BASEMENT SLAB AREA 8	04-Sep-02	25-Sep-02								0	100	
1150	INSTALL SUPPORTING PROPS TO PILES ADJACENT TO GL 17	29-Jul-02	02-Aug-02							0	100		
1160	REMOVE SUPPORTING BERM	05-Aug-02	09-Aug-02								0	100	
1170	FRC CLOSING SECTION OF BASEMENT SLAB	05-Aug-02	28-Aug-02								0	100	
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	05-Aug-02	11-Sep-02								0	100	
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	05-Aug-02	25-Sep-02								0	100	
1200	2 Week Allowance For Breaking Back Female Piles	03-Jul-02	31-Jul-02							0	100		
1210	FRC Columns / Walls Upper Basement - Ground	31-Jul-02	02-Oct-02							0	35	100	
1220	Substructure Arts & Leisure Centre Complete	02-Oct-02	02-Oct-02								0	100	

Superstructure

Activi D	Activity Description	Actual Start	Actual Finish	Wind.1	Wind.2	Wind.3	Wind.4	Wind.5	Wind.6	Wind.7	Wind.8	Wind.9	Wind.10
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12-Jun-02	10-Jul-02						0	70	100		
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	18-Sep-02	02-Oct-02								0	100	
2240	FRC Walls From Low - High Level GF Slab GL 7-9/M & J	30-Sep-02	04-Oct-02								0	100	
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	26-Jun-02	17-Jul-02						0	20	100		
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	25-Sep-02	02-Oct-02								0	100	
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	14-Aug-02	11-Sep-02								0	100	
2280	FRC Walls From Low - High Level GF Slab GL 7-9/M & K	30-Sep-02	04-Oct-02								0	100	
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	17-Jul-02	31-Jul-02							0	100		
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	30-Sep-02	04-Oct-02								0	100	
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14-Aug-02	25-Sep-02								0	100	
2320	FRC Walls From Low - High Level GF Slab GL 12,14 & K	30-Sep-02	04-Oct-02								0	100	
2330	FRC High Level Slab GL 11-14/A-K	03-Jul-02	31-Jul-02							0	100		
2340	FRC High Level Slab GL 11-12/K-M	14-Aug-02	04-Sep-02								0	100	
2350	FRC Ground Floor Slab GL 15-17/F-R	28-Aug-02	11-Sep-02								0	100	
2360	FRC Walls / Columns Ground - 2nd Floor	02-Oct-02									0	85	87
2370	FRC Mezzanine Slab GL 8-12/K-R	04-Sep-02	18-Sep-02								0	100	
2380	FRC Mezzanine Slab GL 13-17/C-R	25-Sep-02									0	12	59
2390	FRC 2nd Floor Slab GL 7-9/A-J	09-Oct-02	30-Oct-02									0	100
2400	FRC 2nd Floor Sla GbL 7-9/J-R	25-Sep-02									0	19	36
2410	FRC 2nd Floor Transfer Slab GL 9-15/H-R	25-Sep-02	30-Oct-02								0	20	100
2420	FRC Remainder Of 2nd Floor Slab	09-Oct-02										0	8
2430	FRC Walls / Columns 2nd - 3rd Floor	09-Oct-02										0	15

No other Arts Centre activities progressed in 'Time Period One'

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
PRELIMINARY WORKS								
0010	Commence Preparatory Activity	0	100	0	05.NOV.02A			0
0020	Commence On Site	0	100	0	03.DEC.02A			-20
0030	General Site Mobilisation	20	100	0	06.NOV.02A	04.DEC.02A		-2
0040	Commence Main Works	1	100	0	05.DEC.02A	05.DEC.02A		-2
0050	Site Establishment	30	100	0	06.NOV.02A	29.NOV.02A		16
0060	Pile Probing	25	70	8	13.NOV.02A	15.JAN.03	-7	-7
0070	Guide Walls	30	50	15	05.DEC.02A	29.JAN.03	-7	-7
0080	Install Secant Piles	45	14	39	11.DEC.02A	05.MAR.03	-7	-7
0090	Cut Down Piles	35	10	32	16.DEC.02A	12.MAR.03	-7	-7
0100	Preliminary Works Complete	1	0	1	13.MAR.03	13.MAR.03	-7	-7
APARTMENT BLOCK								
SUBSTRUCTURE								
0110	FRC CAPPING BEAM	35	0	35	30.JAN.03	19.MAR.03	-7	-7
0120	BULK DIG LEAVING SUPPORTING BERMS	74	0	74	03.FEB.03	27.MAY.03	-7	-7
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	5	0	5	13.MAR.03	19.MAR.03	-2	-7
0140	ERECT TOWER CRANE	0	0	0	27.MAR.03		-7	-7
0150	FRC BASEMENT SLAB AREA 1	9	0	9	27.MAR.03	08.APR.03	-7	-7
SECTIONAL COMPLETIONS								
SECT01	Show Flat (floor 03)	0	0	0		18.FEB.04	-3	-7
SECT02	Arts Complex (partial)	0	0	0		17.MAR.04	-3	-7
SECT03	Residential Floors 04 to 07(incl.)	0	0	0		13.MAY.04	-7	-7
SECT04	Shops	0	0	0		13.MAY.04	-4	-7
SECT07	Remaining Residential	0	0	0		29.SEP.04	-7	-7



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

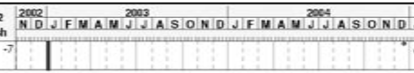
MIXED-USE DEVELOPMENT

As Built: as of 5 Jan..2003
end of WINDOW 1
Progress Comparison Chart

Sheet 1 of 2

APPENDIX 5C a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
SECT08	All Others Areas	0	0	0		12JAN05	-7	-7



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

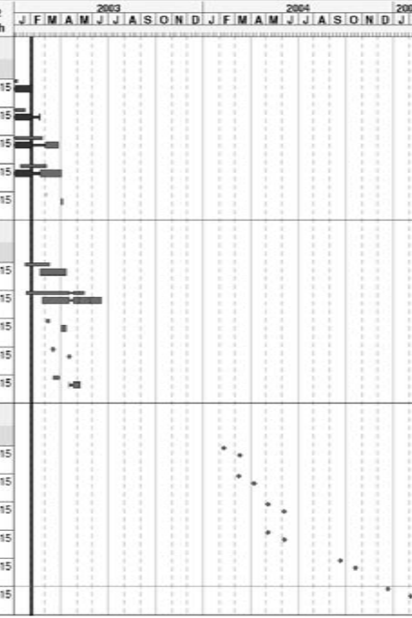
MIXED-USE DEVELOPMENT

As Built: as of 5 Jan..2003
end of WINDOW 1
Progress Comparison Chart

APPENDIX 5C a

Sheet 2 of 2

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
PRELIMINARY WORKS								
0060	Pile Probing	25	90	3	13.NOV.02A	05.FEB.03	-23	-15
0070	Guide Walls	30	90	3	05.DEC.02A	19.FEB.03	-23	-15
0080	Install Secant Piles	45	60	18	11.DEC.02A	26.MAR.03	-23	-15
0090	Cut Down Piles	35	18	29	16.DEC.02A	02.APR.03	-23	-15
0100	Preliminary Works Complete	1	0	1	03.APR.03	03.APR.03	-22	-15
APARTMENT BLOCK								
SUBSTRUCTURE								
0110	FRC CAPPING BEAM	35	0	35	20.FEB.03	09.APR.03	-22	-15
0120	BULK DIG LEAVING SUPPORTING BERMS	74	0	74	24.FEB.03	17.JUN.03	-22	-15
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	5	0	5	03.APR.03	09.APR.03	-17	-15
0140	ERECT TOWER CRANE	0	0	0	17.APR.03		-22	-15
0150	FRC BASEMENT SLAB AREA 1	9	0	9	17.APR.03	08.MAY.03	-22	-15
SECTIONAL COMPLETIONS								
SECT01	Show Flat (floor 03)	0	0	0		10.MAR.04	-18	-15
SECT02	Arts Complex (partial)	0	0	0		07.APR.04	-18	-15
SECT03	Residential Floors 04 to 07(incl.)	0	0	0		04.JUN.04	-22	-15
SECT04	Shops	0	0	0		04.JUN.04	-19	-15
SECT07	Remaining Residential	0	0	0		20.OCT.04	-22	-15
SECT08	All Others Areas	0	0	0		02.FEB.05	-22	-15



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

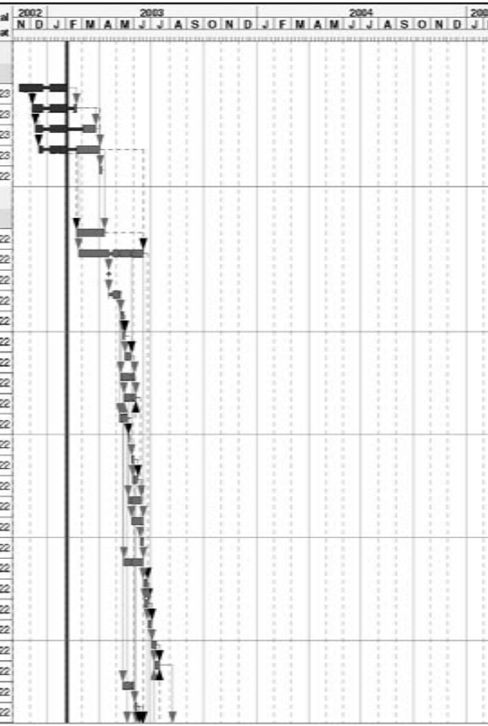
MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
Progress Comparison Chart

Sheet 1 of 1

APPENDIX 5D a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
PRELIMINARY WORKS							
0060	Pile Probing	25	90	3	13.NOV.02A	05.FEB.03	-23
0070	Guide Walls	30	90	3	05.DEC.02A	19.FEB.03	-23
0080	Install Secant Piles	45	60	18	11.DEC.02A	26.MAR.03	-23
0090	Cut Down Piles	35	18	29	16.DEC.02A	02.APR.03	-23
0100	Preliminary Works Complete	1	0	1	03.APR.03	03.APR.03	-22
APARTMENT BLOCK							
SUBSTRUCTURE							
0110	FRC CAPPING BEAM	35	0	35	20.FEB.03	09.APR.03	-22
0120	BULK DIG LEAVING SUPPORTING BERMS	74	0	74	24.FEB.03	17.JUN.03	-22
0140	ERECT TOWER CRANE	0	0	0	17.APR.03		-22
0150	FRC BASEMENT SLAB AREA 1	9	0	9	17.APR.03	08.MAY.03	-22
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	0	3	09.MAY.03	13.MAY.03	-22
0170	REMOVE SIDE BERMS AREA 1	4	0	4	13.MAY.03	16.MAY.03	-22
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	16.MAY.03	27.MAY.03	-22
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	0	16	09.MAY.03	02.JUN.03	-22
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	15.MAY.03	04.JUN.03	-22
0220	FRC BASEMENT SLAB AREA 2	10	0	10	06.MAY.03	19.MAY.03	-22
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	21.MAY.03	23.MAY.03	-22
0240	REMOVE SIDE BERMS AREA 2	4	0	4	27.MAY.03	30.MAY.03	-22
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	30.MAY.03	06.JUN.03	-22
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	21.MAY.03	12.JUN.03	-22
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	28.MAY.03	17.JUN.03	-22
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	12.JUN.03	16.JUN.03	-22
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	15.MAY.03	16.JUN.03	-22
0370	REMOVE BERM	5	0	5	17.JUN.03	23.JUN.03	-22
0380	BREAK BACK FEMALE PILES	4	0	4	20.JUN.03	25.JUN.03	-22
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	24.JUN.03	01.JUL.03	-22
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	02.JUL.03	08.JUL.03	-22
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	07.JUL.03	15.JUL.03	-22
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	12.MAY.03*	30.MAY.03	-22
0470	REMOVE BERM	4	0	4	02.JUN.03	05.JUN.03	-22



The critical path
Progress Bar
Critical Activity

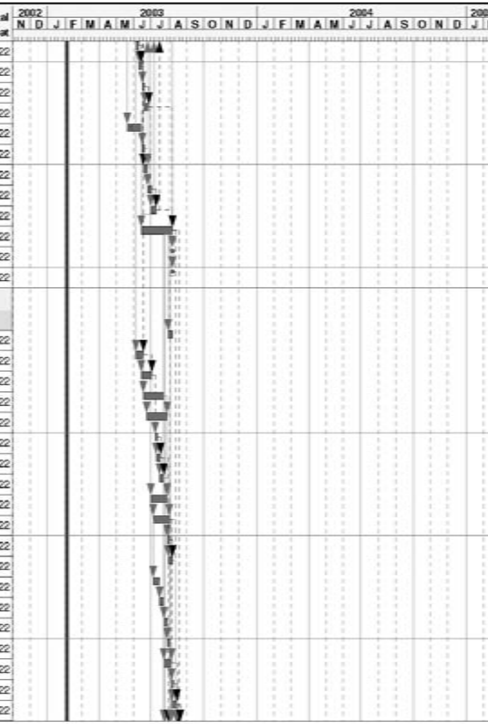
MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Sheet 1 of 7

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0480	BREAK BACK FEMALE PILES	3	0	3	05.JUN.03	09.JUN.03	-22
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	09.JUN.03	13.JUN.03	-22
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	16.JUN.03	19.JUN.03	-22
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	19.JUN.03	26.JUN.03	-22
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	20.MAY.03*	13.JUN.03	-22
0580	REMOVE BERM	4	0	4	16.JUN.03	19.JUN.03	-22
0590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	5	0	5	17.JUN.03	23.JUN.03	-22
0600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	6	0	6	24.JUN.03	01.JUL.03	-22
0610	FRC UPPER BASEMENT SLAB GL 1/J-M	6	0	6	01.JUL.03	08.JUL.03	-22
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	13.JUN.03	07.AUG.03	-22
0630	Substructure Residential Complete	0	0	0	08.AUG.03		-22
1230	Substructure Residential Complete	0	0	0	08.AUG.03		-22
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	5	0	5	31.JUL.03	06.AUG.03	-22
0660	FRC BASEMENT SLAB AREA 3	10	0	10	04.JUN.03	17.JUN.03	-22
0700	FRC BASEMENT SLAB AREA 4	14	0	14	13.JUN.03	02.JUL.03	-22
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	26	0	26	18.JUN.03	23.JUL.03	-22
0760	FRC UPPER BASEMENT SLAB AREA 3	26	0	26	23.JUN.03	28.JUL.03	-22
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	08.JUL.03	10.JUL.03	-22
0780	REMOVE SIDE BERMS AREA 4	5	0	5	10.JUL.03	16.JUL.03	-22
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	5	0	5	16.JUL.03	22.JUL.03	-22
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	21	0	21	30.JUN.03	28.JUL.03	-22
0840	FRC UPPER BASEMENT SLAB 4	20	0	20	04.JUL.03	31.JUL.03	-22
0850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	29.JUL.03	31.JUL.03	-22
0860	REMOVE SIDE BERMS AREA 5	5	0	5	31.JUL.03	06.AUG.03	-22
0870	FRC LOW SECTION OF BASEMT SLAB AREA 6	8	0	8	04.JUL.03	15.JUL.03	-22
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	5	0	5	16.JUL.03	22.JUL.03	-22
0890	FRC INTERMEDIATE SLAB AREA 6	4	0	4	23.JUL.03	28.JUL.03	-22
0900	FRC WALLS FROM INTERMEDIATE TO HIGH LVL SLAB A6	3	0	3	29.JUL.03	31.JUL.03	-22
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	10	0	10	23.JUL.03	05.AUG.03	-22
0960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	06.AUG.03	08.AUG.03	-22
0970	REMOVE SIDE BERMS AREA 6	5	0	5	08.AUG.03	14.AUG.03	-22



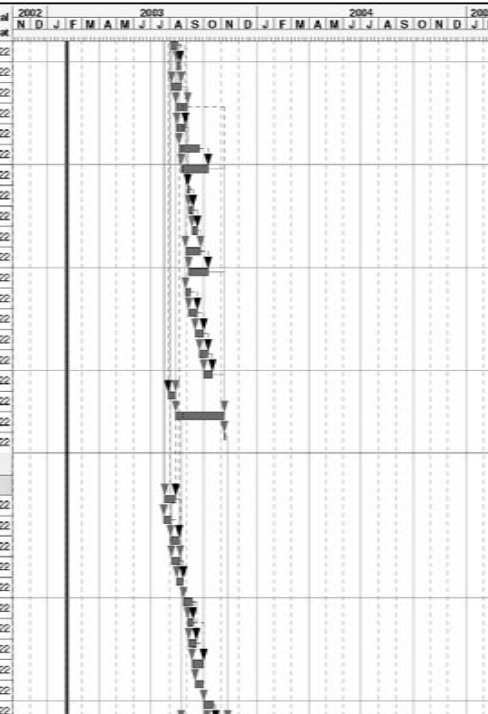
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0980	FRC BASEMENT SLAB SECTION 7	10	0	10	04.AUG.03	15.AUG.03	-22
0990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	4	0	4	14.AUG.03	19.AUG.03	-22
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	13	0	13	06.AUG.03	22.AUG.03	-22
1010	FRC UPPER BASEMENT SLAB 6	15	0	15	12.AUG.03	02.SEP.03	-22
1040	FRC BASEMENT SLAB SECTION 8	10	0	10	14.AUG.03	28.AUG.03	-22
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	26	0	26	18.AUG.03	23.SEP.03	-22
1080	FRC UPPER BASEMENT SLAB 7	33	0	33	22.AUG.03	08.OCT.03	-22
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	03.SEP.03	05.SEP.03	-22
1100	REMOVE SIDE BERMS AREA 8	5	0	5	05.SEP.03	11.SEP.03	-22
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	6	0	6	11.SEP.03	18.SEP.03	-22
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	19	0	19	29.AUG.03	24.SEP.03	-22
1140	FRC UPPER BASEMENT SLAB AREA 8	25	0	25	04.SEP.03	08.OCT.03	-22
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	7	0	7	29.AUG.03	08.SEP.03	-22
1160	REMOVE SUPPORTING BERM	10	0	10	05.SEP.03	18.SEP.03	-22
1170	FRC CLOSING SECTION OF BASEMENT SLAB	12	0	12	15.SEP.03	30.SEP.03	-22
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	11	0	11	23.SEP.03	07.OCT.03	-22
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	11	0	11	01.OCT.03	15.OCT.03	-22
1200	2 Week Allowance For Breaking Back Female Piles	10	0	10	30.JUL.03	12.AUG.03	-22
1210	FRC Columns / Walls Upper Basement - Ground	60	0	60	13.AUG.03	05.NOV.03	-22
1220	Substructure Arts Centre Complete	1	0	1	06.NOV.03	06.NOV.03	-22
APARTMENT BLOCK							
SUPERSTRUCTURE							
1240	FRC GF Slab Incl Part Sect. Of Area 3 GL 1-7/A-H	13	0	13	25.JUL.03	12.AUG.03	-22
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	10	0	10	23.JUL.03	05.AUG.03	-22
1260	FRC Remaining High Level Section Of GF SLAB	11	0	11	04.AUG.03	18.AUG.03	-22
1270	FRC Walls / Columns Ground - Mezz	11	0	11	06.AUG.03	20.AUG.03	-22
1280	FRC Mezz Floor Grid Lines 1-7/A-D	7	0	7	15.AUG.03	26.AUG.03	-22
1300	FRC Walls / Columns Mezz- 2nd Floor	10	0	10	27.AUG.03	09.SEP.03	-22
1330	FRC 2nd Floor Slab GL 1-7/M-R	8	0	8	03.SEP.03	12.SEP.03	-22
1340	FRC 2nd Floor Slab 1-7/A-F	10	0	10	04.SEP.03	17.SEP.03	-22
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	15	0	15	10.SEP.03	30.SEP.03	-22
1360	FRC 3rd Floor Slab GL 1-7/F-M	11	0	11	16.SEP.03	30.SEP.03	-22
1390	FRC Walls / Columns 3rd - 4th Floor	13	0	13	01.OCT.03	17.OCT.03	-22



The critical path
Progress Bar
Critical Activity

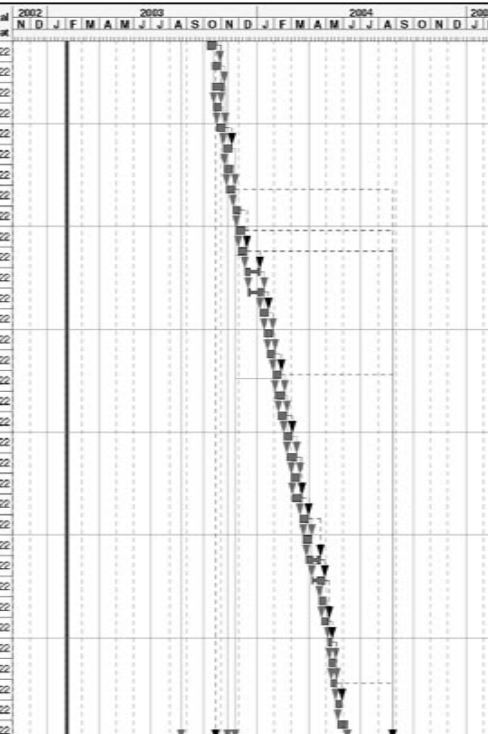
MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Sheet 3 of 7

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	13	0	13	06.OCT.03	22.OCT.03	-22
1440	FRC 4th Floor Slab GL 6-7/M-R	10	0	10	16.OCT.03	29.OCT.03	-22
1450	FRC Walls / Columns 4th - 5th Floor	14	0	14	16.OCT.03	04.NOV.03	-22
1460	FRC 5th Floor Slab GL 1-6/K-R	11	0	11	17.OCT.03	31.OCT.03	-22
1470	FRC 5th Floor Slab GL 1-6/A-K	12	0	12	23.OCT.03	07.NOV.03	-22
1480	FRC Walls/ Columns 5th - 6th Floor	12	0	12	03.NOV.03	18.NOV.03	-22
1490	FRC 6th Floor Slab GL 1-6/K-R	11	0	11	06.NOV.03	20.NOV.03	-22
1500	FRC 6th Floor Slab GL 1-6/A-K	11	0	11	10.NOV.03	24.NOV.03	-22
1510	FRC Walls / Columns 6th - 7th Floor	10	0	10	21.NOV.03	04.DEC.03	-22
1520	FRC 7th Floor Slab GL 1-6/K-R	11	0	11	26.NOV.03	10.DEC.03	-22
1530	FRC 7th Floor Slab GL 1-6/A-K	11	0	11	01.DEC.03	15.DEC.03	-22
1540	FRC Walls/ Columns 7th - 8th Floor	10	0	10	11.DEC.03	07.JAN.04	-22
1550	FRC 8th Floor Slab GL 1-6/K-R	10	0	10	17.DEC.03	13.JAN.04	-22
1560	FRC 8th Floor Slab GL 1-6/A-K	11	0	11	07.JAN.04	21.JAN.04	-22
1570	FRC Walls / Column 8th - 9th Floor	12	0	12	14.JAN.04	29.JAN.04	-22
1580	FRC 9th Floor Slab GL 1-6/K-R	10	0	10	20.JAN.04	02.FEB.04	-22
1590	FRC 9th Floor Slab GL 1-6/A-K	11	0	11	29.JAN.04	12.FEB.04	-22
1600	FRC Walls / Columns 9th - 10th Floor	12	0	12	03.FEB.04	18.FEB.04	-22
1610	FRC 10th Floor Slab GL 1-6/K-R	11	0	11	09.FEB.04	23.FEB.04	-22
1620	FRC 10th Floor SlabGL 1-6/A-K	11	0	11	18.FEB.04	03.MAR.04	-22
1630	FRC Walls / Columns 10th - 11th Floor	12	0	12	24.FEB.04	10.MAR.04	-22
1640	FRC 11th Floor Slab GL 1-6/K-R	11	0	11	01.MAR.04	15.MAR.04	-22
1650	FRC 11th Floor Slab GL 1-6/A-K	12	0	12	04.MAR.04	19.MAR.04	-22
1660	FRC Walls / Columns 11th - 12th Floor	12	0	12	16.MAR.04	31.MAR.04	-22
1670	FRC 12th Floor Slab GL 1-6/K-R	11	0	11	22.MAR.04	05.APR.04	-22
1680	FRC 12th Floor Slab GL 1-6/A-K	11	0	11	29.MAR.04	20.APR.04	-22
1690	FRC Walls / Columns 12th - 13th Floor	11	0	11	06.APR.04	28.APR.04	-22
1700	FRC 13th Floor Slab GL 1-6/K-R	9	0	9	20.APR.04	30.APR.04	-22
1710	FRC 13th Floor Slab GL 1-6/A-K	8	0	8	23.APR.04	05.MAY.04	-22
1720	FRC Walls / Columns 13th - 14th Floor	7	0	7	04.MAY.04	12.MAY.04	-22
1730	FRC 14th Floor Slab GL 1-6/K-R	7	0	7	07.MAY.04	17.MAY.04	-22
1740	FRC 14th Floor Slab GL 1-6/A-K	7	0	7	11.MAY.04	19.MAY.04	-22
1750	FRC Walls/ Columns 14th - 15th Floor	9	0	9	18.MAY.04	28.MAY.04	-22
1760	FRC 15th Floor Slab GL 1-6/K-R	11	0	11	21.MAY.04	07.JUN.04	-22



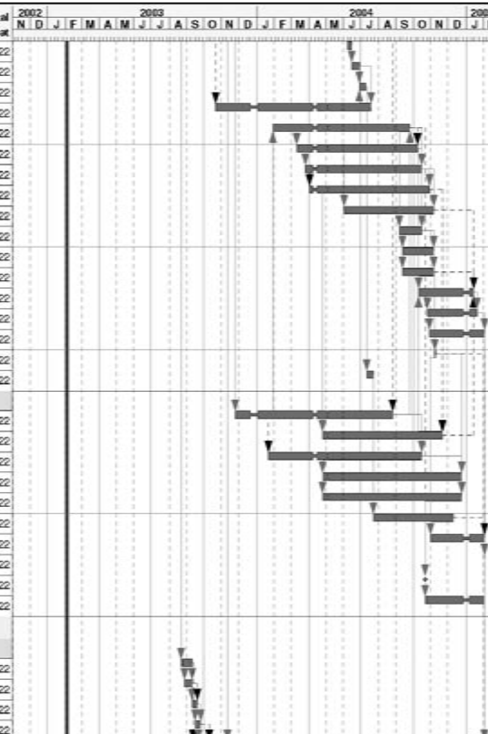
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1780	FRC Core Walls Level 15-16 GL A-B/2-5	6	0	6	08.JUN.04	15.JUN.04	-22
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	9	0	9	16.JUN.04	28.JUN.04	-22
1800	FRC Cover Slab To Core	9	0	9	29.JUN.04	09.JUL.04	-22
1810	Progressive Erection of Precast Stairs	177	0	177	21.OCT.03	19.JUL.04	-22
1860	Timber Grounds Windows & Doors	162	0	162	30.JAN.04	24.SEP.04	-22
1870	Render Insulation & First Coat	142	0	142	12.MAR.04	08.OCT.04	-22
1880	Terracotta Cladding Frame Work	137	0	137	26.MAR.04	15.OCT.04	-22
1890	Metal Cladding	142	0	142	02.APR.04	29.OCT.04	-22
1910	Terracotta Panels	112	0	112	02.JUN.04	05.NOV.04	-22
1950	Penthouse Brise Soleil	30	0	30	06.SEP.04	15.OCT.04	-22
1960	Penthouse Curtain Walling	40	0	40	13.SEP.04	05.NOV.04	-22
1970	Penthouse Roof Cladding/Roof Lights	40	0	40	13.SEP.04	05.NOV.04	-22
1980	Render Final Coat Top Down	59	0	59	11.OCT.04	13.JAN.05	-22
1990	Bolt On Balconies	54	0	54	25.OCT.04	20.JAN.05	-22
2000	Dismatle Scaffolds	59	0	59	29.OCT.04	02.FEB.05	-22
2050	Penthouse Roof Weathered	1	0	1	08.NOV.04	08.NOV.04	-22
2100	Lift Shaft Temporary Weathered	9	0	9	12.JUL.04	22.JUL.04	-22
INTERNAL FINISHES							
1850	Blockwork	181	0	181	24.NOV.03	26.AUG.04	-22
1900	Balcony/Balustrades & Finishes	147	0	147	26.APR.04	19.NOV.04	-22
2060	Internal Blockwork to Cores	182	0	182	23.JAN.04	15.OCT.04	-22
2070	M & E Services to Cores & Risers	171	0	171	26.APR.04	23.DEC.04	-22
2080	Staircase Lobbies & Common Areas	171	0	171	26.APR.04	23.DEC.04	-22
2110	Lift installations	98	0	98	23.JUL.04	08.DEC.04	-22
2120	Final Commision Clean & Snag	58	0	58	01.NOV.04	02.FEB.05	-22
2130	Shell & Core Completion	1	0	1	02.FEB.05	02.FEB.05	-22
2200	Access For Third Fit Out Phase	0	0	0	22.OCT.04		-22
2210	Third Phase Notional Fit Out Period	64	0	64	22.OCT.04	02.FEB.05	-22
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12	0	12	22.AUG.03	09.SEP.03	-22
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	10	0	10	28.AUG.03	10.SEP.03	-22
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	7	0	7	10.SEP.03	18.SEP.03	-22
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	9	0	9	15.SEP.03	25.SEP.03	-22



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	14	0	14	22.SEP.03	09.OCT.03	-22
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	10	0	10	25.SEP.03	08.OCT.03	-22
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	6	0	6	09.OCT.03	16.OCT.03	-22
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	10	0	10	08.OCT.03	21.OCT.03	-22
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	15	0	15	22.OCT.03	11.NOV.03	-22
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14	0	14	22.OCT.03	10.NOV.03	-22
2320	FRC Walls From Low - High Lvl GF Slab GL 12,14&K	6	0	6	11.NOV.03	18.NOV.03	-22
2330	FRC High Level Slab GL 11-14/A-K	8	0	8	12.NOV.03	21.NOV.03	-22
2340	FRC High Level Slab GL 11-12/K-M	5	0	5	21.NOV.03	27.NOV.03	-22
2350	FRC Ground Floor Slab GL 15-17/F-R	14	0	14	07.NOV.03	26.NOV.03	-22
2360	FRC Walls / Columns Ground - 2nd Floor	57	0	57	12.SEP.03	01.DEC.03	-22
2380	FRC Mezzanine Slab GL 13-17/C-R	11	0	11	02.DEC.03	16.DEC.03	-22
2390	FRC 2nd Floor Slab GL 7-9/A-J	12	0	12	23.SEP.03	08.OCT.03	-22
2420	FRC Remainder Of 2nd Floor Slab	12	0	12	17.DEC.03	15.JAN.04	-22
2430	FRC Walls / Columns 2nd - 3rd Floor	71	0	71	09.OCT.03	29.JAN.04	-22
2440	FRC 3rd Floor Slab GL 7-9/L-R	20	0	20	18.NOV.03	15.DEC.03	-22
2450	FRC 3rd Floor Slab GL 9-14/H-R	17	0	17	15.DEC.03	20.JAN.04	-22
2460	FRC 3rd Floor Slab GL 14-17/F-R	24	0	24	13.JAN.04	13.FEB.04	-22
2510	FRC 4th Floor Slab GL 9-15/F-R	18	0	18	27.JAN.04	19.FEB.04	-22
2570	Concrete Studio Theater Roof	5	0	5	05.MAR.04	11.MAR.04	-22
2620	Steelwork & Decking Level 4	10	0	10	20.FEB.04	04.MAR.04	-22
2830	Roofing Roof Finishes Lvl 4 & 5	61	0	61	19.FEB.04	24.MAY.04	-22
2880	Rooflights Fitness Centre	15	0	15	12.MAR.04	01.APR.04	-22
3060	Barriers/Markings	40	0	40	25.NOV.04	02.FEB.05	-22
3110	Barriers & Marking	20	0	20	23.DEC.04	02.FEB.05	-22
INTERNAL FINISHES							
2940	Blockwork Partitions/Builders Work	100	0	100	27.FEB.04	27.JUL.04	-22
2960	Service Installations/Commission	186	0	186	30.APR.04	02.FEB.05	-22
2980	Specialist Fit Out Works	153	0	153	18.JUN.04	02.FEB.05	-22
3050	Walls/Finishes & S	49	0	49	15.OCT.04	22.DEC.04	-22
3070	Office Area Fit Out	99	0	99	03.SEP.04	02.FEB.05	-22
3080	Remaining Retail Areas	1	0	1	02.FEB.05	02.FEB.05	-22
3100	Finishes & Service	79	0	79	03.SEP.04	22.DEC.04	-22

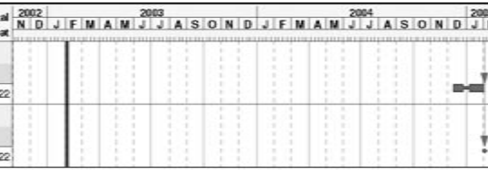
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
EXTERNAL WORKS							
3140	External Pavings Remainder (By Others)	30	0	30	09.DEC.04	02.FEB.05	-22
SECTIONAL COMPLETIONS							
SECT08	All Others Areas	0	0	0		02.FEB.05	-22



The critical path
Progress Bar
Critical Activity

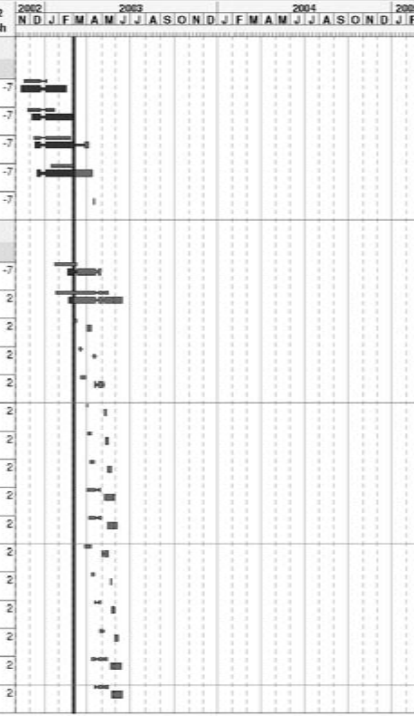
MIXED-USE DEVELOPMENT

As Built: as of 2 Feb.2003
end of WINDOW 2
The Critical Path

APPENDIX 5D b

Sheet 7 of 7

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
PRELIMINARY WORKS								
0060	Pile Probing	25	100	0	13.NOV.02A	14.FEB.03A		-7
0070	Guide Walls	30	100	0	05.DEC.02A	01.MAR.03A		-7
0080	Install Secant Piles	45	85	7	11.DEC.02A	04.APR.03	-8	-7
0090	Cut Down Piles	35	25	26	16.DEC.02A	11.APR.03	-8	-7
0100	Preliminary Works Complete	1	0	1	14.APR.03	14.APR.03	-8	-7
APARTMENT BLOCK								
SUBSTRUCTURE								
0110	FRC CAPPING BEAM	35	15	30	18.FEB.03A	28.APR.03	-8	-7
0120	BULK DIG LEAVING SUPPORTING BERMS	74	10	67	20.FEB.03A	13.JUN.03	-20	2
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	5	0	5	01.APR.03	07.APR.03	-15	2
0140	ERECT TOWER CRANE	0	0	0	15.APR.03		-20	2
0150	FRC BASEMENT SLAB AREA 1	9	0	9	15.APR.03	06.MAY.03	-20	2
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	0	3	07.MAY.03	09.MAY.03	-20	2
0170	REMOVE SIDE BERMS AREA 1	4	0	4	09.MAY.03	14.MAY.03	-20	2
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	14.MAY.03	22.MAY.03	-20	2
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	0	16	07.MAY.03	29.MAY.03	-20	2
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	13.MAY.03	02.JUN.03	-20	2
0220	FRC BASEMENT SLAB AREA 2	10	0	10	01.MAY.03	15.MAY.03	-20	2
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	19.MAY.03	21.MAY.03	-20	2
0240	REMOVE SIDE BERMS AREA 2	4	0	4	22.MAY.03	28.MAY.03	-20	2
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	28.MAY.03	04.JUN.03	-20	2
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	19.MAY.03	10.JUN.03	-20	2
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	23.MAY.03	13.JUN.03	-20	2



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

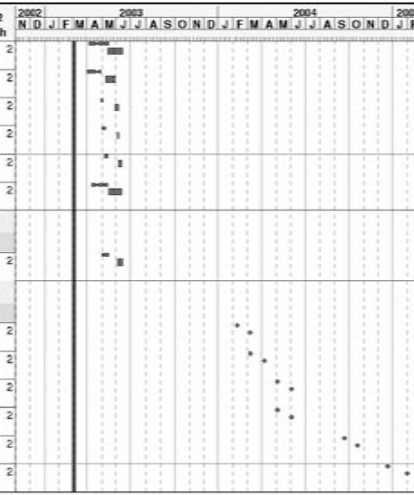
MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
Progress Comparison Chart

Sheet 1 of 2

APPENDIX 5E a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	13.MAY.03	12.JUN.03	-20	2
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	08.MAY.03*	28.MAY.03	-20	2
0470	REMOVE BERM	4	0	4	29.MAY.03	03.JUN.03	-20	2
0480	BREAK BACK FEMALE PILES	3	0	3	03.JUN.03	05.JUN.03	-20	2
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	05.JUN.03	11.JUN.03	-20	2
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	16.MAY.03*	11.JUN.03	-20	2
ARTS CENTRE								
SUBSTRUCTURE								
0660	FRC BASEMENT SLAB AREA 3	10	0	10	02.JUN.03	13.JUN.03	-20	2
SECTIONAL COMPLETIONS								
SECT01	Show Flat (floor 03)	0	0	0		08.MAR.04	-16	2
SECT02	Arts Complex (partial)	0	0	0		05.APR.04	-16	2
SECT03	Residential Floors 04 to 07(incl.)	0	0	0		02.JUN.04	-20	2
SECT04	Shops	0	0	0		02.JUN.04	-17	2
SECT07	Remaining Residential	0	0	0		18.OCT.04	-20	2
SECT08	All Others Areas	0	0	0		31.JAN.05	-20	2



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

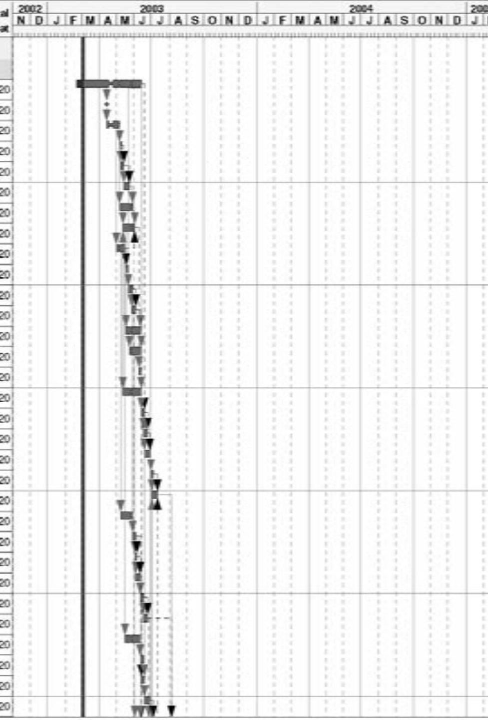
MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
Progress Comparison Chart

APPENDIX 5E a

Sheet 2 of 2

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
APARTMENT BLOCK							
SUBSTRUCTURE							
0120	BULK DIG LEAVING SUPPORTING BERMS	74	10	67	20.FEB.03A	13.JUN.03	-20
0140	ERECT TOWER CRANE	0	0	0	15.APR.03		-20
0150	FRC BASEMENT SLAB AREA 1	9	0	9	15.APR.03	06.MAY.03	-20
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	0	3	07.MAY.03	09.MAY.03	-20
0170	REMOVE SIDE BERMS AREA 1	4	0	4	09.MAY.03	14.MAY.03	-20
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	14.MAY.03	22.MAY.03	-20
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	0	16	07.MAY.03	29.MAY.03	-20
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	13.MAY.03	02.JUN.03	-20
0220	FRC BASEMENT SLAB AREA 2	10	0	10	01.MAY.03	15.MAY.03	-20
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	19.MAY.03	21.MAY.03	-20
0240	REMOVE SIDE BERMS AREA 2	4	0	4	22.MAY.03	28.MAY.03	-20
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	28.MAY.03	04.JUN.03	-20
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	19.MAY.03	10.JUN.03	-20
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	23.MAY.03	13.JUN.03	-20
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	10.JUN.03	12.JUN.03	-20
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	13.MAY.03	12.JUN.03	-20
0370	REMOVE BERM	5	0	5	13.JUN.03	19.JUN.03	-20
0380	BREAK BACK FEMALE PILES	4	0	4	18.JUN.03	23.JUN.03	-20
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	20.JUN.03	27.JUN.03	-20
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	30.JUN.03	04.JUL.03	-20
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	03.JUL.03	11.JUL.03	-20
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	08.MAY.03*	28.MAY.03	-20
0470	REMOVE BERM	4	0	4	29.MAY.03	03.JUN.03	-20
0480	BREAK BACK FEMALE PILES	3	0	3	03.JUN.03	05.JUN.03	-20
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	05.JUN.03	11.JUN.03	-20
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	12.JUN.03	17.JUN.03	-20
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	17.JUN.03	24.JUN.03	-20
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	16.MAY.03*	11.JUN.03	-20
0580	REMOVE BERM	4	0	4	12.JUN.03	17.JUN.03	-20
0590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	5	0	5	13.JUN.03	19.JUN.03	-20
0600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	6	0	6	20.JUN.03	27.JUN.03	-20



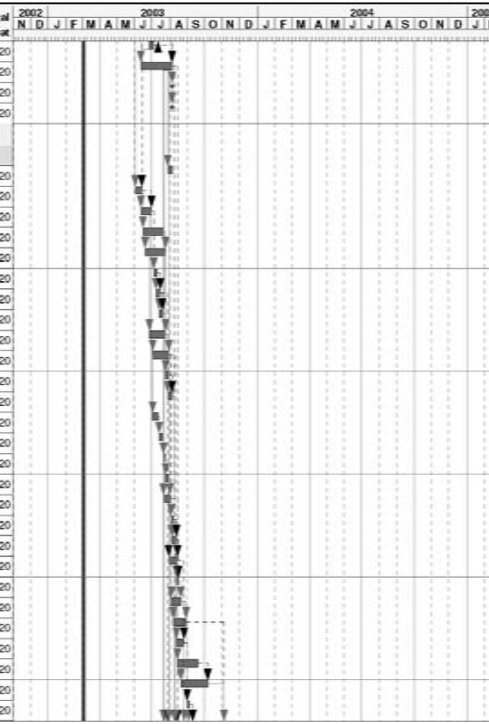
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0610	FRC UPPER BASEMENT SLAB GL 1/J-M	6	0	6	27.JUN.03	04.JUL.03	-20
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	11.JUN.03	05.AUG.03	-20
0630	Substructure Residential Complete	0	0	0	06.AUG.03		-20
1230	Substructure Residential Complete	0	0	0	06.AUG.03		-20
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	5	0	5	29.JUL.03	04.AUG.03	-20
0660	FRC BASEMENT SLAB AREA 3	10	0	10	02.JUN.03	13.JUN.03	-20
0700	FRC BASEMENT SLAB AREA 4	14	0	14	11.JUN.03	30.JUN.03	-20
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	26	0	26	16.JUN.03	21.JUL.03	-20
0760	FRC UPPER BASEMENT SLAB AREA 3	26	0	26	19.JUN.03	24.JUL.03	-20
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	04.JUL.03	08.JUL.03	-20
0780	REMOVE SIDE BERMS AREA 4	5	0	5	08.JUL.03	14.JUL.03	-20
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	5	0	5	14.JUL.03	18.JUL.03	-20
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	21	0	21	26.JUN.03	24.JUL.03	-20
0840	FRC UPPER BASEMENT SLAB 4	20	0	20	02.JUL.03	29.JUL.03	-20
0850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	25.JUL.03	29.JUL.03	-20
0860	REMOVE SIDE BERMS AREA 5	5	0	5	29.JUL.03	04.AUG.03	-20
0870	FRC LOW SECTION OF BASEMT SLAB AREA 6	8	0	8	02.JUL.03	11.JUL.03	-20
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	5	0	5	14.JUL.03	18.JUL.03	-20
0890	FRC INTERMEDIATE SLAB AREA 6	4	0	4	21.JUL.03	24.JUL.03	-20
0900	FRC WALLS FROM INTERMEDIATE TO HIGH LVL SLAB A6	3	0	3	25.JUL.03	29.JUL.03	-20
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	10	0	10	21.JUL.03	01.AUG.03	-20
0960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	04.AUG.03	06.AUG.03	-20
0970	REMOVE SIDE BERMS AREA 6	5	0	5	06.AUG.03	12.AUG.03	-20
0980	FRC BASEMENT SLAB SECTION 7	10	0	10	31.JUL.03	13.AUG.03	-20
0990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	4	0	4	12.AUG.03	15.AUG.03	-20
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	13	0	13	04.AUG.03	20.AUG.03	-20
1010	FRC UPPER BASEMENT SLAB 6	15	0	15	08.AUG.03	29.AUG.03	-20
1040	FRC BASEMENT SLAB SECTION 8	10	0	10	12.AUG.03	26.AUG.03	-20
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	26	0	26	14.AUG.03	19.SEP.03	-20
1080	FRC UPPER BASEMENT SLAB 7	33	0	33	20.AUG.03	06.OCT.03	-20
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	01.SEP.03	03.SEP.03	-20



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

Sheet 2 of 6

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1100	REMOVE SIDE BERMS AREA 8	5	0	5	03.SEP.03	09.SEP.03	-20
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	6	0	6	09.SEP.03	16.SEP.03	-20
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	19	0	19	27.AUG.03	22.SEP.03	-20
1140	FRC UPPER BASEMENT SLAB AREA 8	25	0	25	02.SEP.03	06.OCT.03	-20
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	7	0	7	27.AUG.03	04.SEP.03	-20
1160	REMOVE SUPPORTING BERM	10	0	10	03.SEP.03	16.SEP.03	-20
1170	FRC CLOSING SECTION OF BASEMENT SLAB	12	0	12	11.SEP.03	26.SEP.03	-20
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	11	0	11	19.SEP.03	03.OCT.03	-20
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	11	0	11	29.SEP.03	13.OCT.03	-20
1200	2 Week Allowance For Breaking Back Female Piles	10	0	10	28.JUL.03	08.AUG.03	-20
1210	FRC Columns / Walls Upper Basement - Ground	60	0	60	11.AUG.03	03.NOV.03	-20
1220	Substructure Arts Centre Complete	1	0	1	04.NOV.03	04.NOV.03	-20
APARTMENT BLOCK							
SUPERSTRUCTURE							
1240	FRC GF Slab incl Part Sect. Of Area 3 GL 1-7/A-H	13	0	13	23.JUL.03	08.AUG.03	-20
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	10	0	10	21.JUL.03	01.AUG.03	-20
1260	FRC Remaining High Level Section Of GF SLAB	11	0	11	31.JUL.03	14.AUG.03	-20
1270	FRC Walls / Columns Ground - Mezz	11	0	11	04.AUG.03	18.AUG.03	-20
1280	FRC Mezz Floor Grid Lines 1-7/A-D	7	0	7	13.AUG.03	21.AUG.03	-20
1300	FRC Walls / Columns Mezz- 2nd Floor	10	0	10	22.AUG.03	05.SEP.03	-20
1330	FRC 2nd Floor Slab GL 1-7/M-R	8	0	8	01.SEP.03	10.SEP.03	-20
1340	FRC 2nd Floor Slab 1-7/A-F	10	0	10	02.SEP.03	15.SEP.03	-20
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	15	0	15	08.SEP.03	26.SEP.03	-20
1360	FRC 3rd Floor Slab GL 1-7/F-M	11	0	11	12.SEP.03	26.SEP.03	-20
1390	FRC Walls / Columns 3rd - 4th Floor	13	0	13	29.SEP.03	15.OCT.03	-20
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	13	0	13	02.OCT.03	20.OCT.03	-20
1440	FRC 4th Floor Slab GL 6-7/M-R	10	0	10	14.OCT.03	27.OCT.03	-20
1450	FRC Walls / Columns 4th - 5th Floor	14	0	14	14.OCT.03	31.OCT.03	-20
1460	FRC 5th Floor Slab GL 1-6/K-R	11	0	11	15.OCT.03	29.OCT.03	-20
1470	FRC 5th Floor Slab GL 1-6/A-K	12	0	12	21.OCT.03	05.NOV.03	-20
1480	FRC Walls/ Columns 5th - 6th Floor	12	0	12	30.OCT.03	14.NOV.03	-20
1490	FRC 6th Floor Slab GL 1-6/K-R	11	0	11	04.NOV.03	18.NOV.03	-20
1500	FRC 6th Floor Slab GL 1-6/A-K	11	0	11	06.NOV.03	20.NOV.03	-20

The critical path
Progress Bar
Critical Activity

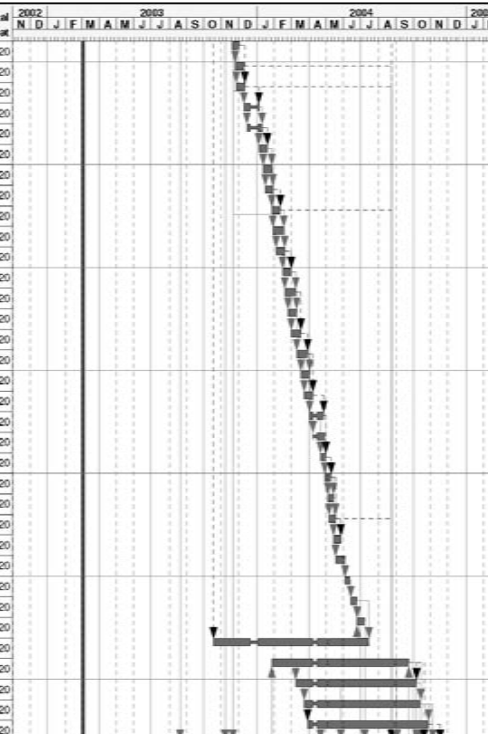
MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

Sheet 3 of 6

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1510	FRC Walls / Columns 6th - 7th Floor	10	0	10	19.NOV.03	02.DEC.03	-20
1520	FRC 7th Floor Slab GL 1-6/K-R	11	0	11	24.NOV.03	08.DEC.03	-20
1530	FRC 7th Floor Slab GL 1-6/A-K	11	0	11	27.NOV.03	11.DEC.03	-20
1540	FRC Walls/ Columns 7th - 8th Floor	10	0	10	09.DEC.03	05.JAN.04	-20
1550	FRC 8th Floor Slab GL 1-6/K-R	10	0	10	15.DEC.03	09.JAN.04	-20
1560	FRC 8th Floor Slab GL 1-6/A-K	11	0	11	05.JAN.04	19.JAN.04	-20
1570	FRC Walls / Column 8th - 9th Floor	12	0	12	12.JAN.04	27.JAN.04	-20
1580	FRC 9th Floor Slab GL 1-6/K-R	10	0	10	16.JAN.04	29.JAN.04	-20
1590	FRC 9th Floor Slab GL 1-6/A-K	11	0	11	27.JAN.04	10.FEB.04	-20
1600	FRC Walls / Columns 9th - 10th Floor	12	0	12	30.JAN.04	16.FEB.04	-20
1610	FRC 10th Floor Slab GL 1-6/K-R	11	0	11	05.FEB.04	19.FEB.04	-20
1620	FRC 10th Floor SlabGL 1-6/A-K	11	0	11	16.FEB.04	01.MAR.04	-20
1630	FRC Walls / Columns 10th - 11th Floor	12	0	12	20.FEB.04	08.MAR.04	-20
1640	FRC 11th Floor Slab GL 1-6/K-R	11	0	11	26.FEB.04	11.MAR.04	-20
1650	FRC 11th Floor Slab GL 1-6/A-K	12	0	12	02.MAR.04	17.MAR.04	-20
1660	FRC Walls / Columns 11th - 12th Floor	12	0	12	12.MAR.04	29.MAR.04	-20
1670	FRC 12th Floor Slab GL 1-6/K-R	11	0	11	18.MAR.04	01.APR.04	-20
1680	FRC 12th Floor Slab GL 1-6/A-K	11	0	11	25.MAR.04	08.APR.04	-20
1690	FRC Walls / Columns 12th - 13th Floor	11	0	11	02.APR.04	26.APR.04	-20
1700	FRC 13th Floor Slab GL 1-6/K-R	9	0	9	08.APR.04	28.APR.04	-20
1710	FRC 13th Floor Slab GL 1-6/A-K	8	0	8	21.APR.04	30.APR.04	-20
1720	FRC Walls / Columns 13th - 14th Floor	7	0	7	29.APR.04	10.MAY.04	-20
1730	FRC 14th Floor Slab GL 1-6/K-R	7	0	7	05.MAY.04	13.MAY.04	-20
1740	FRC 14th Floor Slab GL 1-6/A-K	7	0	7	07.MAY.04	17.MAY.04	-20
1750	FRC Walls/ Columns 14th - 15th Floor	9	0	9	14.MAY.04	26.MAY.04	-20
1760	FRC 15th Floor Slab GL 1-6/K-R	11	0	11	19.MAY.04	03.JUN.04	-20
1780	FRC Core Walls Level 15-16 GL A-B/2-5	6	0	6	04.JUN.04	11.JUN.04	-20
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	9	0	9	14.JUN.04	24.JUN.04	-20
1800	FRC Cover Slab To Core	9	0	9	25.JUN.04	07.JUL.04	-20
1810	Progressive Erection of Precast Stairs	177	0	177	17.OCT.03	15.JUL.04	-20
1860	Timber Grounds Windows & Doors	162	0	162	28.JAN.04	22.SEP.04	-20
1870	Render Insulation & First Coat	142	0	142	10.MAR.04	06.OCT.04	-20
1880	Terracotta Cladding Frame Work	137	0	137	24.MAR.04	13.OCT.04	-20
1890	Metal Cladding	142	0	142	31.MAR.04	27.OCT.04	-20



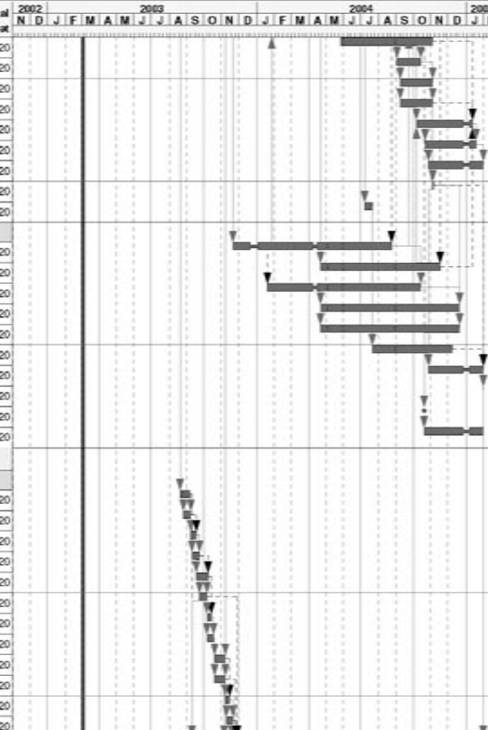
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1910	Terracotta Panels	112	0	112	28.MAY.04	03.NOV.04	-20
1950	Penthouse Brise Soleil	30	0	30	02.SEP.04	13.OCT.04	-20
1960	Penthouse Curtain Walling	40	0	40	09.SEP.04	03.NOV.04	-20
1970	Penthouse Roof Cladding/Roof Lights	40	0	40	09.SEP.04	03.NOV.04	-20
1980	Render Final Coat Top Down	59	0	59	07.OCT.04	11.JAN.05	-20
1990	Bolt On Balconies	54	0	54	21.OCT.04	18.JAN.05	-20
2000	Dismatle Scaffolds	59	0	59	27.OCT.04	31.JAN.05	-20
2050	Penthouse Roof Weathered	1	0	1	04.NOV.04	04.NOV.04	-20
2100	Lift Shaft Temporary Weathered	9	0	9	08.JUL.04	20.JUL.04	-20
INTERNAL FINISHES							
1850	Blockwork	181	0	181	20.NOV.03	24.AUG.04	-20
1900	Balcony/Balustrades & Finishes	147	0	147	22.APR.04	17.NOV.04	-20
2060	Internal Blockwork to Cores	182	0	182	21.JAN.04	13.OCT.04	-20
2070	M & E Services to Cores & Risers	171	0	171	22.APR.04	21.DEC.04	-20
2080	Staircase Lobbies & Common Areas	171	0	171	22.APR.04	21.DEC.04	-20
2110	Lift installations	98	0	98	21.JUL.04	06.DEC.04	-20
2120	Final Commision Clean & Snag	58	0	58	28.OCT.04	31.JAN.05	-20
2130	Shell & Core Completion	1	0	1	31.JAN.05	31.JAN.05	-20
2200	Access For Third Fit Out Phase	0	0	0	20.OCT.04		-20
2210	Third Phase Notional Fit Out Period	64	0	64	20.OCT.04	31.JAN.05	-20
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12	0	12	20.AUG.03	05.SEP.03	-20
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	10	0	10	26.AUG.03	08.SEP.03	-20
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	7	0	7	08.SEP.03	16.SEP.03	-20
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	9	0	9	11.SEP.03	23.SEP.03	-20
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	14	0	14	18.SEP.03	07.OCT.03	-20
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	10	0	10	23.SEP.03	06.OCT.03	-20
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	6	0	6	07.OCT.03	14.OCT.03	-20
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	10	0	10	06.OCT.03	17.OCT.03	-20
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	15	0	15	20.OCT.03	07.NOV.03	-20
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14	0	14	20.OCT.03	06.NOV.03	-20
2320	FRC Walls From Low - High Lvl GF Slab GL 12,14&K	6	0	6	07.NOV.03	14.NOV.03	-20
2330	FRC High Level Slab GL 11-14/A-K	8	0	8	10.NOV.03	19.NOV.03	-20



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2340	FRC High Level Slab GL 11-12/K-M	5	0	5	19.NOV.03	25.NOV.03	-20
2350	FRC Ground Floor Slab GL 15-17/F-R	14	0	14	05.NOV.03	24.NOV.03	-20
2360	FRC Walls / Columns Ground - 2nd Floor	57	0	57	10.SEP.03	27.NOV.03	-20
2380	FRC Mezzanine Slab GL 13-17/C-R	11	0	11	28.NOV.03	12.DEC.03	-20
2390	FRC 2nd Floor Slab GL 7-9/A-J	12	0	12	19.SEP.03	06.OCT.03	-20
2420	FRC Remainder Of 2nd Floor Slab	12	0	12	15.DEC.03	13.JAN.04	-20
2430	FRC Walls / Columns 2nd - 3rd Floor	71	0	71	07.OCT.03	27.JAN.04	-20
2440	FRC 3rd Floor Slab GL 7-9/L-R	20	0	20	14.NOV.03	11.DEC.03	-20
2450	FRC 3rd Floor Slab GL 9-14/H-R	17	0	17	11.DEC.03	16.JAN.04	-20
2460	FRC 3rd Floor Slab GL 14-17/F-R	24	0	24	09.JAN.04	11.FEB.04	-20
2510	FRC 4th Floor Slab GL 9-15/F-R	18	0	18	23.JAN.04	17.FEB.04	-20
2570	Concrete Studio Theater Roof	5	0	5	03.MAR.04	09.MAR.04	-20
2620	Steelwork & Decking Level 4	10	0	10	18.FEB.04	02.MAR.04	-20
2830	Roofing Roof Finishes Lvl 4 & 5	61	0	61	17.FEB.04	20.MAY.04	-20
2880	Rooflights Fitness Centre	15	0	15	10.MAR.04	30.MAR.04	-20
3060	Barriers/Markings	40	0	40	23.NOV.04	31.JAN.05	-20
3110	Barriers & Marking	20	0	20	21.DEC.04	31.JAN.05	-20
INTERNAL FINISHES							
2940	Blockwork Partitions/Builders Work	100	0	100	25.FEB.04	23.JUL.04	-20
2960	Service Installations/Commission	186	0	186	28.APR.04	31.JAN.05	-20
2980	Specialist Fit Out Works	153	0	153	16.JUN.04	31.JAN.05	-20
3050	Walls/Finishes & S	49	0	49	13.OCT.04	20.DEC.04	-20
3070	Office Area Fit Out	99	0	99	01.SEP.04	31.JAN.05	-20
3080	Remaining Retail Areas	1	0	1	31.JAN.05	31.JAN.05	-20
3100	Finishes & Service	79	0	79	01.SEP.04	20.DEC.04	-20
EXTERNAL WORKS							
3140	External Pavings Remainder (By Others)	30	0	30	07.DEC.04	31.JAN.05	-20
SECTIONAL COMPLETIONS							
SECT08	All Others Areas	0	0	0		31.JAN.05	-20

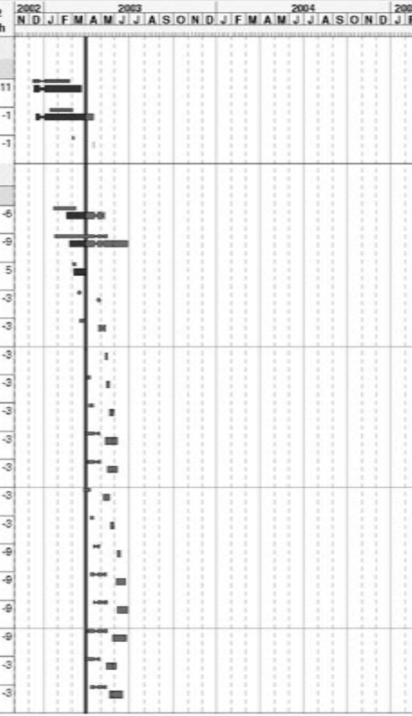
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 2 Mar.2003
end of WINDOW 3
The Critical Path

APPENDIX 5E b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
PRELIMINARY WORKS								
0080	Install Secant Piles	45	100	0	11.DEC.02A	20.MAR.03A		11
0090	Cut Down Piles	35	70	11	16.DEC.02A	14.APR.03	-9	-1
0100	Preliminary Works Complete	1	0	1	15.APR.03	15.APR.03	-9	-1
APARTMENT BLOCK								
SUBSTRUCTURE								
0110	FRC CAPPING BEAM	35	40	21	18.FEB.03A	07.MAY.03	-14	-6
0120	BULK DIG LEAVING SUPPORTING BERMS	74	25	56	25.FEB.03A	26.JUN.03	-29	-9
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	5	85	1	06.MAR.03A	31.MAR.03	-10	5
0140	ERECT TOWER CRANE	0	0	0	28.APR.03		-23	-3
0150	FRC BASEMENT SLAB AREA 1	9	0	9	28.APR.03	09.MAY.03	-23	-3
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	0	3	12.MAY.03	14.MAY.03	-23	-3
0170	REMOVE SIDE BERMS AREA 1	4	0	4	14.MAY.03	19.MAY.03	-23	-3
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	19.MAY.03	28.MAY.03	-23	-3
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	0	16	12.MAY.03	03.JUN.03	-23	-3
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	16.MAY.03	05.JUN.03	-23	-3
0220	FRC BASEMENT SLAB AREA 2	10	0	10	07.MAY.03	20.MAY.03	-23	-3
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	22.MAY.03	27.MAY.03	-23	-3
0240	REMOVE SIDE BERMS AREA 2	4	0	4	05.JUN.03	10.JUN.03	-29	-9
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	02.JUN.03	23.JUN.03	-29	-9
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	06.JUN.03	26.JUN.03	-29	-9
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	27.MAY.03	25.JUN.03	-29	-9
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	13.MAY.03*	02.JUN.03	-23	-3
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	21.MAY.03*	16.JUN.03	-23	-3



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

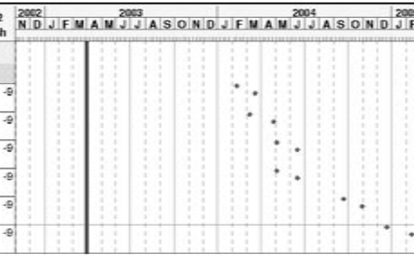
MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
Progress Comparison Chart

APPENDIX 5F a

Sheet 1 of 2

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
SECTIONAL COMPLETIONS								
SECT01	Show Flat (floor 03)	0	0	0		19.MAR.04	-25	-9
SECT02	Arts Complex (partial)	0	0	0		26.APR.04	-25	-9
SECT03	Residential Floors 04 to 07(incl.)	0	0	0		15.JUN.04	-29	-9
SECT04	Shops	0	0	0		15.JUN.04	-26	-9
SECT07	Remaining Residential	0	0	0		29.OCT.04	-29	-9
SECT08	All Others Areas	0	0	0		11.FEB.05	-29	-9



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

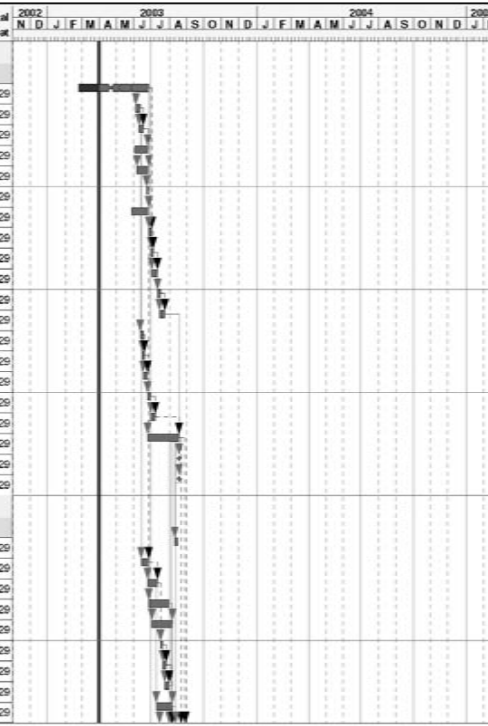
MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
Progress Comparison Chart

Sheet 2 of 2

APPENDIX 5F a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
APARTMENT BLOCK							
SUBSTRUCTURE							
0120	BULK DIG LEAVING SUPPORTING BERMS	74	25	56	25.FEB.03A	26.JUN.03	-29
0240	REMOVE SIDE BERMS AREA 2	4	0	4	05.JUN.03	10.JUN.03	-29
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	10.JUN.03	17.JUN.03	-29
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	02.JUN.03	23.JUN.03	-29
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	06.JUN.03	26.JUN.03	-29
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	23.JUN.03	25.JUN.03	-29
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	27.MAY.03	25.JUN.03	-29
0370	REMOVE BERM	5	0	5	26.JUN.03	02.JUL.03	-29
0380	BREAK BACK FEMALE PILES	4	0	4	01.JUL.03	04.JUL.03	-29
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	03.JUL.03	10.JUL.03	-29
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	11.JUL.03	17.JUL.03	-29
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	16.JUL.03	24.JUL.03	-29
0470	REMOVE BERM	4	0	4	11.JUN.03	16.JUN.03	-29
0480	BREAK BACK FEMALE PILES	3	0	3	16.JUN.03	18.JUN.03	-29
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	18.JUN.03	24.JUN.03	-29
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	25.JUN.03	30.JUN.03	-29
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	30.JUN.03	07.JUL.03	-29
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	24.JUN.03	18.AUG.03	-29
0630	Substructure Residential Complete	0	0	0	19.AUG.03		-29
1230	Substructure Residential Complete	0	0	0	19.AUG.03		-29
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	5	0	5	11.AUG.03	15.AUG.03	-29
0660	FRC BASEMENT SLAB AREA 3	10	0	10	13.JUN.03	26.JUN.03	-29
0700	FRC BASEMENT SLAB AREA 4	14	0	14	24.JUN.03	11.JUL.03	-29
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	26	0	26	27.JUN.03	01.AUG.03	-29
0760	FRC UPPER BASEMENT SLAB AREA 3	26	0	26	02.JUL.03	06.AUG.03	-29
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	17.JUL.03	21.JUL.03	-29
0780	REMOVE SIDE BERMS AREA 4	5	0	5	21.JUL.03	25.JUL.03	-29
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	5	0	5	25.JUL.03	31.JUL.03	-29
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	21	0	21	09.JUL.03	06.AUG.03	-29



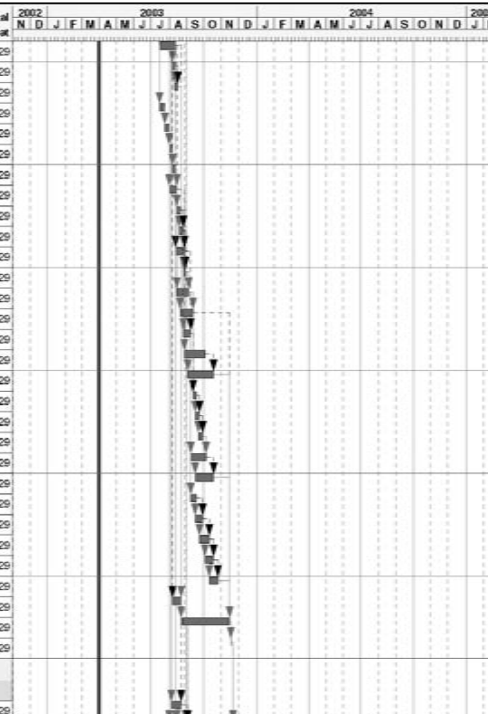
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
0840	FRC UPPER BASEMENT SLAB 4	20	0	20	15.JUL.03	11.AUG.03	-29
0850	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	07.AUG.03	11.AUG.03	-29
0860	REMOVE SIDE BERMS AREA 5	5	0	5	11.AUG.03	15.AUG.03	-29
0870	FRC LOW SECTION OF BASEM'T SLAB AREA 6	8	0	8	15.JUL.03	24.JUL.03	-29
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	5	0	5	25.JUL.03	31.JUL.03	-29
0890	FRC INTERMEDIATE SLAB AREA 6	4	0	4	01.AUG.03	06.AUG.03	-29
0900	FRC WALLS FROM INTERMEDIATE TO HIGH LVL SLAB A6	3	0	3	07.AUG.03	11.AUG.03	-29
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	10	0	10	01.AUG.03	14.AUG.03	-29
0960	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	15.AUG.03	19.AUG.03	-29
0970	REMOVE SIDE BERMS AREA 6	5	0	5	19.AUG.03	26.AUG.03	-29
0980	FRC BASEMENT SLAB SECTION 7	10	0	10	13.AUG.03	27.AUG.03	-29
0990	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 6	4	0	4	26.AUG.03	29.AUG.03	-29
1000	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 6	13	0	13	15.AUG.03	03.SEP.03	-29
1010	FRC UPPER BASEMENT SLAB 6	15	0	15	21.AUG.03	11.SEP.03	-29
1040	FRC BASEMENT SLAB SECTION 8	10	0	10	26.AUG.03	08.SEP.03	-29
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	26	0	26	28.AUG.03	02.OCT.03	-29
1080	FRC UPPER BASEMENT SLAB 7	33	0	33	03.SEP.03	17.OCT.03	-29
1090	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	12.SEP.03	16.SEP.03	-29
1100	REMOVE SIDE BERMS AREA 8	5	0	5	16.SEP.03	22.SEP.03	-29
1110	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 8	6	0	6	22.SEP.03	29.SEP.03	-29
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	19	0	19	09.SEP.03	03.OCT.03	-29
1140	FRC UPPER BASEMENT SLAB AREA 8	25	0	25	15.SEP.03	17.OCT.03	-29
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	7	0	7	09.SEP.03	17.SEP.03	-29
1160	REMOVE SUPPORTING BERM	10	0	10	16.SEP.03	29.SEP.03	-29
1170	FRC CLOSING SECTION OF BASEMENT SLAB	12	0	12	24.SEP.03	09.OCT.03	-29
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	11	0	11	02.OCT.03	16.OCT.03	-29
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	11	0	11	10.OCT.03	24.OCT.03	-29
1200	2 Week Allowance For Breaking Back Female Piles	10	0	10	08.AUG.03	21.AUG.03	-29
1210	FRC Columns / Walls Upper Basement - Ground	60	0	60	22.AUG.03	14.NOV.03	-29
1220	Substructure Arts Centre Complete	1	0	1	17.NOV.03	17.NOV.03	-29
APARTMENT BLOCK							
SUPERSTRUCTURE							
1240	FRC GF Slab Incl Part Sect. Of Area 3 GL 1-7/A-H	13	0	13	05.AUG.03	21.AUG.03	-29



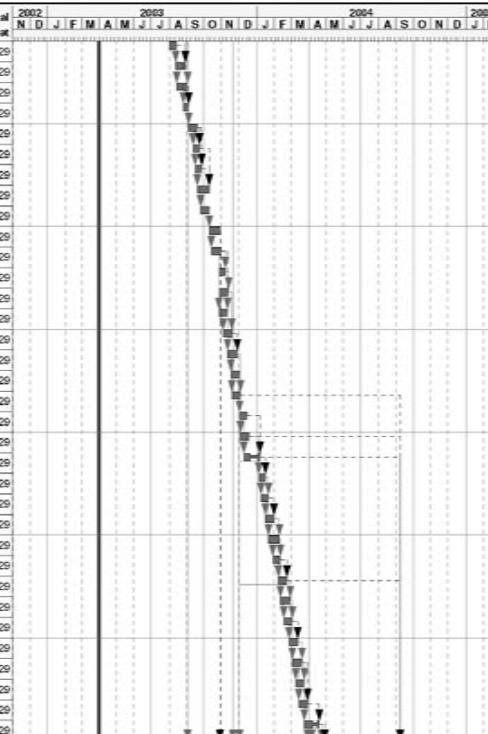
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	10	0	10	01.AUG.03	14.AUG.03	-29
1260	FRC Remaining High Level Section Of GF SLAB	11	0	11	13.AUG.03	28.AUG.03	-29
1270	FRC Walls / Columns Ground - Mezz	11	0	11	15.AUG.03	01.SEP.03	-29
1280	FRC Mezz Floor Grid Lines 1-7/A-D	7	0	7	27.AUG.03	04.SEP.03	-29
1300	FRC Walls / Columns Mezz- 2nd Floor	10	0	10	05.SEP.03	18.SEP.03	-29
1330	FRC 2nd Floor Slab GL 1-7/M-R	8	0	8	12.SEP.03	23.SEP.03	-29
1340	FRC 2nd Floor Slab 1-7/A-F	10	0	10	15.SEP.03	26.SEP.03	-29
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	15	0	15	19.SEP.03	09.OCT.03	-29
1360	FRC 3rd Floor Slab GL 1-7/F-M	11	0	11	25.SEP.03	09.OCT.03	-29
1390	FRC Walls / Columns 3rd - 4th Floor	13	0	13	10.OCT.03	28.OCT.03	-29
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	13	0	13	15.OCT.03	31.OCT.03	-29
1440	FRC 4th Floor Slab GL 6-7/M-R	10	0	10	27.OCT.03	07.NOV.03	-29
1450	FRC Walls / Columns 4th - 5th Floor	14	0	14	27.OCT.03	13.NOV.03	-29
1460	FRC 5th Floor Slab GL 1-6/K-R	11	0	11	28.OCT.03	11.NOV.03	-29
1470	FRC 5th Floor Slab GL 1-6/A-K	12	0	12	03.NOV.03	18.NOV.03	-29
1480	FRC Walls/ Columns 5th - 6th Floor	12	0	12	12.NOV.03	27.NOV.03	-29
1490	FRC 6th Floor Slab GL 1-6/K-R	11	0	11	17.NOV.03	01.DEC.03	-29
1500	FRC 6th Floor Slab GL 1-6/A-K	11	0	11	19.NOV.03	03.DEC.03	-29
1510	FRC Walls / Columns 6th - 7th Floor	10	0	10	02.DEC.03	15.DEC.03	-29
1520	FRC 7th Floor Slab GL 1-6/K-R	11	0	11	05.DEC.03	19.DEC.03	-29
1530	FRC 7th Floor Slab GL 1-6/A-K	11	0	11	10.DEC.03	07.JAN.04	-29
1540	FRC Walls/ Columns 7th - 8th Floor	10	0	10	05.JAN.04	16.JAN.04	-29
1550	FRC 8th Floor Slab GL 1-6/K-R	10	0	10	09.JAN.04	22.JAN.04	-29
1560	FRC 8th Floor Slab GL 1-6/A-K	11	0	11	16.JAN.04	30.JAN.04	-29
1570	FRC Walls / Column 8th - 9th Floor	12	0	12	23.JAN.04	09.FEB.04	-29
1580	FRC 9th Floor Slab GL 1-6/K-R	10	0	10	29.JAN.04	11.FEB.04	-29
1590	FRC 9th Floor Slab GL 1-6/A-K	11	0	11	09.FEB.04	23.FEB.04	-29
1600	FRC Walls / Columns 9th - 10th Floor	12	0	12	12.FEB.04	27.FEB.04	-29
1610	FRC 10th Floor Slab GL 1-6/K-R	11	0	11	18.FEB.04	03.MAR.04	-29
1620	FRC 10th Floor SlabGL 1-6/A-K	11	0	11	27.FEB.04	12.MAR.04	-29
1630	FRC Walls / Columns 10th - 11th Floor	12	0	12	04.MAR.04	19.MAR.04	-29
1640	FRC 11th Floor Slab GL 1-6/K-R	11	0	11	10.MAR.04	24.MAR.04	-29
1650	FRC 11th Floor Slab GL 1-6/A-K	12	0	12	15.MAR.04	30.MAR.04	-29
1660	FRC Walls / Columns 11th - 12th Floor	12	0	12	25.MAR.04	19.APR.04	-29



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

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Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1670	FRC 12th Floor Slab GL 1-6/K-R	11	0	11	31.MAR.04	22.APR.04	-29
1680	FRC 12th Floor Slab GL 1-6/A-K	11	0	11	07.APR.04	29.APR.04	-29
1690	FRC Walls / Columns 12th - 13th Floor	11	0	11	23.APR.04	10.MAY.04	-29
1700	FRC 13th Floor Slab GL 1-6/K-R	9	0	9	29.APR.04	12.MAY.04	-29
1710	FRC 13th Floor Slab GL 1-6/A-K	8	0	8	05.MAY.04	14.MAY.04	-29
1720	FRC Walls / Columns 13th - 14th Floor	7	0	7	13.MAY.04	21.MAY.04	-29
1730	FRC 14th Floor Slab GL 1-6/K-R	7	0	7	18.MAY.04	26.MAY.04	-29
1740	FRC 14th Floor Slab GL 1-6/A-K	7	0	7	20.MAY.04	28.MAY.04	-29
1750	FRC Walls/ Columns 14th - 15th Floor	9	0	9	27.MAY.04	09.JUN.04	-29
1760	FRC 15th Floor Slab GL 1-6/K-R	11	0	11	02.JUN.04	16.JUN.04	-29
1780	FRC Core Walls Level 15-16 GL A-B/2-5	6	0	6	17.JUN.04	24.JUN.04	-29
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	9	0	9	25.JUN.04	07.JUL.04	-29
1800	FRC Cover Slab To Core	9	0	9	08.JUL.04	20.JUL.04	-29
1810	Progressive Erection of Precast Stairs	177	0	177	30.OCT.03	28.JUL.04	-29
1860	Timber Grounds Windows & Doors	162	0	162	10.FEB.04	05.OCT.04	-29
1870	Render Insulation & First Coat	142	0	142	23.MAR.04	19.OCT.04	-29
1880	Terracotta Cladding Frame Work	137	0	137	06.APR.04	26.OCT.04	-29
1890	Metal Cladding	142	0	142	21.APR.04	09.NOV.04	-29
1910	Terracotta Panels	112	0	112	11.JUN.04	16.NOV.04	-29
1950	Penthouse Brise Soleil	30	0	30	15.SEP.04	26.OCT.04	-29
1960	Penthouse Curtain Walling	40	0	40	22.SEP.04	16.NOV.04	-29
1970	Penthouse Roof Cladding/Roof Lights	40	0	40	22.SEP.04	16.NOV.04	-29
1980	Render Final Coat Top Down	59	0	59	20.OCT.04	24.JAN.05	-29
1990	Bolt On Balconies	54	0	54	03.NOV.04	31.JAN.05	-29
2000	Dismatle Scaffolds	59	0	59	09.NOV.04	11.FEB.05	-29
2050	Penthouse Roof Weathered	1	0	1	17.NOV.04	17.NOV.04	-29
2100	Lift Shaft Temporary Weathered	9	0	9	21.JUL.04	02.AUG.04	-29
INTERNAL FINISHES							
1850	Blockwork	181	0	181	03.DEC.03	07.SEP.04	-29
1900	Balcony/Balustrades & Finishes	147	0	147	06.MAY.04	30.NOV.04	-29
2060	Internal Blockwork to Cores	182	0	182	03.FEB.04	26.OCT.04	-29
2070	M & E Services to Cores & Risers	171	0	171	06.MAY.04	17.JAN.05	-29
2080	Staircase Lobbies & Common Areas	171	0	171	06.MAY.04	17.JAN.05	-29
2110	Lift installations	98	0	98	03.AUG.04	17.DEC.04	-29

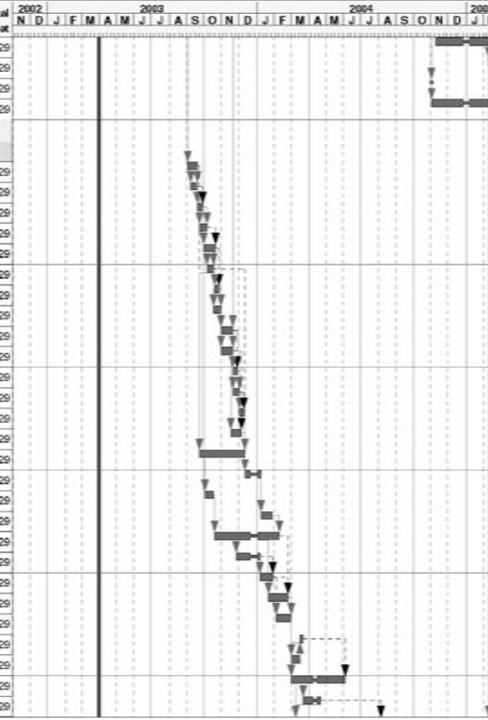
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2120	Final Commision Clean & Snag	58	0	58	10.NOV.04	11.FEB.05	-29
2130	Shell & Core Completion	1	0	1	11.FEB.05	11.FEB.05	-29
2200	Access For Third Fit Out Phase	0	0	0	02.NOV.04		-29
2210	Third Phase Notional Fit Out Period	64	0	64	02.NOV.04	11.FEB.05	-29
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12	0	12	03.SEP.03	18.SEP.03	-29
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	10	0	10	08.SEP.03	19.SEP.03	-29
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	7	0	7	19.SEP.03	29.SEP.03	-29
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	9	0	9	24.SEP.03	06.OCT.03	-29
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	14	0	14	01.OCT.03	20.OCT.03	-29
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	10	0	10	06.OCT.03	17.OCT.03	-29
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	6	0	6	20.OCT.03	27.OCT.03	-29
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	10	0	10	17.OCT.03	30.OCT.03	-29
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	15	0	15	31.OCT.03	20.NOV.03	-29
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14	0	14	31.OCT.03	19.NOV.03	-29
2320	FRC Walls From Low - High Lvl GF Slab GL 12,14&K	6	0	6	20.NOV.03	27.NOV.03	-29
2330	FRC High Level Slab GL 11-14/A-K	8	0	8	21.NOV.03	02.DEC.03	-29
2340	FRC High Level Slab GL 11-12/K-M	5	0	5	02.DEC.03	08.DEC.03	-29
2350	FRC Ground Floor Slab GL 15-17/F-R	14	0	14	18.NOV.03	05.DEC.03	-29
2360	FRC Walls / Columns Ground - 2nd Floor	57	0	57	23.SEP.03	10.DEC.03	-29
2380	FRC Mezzanine Slab GL 13-17/C-R	11	0	11	11.DEC.03	08.JAN.04	-29
2390	FRC 2nd Floor Slab GL 7-9/A-J	12	0	12	02.OCT.03	17.OCT.03	-29
2420	FRC Remainder Of 2nd Floor Slab	12	0	12	09.JAN.04	26.JAN.04	-29
2430	FRC Walls / Columns 2nd - 3rd Floor	71	0	71	20.OCT.03	09.FEB.04	-29
2440	FRC 3rd Floor Slab GL 7-9/L-R	20	0	20	27.NOV.03	07.JAN.04	-29
2450	FRC 3rd Floor Slab GL 9-14/H-R	17	0	17	07.JAN.04	29.JAN.04	-29
2460	FRC 3rd Floor Slab GL 14-17/F-R	24	0	24	22.JAN.04	24.FEB.04	-29
2510	FRC 4th Floor Slab GL 9-15/F-R	18	0	18	05.FEB.04	01.MAR.04	-29
2570	Concrete Studio Theater Roof	5	0	5	16.MAR.04	22.MAR.04	-29
2620	Steelwork & Decking Level 4	10	0	10	02.MAR.04	15.MAR.04	-29
2830	Roofing Roof Finishes Lvl 4 & 5	61	0	61	01.MAR.04	03.JUN.04	-29
2880	Rooflights Fitness Centre	15	0	15	23.MAR.04	20.APR.04	-29



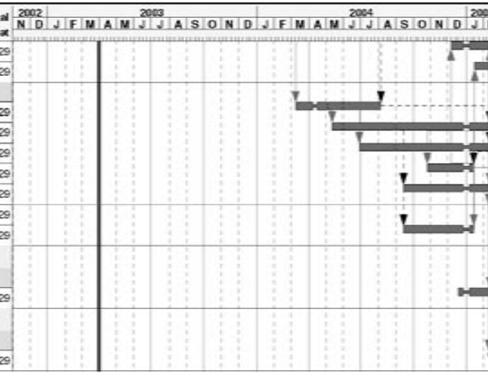
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
3060	Barriers/Markings	40	0	40	06.DEC.04	11.FEB.05	-29
3110	Barriers & Marking	20	0	20	17.JAN.05	11.FEB.05	-29
INTERNAL FINISHES							
2940	Blockwork Partitions/Builders Work	100	0	100	09.MAR.04	05.AUG.04	-29
2960	Service Installations/Commission	186	0	186	12.MAY.04	11.FEB.05	-29
2980	Specialist Fit Out Works	153	0	153	29.JUN.04	11.FEB.05	-29
3050	Walls/Finishes & S	49	0	49	26.OCT.04	14.JAN.05	-29
3070	Office Area Fit Out	99	0	99	14.SEP.04	11.FEB.05	-29
3080	Remaining Retail Areas	1	0	1	11.FEB.05	11.FEB.05	-29
3100	Finishes & Service	79	0	79	14.SEP.04	14.JAN.05	-29
EXTERNAL WORKS							
3140	External Pavings Remainder (By Others)	30	0	30	20.DEC.04	11.FEB.05	-29
SECTIONAL COMPLETIONS							
SECT08	All Others Areas	0	0	0		11.FEB.05	-29



The critical path
Progress Bar
Critical Activity

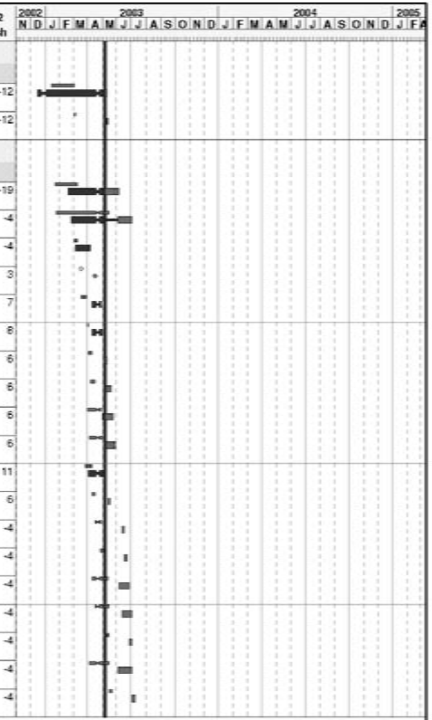
MIXED-USE DEVELOPMENT

As Built: as of 30 Mar.2003
end of WINDOW 4
The Critical Path

APPENDIX 5F b

Sheet 6 of 6

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
PRELIMINARY WORKS								
0090	Cut Down Piles	35	88	4	16.DEC.02A	09.MAY.03	-21	-12
0100	Preliminary Works Complete	1	0	1	12.MAY.03	12.MAY.03	-21	-12
APARTMENT BLOCK								
SUBSTRUCTURE								
0110	FRC CAPPING BEAM	35	40	21	18.FEB.03A	04.JUN.03	-33	-19
0120	BULK DIG LEAVING SUPPORTING BERMS	74	70	22	25.FEB.03A	02.JUL.03	-33	-4
0130	FRC SECTION OF AREA 3 SLAB FOR TOWER CRANE 1	5	100	0	06.MAR.03A	05.APR.03A		-4
0140	ERECT TOWER CRANE	0	100	0	15.APR.03A			3
0150	FRC BASEMENT SLAB AREA 1	9	100	0	10.APR.03A	29.APR.03A		7
0160	INSTALL TEMPORARY WORKS JIGS 1 & 2	3	100	0	08.APR.03A	01.MAY.03A		8
0170	REMOVE SIDE BERMS AREA 1	4	0	4	06.MAY.03	09.MAY.03	-17	6
0180	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 1	7	0	7	09.MAY.03	19.MAY.03	-17	6
0190	FRC WALLS AND COLUMNS LOWER - UPPER BASEMENT	16	10	14	01.MAY.03A	23.MAY.03	-17	6
0210	FRC UPPER BASEMENT SLAB AREA 1	14	0	14	08.MAY.03	28.MAY.03	-17	6
0220	FRC BASEMENT SLAB AREA 2	10	100	0	03.APR.03A	03.MAY.03A		11
0230	INSTALL TEMPORARY WORKS JIGS 3 & 4	3	0	3	14.MAY.03	16.MAY.03	-17	6
0240	REMOVE SIDE BERMS AREA 2	4	0	4	11.JUN.03	16.JUN.03	-33	-4
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	16.JUN.03	23.JUN.03	-33	-4
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	06.JUN.03	27.JUN.03	-33	-4
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	12.JUN.03	02.JUL.03	-33	-4
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	27.JUN.03	01.JUL.03	-33	-4
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	02.JUN.03	01.JUL.03	-33	-4
0370	REMOVE BERM	5	0	5	02.JUL.03	08.JUL.03	-33	-4



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

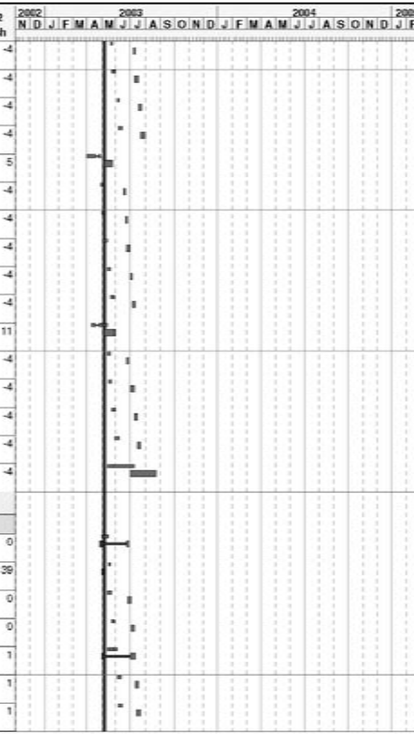
MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
Progress Comparison Chart

Sheet 1 of 3

APPENDIX 5G a

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
0380	BREAK BACK FEMALE PILES	4	0	4	07.JUL.03	10.JUL.03	-33	-4
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	09.JUL.03	16.JUL.03	-33	-4
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	17.JUL.03	23.JUL.03	-33	-4
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	22.JUL.03	30.JUL.03	-33	-4
0420	INSTALL TEMP SUPPORT PROPS GL 1/M-R	14	0	14	06.MAY.03*	23.MAY.03	-18	5
0470	REMOVE BERM	4	0	4	17.JUN.03	20.JUN.03	-33	-4
0480	BREAK BACK FEMALE PILES	3	0	3	20.JUN.03	24.JUN.03	-33	-4
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	24.JUN.03	30.JUN.03	-33	-4
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	01.JUL.03	04.JUL.03	-33	-4
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	04.JUL.03	11.JUL.03	-33	-4
0520	INSTALL TEMP SUPPORT PROPS GL 1/J-M	18	0	18	06.MAY.03*	30.MAY.03	-12	11
0580	REMOVE BERM	4	0	4	23.JUN.03	26.JUN.03	-27	-4
0590	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/J-M	5	0	5	01.JUL.03	07.JUL.03	-32	-4
0600	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	6	0	6	08.JUL.03	15.JUL.03	-32	-4
0610	FRC UPPER BASEMENT SLAB GL 1/J-M	6	0	6	15.JUL.03	22.JUL.03	-32	-4
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	30.JUN.03	22.AUG.03	-33	-4
ARTS CENTRE								
SUBSTRUCTURE								
0660	FRC BASEMENT SLAB AREA 3	10	60	4	28.APR.03A	26.JUN.03	-29	0
0670	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	70	1	02.MAY.03A	06.MAY.03	23	39
0680	FRC LOW LEVEL BASEMENT SLAB AREA 4	6	0	6	25.JUN.03	02.JUL.03	-28	0
0690	FRC WALLS LOW - HIGH LEVEL AREA 4 GL 8-9/P-M	4	0	4	03.JUL.03	08.JUL.03	-28	0
0700	FRC BASEMENT SLAB AREA 4	14	40	8	02.MAY.03A	10.JUL.03	-28	1
0720	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 3	6	0	6	11.JUL.03*	18.JUL.03	-26	1
0730	FRC LIFT PITS IN CLOSING SECT. OF B3 GL Q-P/7-8	7	0	7	14.JUL.03*	22.JUL.03	-24	1



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

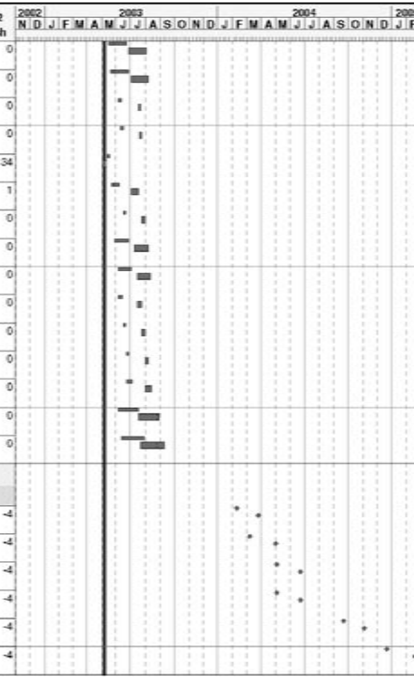
MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
Progress Comparison Chart

APPENDIX 5G a

Sheet 2 of 3

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float	Variance 2 Early Finish
0740	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 3	26	0	26	27.JUN.03	01.AUG.03	-29	0
0760	FRC UPPER BASEMENT SLAB AREA 3	26	0	26	02.JUL.03	06.AUG.03	-29	0
0770	RELOCATE TEMPORARY WORKS JIGS 3 & 4	3	0	3	17.JUL.03	21.JUL.03	-29	0
0780	REMOVE SIDE BERMS AREA 4	5	0	5	21.JUL.03	25.JUL.03	-29	0
0790	FRC RAMP & WALLS BASEM'T SLAB AREA 5 GL 9-10/H-E	4	0	4	06.MAY.03*	09.MAY.03	13	34
0800	FRC BASEMENT SLAB AREA 5	11	0	11	02.JUL.03	16.JUL.03	-27	1
0810	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 4	5	0	5	25.JUL.03	31.JUL.03	-29	0
0820	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 4	21	0	21	09.JUL.03	06.AUG.03	-29	0
0840	FRC UPPER BASEMENT SLAB 4	20	0	20	15.JUL.03	11.AUG.03	-29	0
0870	FRC LOW SECTION OF BASEM'T SLAB AREA 6	8	0	8	15.JUL.03	24.JUL.03	-29	0
0880	FRC WALLS LOW - HIGH BASEMENT SLAB AREA 6	5	0	5	25.JUL.03	31.JUL.03	-29	0
0890	FRC INTERMEDIATE SLAB AREA 6	4	0	4	01.AUG.03	06.AUG.03	-29	0
0910	FRC HIGH LEVEL BASEMENT SLAB AREA 6	10	0	10	01.AUG.03	14.AUG.03	-29	0
0930	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 5	31	0	31	17.JUL.03	29.AUG.03	-28	0
0950	FRC UPPER BASEMENT SLAB 5	34	0	34	23.JUL.03	09.SEP.03	-28	0
SECTIONAL COMPLETIONS								
SECT01	Show Flat (floor 03)	0	0	0		25.MAR.04	-29	-4
SECT02	Arts Complex (partial)	0	0	0		30.APR.04	-29	-4
SECT03	Residential Floors 04 to 07(incl.)	0	0	0		21.JUN.04	-33	-4
SECT04	Shops	0	0	0		21.JUN.04	-30	-4
SECT07	Remaining Residential	0	0	0		04.NOV.04	-33	-4
SECT08	All Others Areas	0	0	0		17.FEB.05	-33	-4



Original plan
Current forecast at end of window
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
Progress Comparison Chart

APPENDIX 5G a

Sheet 3 of 3

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
APARTMENT BLOCK							
SUBSTRUCTURE							
0110	FRC CAPPING BEAM	35	40	21	18.FEB.03A	04.JUN.03	-33
0120	BULK DIG LEAVING SUPPORTING BERMS	74	70	22	25.FEB.03A	02.JUL.03	-33
0240	REMOVE SIDE BERMS AREA 2	4	0	4	11.JUN.03	16.JUN.03	-33
0250	FRC CLOSING SECTIONS OF BASEMENT SLABS AREA 2	6	0	6	16.JUN.03	23.JUN.03	-33
0260	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 2	16	0	16	06.JUN.03	27.JUN.03	-33
0280	FRC UPPER BASEMENT SLAB AREA 2	15	0	15	12.JUN.03	02.JUL.03	-33
0290	RELOCATE TEMPORARY WORKS JIGS 1 & 2	3	0	3	27.JUN.03	01.JUL.03	-33
0300	INSTALL TEMP SUPPORT PROPS GL 1/A-J	22	0	22	02.JUN.03	01.JUL.03	-33
0370	REMOVE BERM	5	0	5	02.JUL.03	08.JUL.03	-33
0380	BREAK BACK FEMALE PILES	4	0	4	07.JUL.03	10.JUL.03	-33
0390	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/A-J	6	0	6	09.JUL.03	16.JUL.03	-33
0400	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	5	0	5	17.JUL.03	23.JUL.03	-33
0410	FRC UPPER BASEMENT SLAB GL 1/A-J	7	0	7	22.JUL.03	30.JUL.03	-33
0470	REMOVE BERM	4	0	4	17.JUN.03	20.JUN.03	-33
0480	BREAK BACK FEMALE PILES	3	0	3	20.JUN.03	24.JUN.03	-33
0490	FRC CLOSING SECTION OF BASEMENT SLAB GL 1/M-R	5	0	5	24.JUN.03	30.JUN.03	-33
0500	FRC WALLS & COLUMNS BASEMENT - UPPER BASEMENT	4	0	4	01.JUL.03	04.JUL.03	-33
0510	FRC UPPER BASEMENT SLAB GL 1/M-R	6	0	6	04.JUL.03	11.JUL.03	-33
0620	FRC Walls/Columns Upper Basement- Ground Floor	40	0	40	30.JUN.03	22.AUG.03	-33
0630	Substructure Residential Complete	0	0	0	26.AUG.03		-33
1230	Substructure Residential Complete	0	0	0	26.AUG.03		-33
ARTS CENTRE							
SUBSTRUCTURE							
0640	Crane Base	5	0	5	15.AUG.03	21.AUG.03	-33
0980	FRC BASEMENT SLAB SECTION 7	10	0	10	19.AUG.03	02.SEP.03	-33
1040	FRC BASEMENT SLAB SECTION 8	10	0	10	01.SEP.03	12.SEP.03	-33
1060	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 7	26	0	26	03.SEP.03	08.OCT.03	-33
1080	FRC UPPER BASEMENT SLAB 7	33	0	33	09.SEP.03	23.OCT.03	-33
1120	FRC WALLS & COLUMNS LOWER -UPPER BAS'NT AREA 8	19	0	19	15.SEP.03	09.OCT.03	-33
1140	FRC UPPER BASEMENT SLAB AREA 8	25	0	25	19.SEP.03	23.OCT.03	-33
1150	INSTALL SUPPORTING PROPS TO PILES ADJ. TO GL 17	7	0	7	15.SEP.03	23.SEP.03	-33

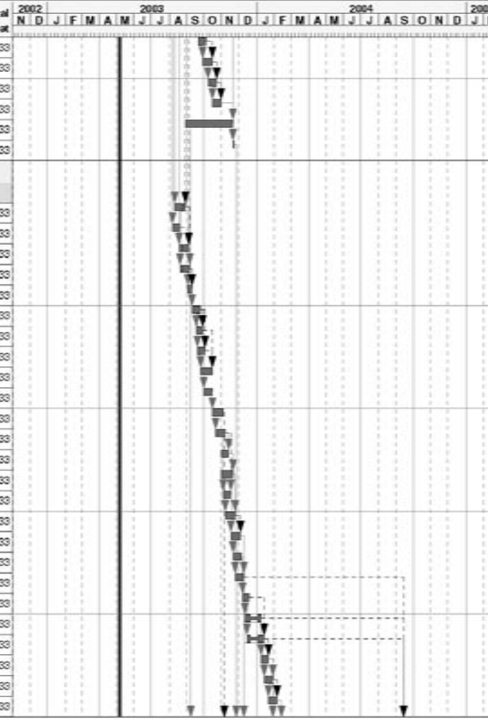
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
The Critical Path

APPENDIX 5G b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1160	REMOVE SUPPORTING BERM	10	0	10	22.SEP.03	03.OCT.03	-33
1170	FRC CLOSING SECTION OF BASEMENT SLAB	12	0	12	30.SEP.03	15.OCT.03	-33
1180	FRC WALLS / COLUMNS LOWER - UPPER BASEMENT	11	0	11	08.OCT.03	22.OCT.03	-33
1190	FRC CLOSING SECTION OF UPPER BASEMENT SLAB	11	0	11	16.OCT.03	30.OCT.03	-33
1210	FRC Columns / Walls Upper Basement - Ground	60	0	60	29.AUG.03	20.NOV.03	-33
1220	Substructure Arts Centre Complete	1	0	1	21.NOV.03	21.NOV.03	-33
APARTMENT BLOCK							
SUPERSTRUCTURE							
1240	FRC GF Slab Incl Part Sect. Of Area 3 GL 1-7/A-H	13	0	13	11.AUG.03	28.AUG.03	-33
1250	FRC Ground Floor Slab Low Level GL 1-7/M-R	10	0	10	07.AUG.03	20.AUG.03	-33
1260	FRC Remaining High Level Section Of GF SLAB	11	0	11	19.AUG.03	03.SEP.03	-33
1270	FRC Walls / Columns Ground - Mezz	11	0	11	21.AUG.03	05.SEP.03	-33
1280	FRC Mezz Floor Grid Lines 1-7/A-D	7	0	7	02.SEP.03	10.SEP.03	-33
1300	FRC Walls / Columns Mezz- 2nd Floor	10	0	10	11.SEP.03	24.SEP.03	-33
1330	FRC 2nd Floor Slab GL 1-7/M-R	8	0	8	18.SEP.03	29.SEP.03	-33
1340	FRC 2nd Floor Slab 1-7/A-F	10	0	10	19.SEP.03	02.OCT.03	-33
1350	FRC Walls/Columns 2nd - 3rd/4th Floor	15	0	15	25.SEP.03	15.OCT.03	-33
1360	FRC 3rd Floor Slab GL 1-7/F-M	11	0	11	01.OCT.03	15.OCT.03	-33
1390	FRC Walls / Columns 3rd - 4th Floor	13	0	13	16.OCT.03	03.NOV.03	-33
1420	FRC 4th Floor Slab GL 1-3/J-R/ + 4-7/L-P	13	0	13	21.OCT.03	06.NOV.03	-33
1440	FRC 4th Floor Slab GL 6-7/M-R	10	0	10	31.OCT.03	13.NOV.03	-33
1450	FRC Walls / Columns 4th - 5th Floor	14	0	14	31.OCT.03	19.NOV.03	-33
1460	FRC 5th Floor Slab GL 1-6/K-R	11	0	11	03.NOV.03	17.NOV.03	-33
1470	FRC 5th Floor Slab GL 1-6/A-K	12	0	12	07.NOV.03	24.NOV.03	-33
1480	FRC Walls/ Columns 5th - 6th Floor	12	0	12	18.NOV.03	03.DEC.03	-33
1490	FRC 6th Floor Slab GL 1-6/K-R	11	0	11	21.NOV.03	05.DEC.03	-33
1500	FRC 6th Floor Slab GL 1-6/A-K	11	0	11	25.NOV.03	09.DEC.03	-33
1510	FRC Walls / Columns 6th - 7th Floor	10	0	10	08.DEC.03	19.DEC.03	-33
1520	FRC 7th Floor Slab GL 1-6/K-R	11	0	11	11.DEC.03	08.JAN.04	-33
1530	FRC 7th Floor Slab GL 1-6/A-K	11	0	11	16.DEC.03	13.JAN.04	-33
1540	FRC Walls/ Columns 7th - 8th Floor	10	0	10	09.JAN.04	22.JAN.04	-33
1550	FRC 8th Floor Slab GL 1-6/K-R	10	0	10	15.JAN.04	28.JAN.04	-33
1560	FRC 8th Floor Slab GL 1-6/A-K	11	0	11	22.JAN.04	05.FEB.04	-33



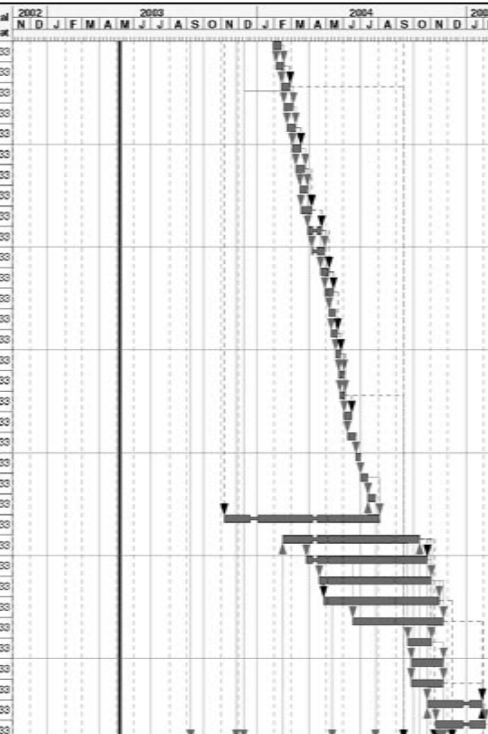
The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
The Critical Path

APPENDIX 5G b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
1570	FRC Walls / Column 8th - 9th Floor	12	0	12	29.JAN.04	13.FEB.04	-33
1580	FRC 9th Floor Slab GL 1-6/K-R	10	0	10	04.FEB.04	17.FEB.04	-33
1590	FRC 9th Floor Slab GL 1-6/A-K	11	0	11	13.FEB.04	27.FEB.04	-33
1600	FRC Walls / Columns 9th - 10th Floor	12	0	12	18.FEB.04	04.MAR.04	-33
1610	FRC 10th Floor Slab GL 1-6/K-R	11	0	11	24.FEB.04	09.MAR.04	-33
1620	FRC 10th Floor SlabGL 1-6/A-K	11	0	11	04.MAR.04	18.MAR.04	-33
1630	FRC Walls / Columns 10th - 11th Floor	12	0	12	10.MAR.04	25.MAR.04	-33
1640	FRC 11th Floor Slab GL 1-6/K-R	11	0	11	16.MAR.04	30.MAR.04	-33
1650	FRC 11th Floor Slab GL 1-6/A-K	12	0	12	19.MAR.04	05.APR.04	-33
1660	FRC Walls / Columns 11th - 12th Floor	12	0	12	31.MAR.04	23.APR.04	-33
1670	FRC 12th Floor Slab GL 1-6/K-R	11	0	11	06.APR.04	28.APR.04	-33
1680	FRC 12th Floor Slab GL 1-6/A-K	11	0	11	21.APR.04	06.MAY.04	-33
1690	FRC Walls / Columns 12th - 13th Floor	11	0	11	29.APR.04	14.MAY.04	-33
1700	FRC 13th Floor Slab GL 1-6/K-R	9	0	9	06.MAY.04	18.MAY.04	-33
1710	FRC 13th Floor Slab GL 1-6/A-K	8	0	8	11.MAY.04	20.MAY.04	-33
1720	FRC Walls / Columns 13th - 14th Floor	7	0	7	19.MAY.04	27.MAY.04	-33
1730	FRC 14th Floor Slab GL 1-6/K-R	7	0	7	24.MAY.04	02.JUN.04	-33
1740	FRC 14th Floor Slab GL 1-6/A-K	7	0	7	26.MAY.04	04.JUN.04	-33
1750	FRC Walls/ Columns 14th - 15th Floor	9	0	9	03.JUN.04	15.JUN.04	-33
1760	FRC 15th Floor Slab GL 1-6/K-R	11	0	11	08.JUN.04	22.JUN.04	-33
1780	FRC Core Walls Level 15-16 GL A-B/2-5	6	0	6	23.JUN.04	30.JUN.04	-33
1790	FRC Core Walls Level 16-Roof GL A-B/2-5	9	0	9	01.JUL.04	13.JUL.04	-33
1800	FRC Cover Slab To Core	9	0	9	14.JUL.04	26.JUL.04	-33
1810	Progressive Erection of Precast Stairs	177	0	177	05.NOV.03	03.AUG.04	-33
1860	Timber Grounds Windows & Doors	162	0	162	16.FEB.04	11.OCT.04	-33
1870	Render Insulation & First Coat	142	0	142	29.MAR.04	25.OCT.04	-33
1880	Terracotta Cladding Frame Work	137	0	137	20.APR.04	01.NOV.04	-33
1890	Metal Cladding	142	0	142	27.APR.04	15.NOV.04	-33
1910	Terracotta Panels	112	0	112	17.JUN.04	22.NOV.04	-33
1950	Penthouse Brise Soleil	30	0	30	21.SEP.04	01.NOV.04	-33
1960	Penthouse Curtain Walling	40	0	40	28.SEP.04	22.NOV.04	-33
1970	Penthouse Roof Cladding/Roof Lights	40	0	40	28.SEP.04	22.NOV.04	-33
1980	Render Final Coat Top Down	59	0	59	26.OCT.04	28.JAN.05	-33
1990	Bolt On Balconies	54	0	54	09.NOV.04	04.FEB.05	-33



The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
The Critical Path

APPENDIX 5G b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2000	Dismatle Scaffolds	59	0	59	15.NOV.04	17.FEB.05	-33
2050	Penthouse Roof Weathered	1	0	1	23.NOV.04	23.NOV.04	-33
2100	Lift Shaft Temporary Weathered	9	0	9	27.JUL.04	06.AUG.04	-33
INTERNAL FINISHES							
1850	Blockwork	181	0	181	09.DEC.03	13.SEP.04	-33
1900	Balcony/Balustrades & Finishes	147	0	147	12.MAY.04	06.DEC.04	-33
2060	Internal Blockwork to Cores	182	0	182	09.FEB.04	01.NOV.04	-33
2070	M & E Services to Cores & Risers	171	0	171	12.MAY.04	21.JAN.05	-33
2080	Staircase Lobbies & Common Areas	171	0	171	12.MAY.04	21.JAN.05	-33
2110	Lift installations	98	0	98	09.AUG.04	23.DEC.04	-33
2120	Final Commision Clean & Snag	58	0	58	16.NOV.04	17.FEB.05	-33
2130	Shell & Core Completion	1	0	1	17.FEB.05	17.FEB.05	-33
2200	Access For Third Fit Out Phase	0	0	0	08.NOV.04		-33
2210	Third Phase Notional Fit Out Period	64	0	64	08.NOV.04	17.FEB.05	-33
ARTS CENTRE							
SUPERSTRUCTURE							
2220	FRC Ground Floor Slab Low Level GL 7-9/A-J	12	0	12	09.SEP.03	24.SEP.03	-33
2230	FRC Ground Floor Slab Low Level GL 7-9/M-R	10	0	10	12.SEP.03	25.SEP.03	-33
2240	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&J	7	0	7	25.SEP.03	03.OCT.03	-33
2250	FRC Ground Floor Slab High Level GL 7-9/J-M	9	0	9	30.SEP.03	10.OCT.03	-33
2260	FRC Ground Floor Slab Low Level GL 9-11/A-K	14	0	14	07.OCT.03	24.OCT.03	-33
2270	FRC Grond Floor Slab Low Level GL 9-11/M-R	10	0	10	10.OCT.03	23.OCT.03	-33
2280	FRC Walls From Low - High Lvl GF Slab GL 7-9/M&K	6	0	6	24.OCT.03	31.OCT.03	-33
2290	FRC Ground Floor Sab High Level GL 9-11/K-M	10	0	10	23.OCT.03	05.NOV.03	-33
2300	FRC Ground Floor Slab Low Level GL 12-15/A-L	15	0	15	06.NOV.03	26.NOV.03	-33
2310	FRC Ground Floor Slab Low Level GL 12-15/L-R	14	0	14	06.NOV.03	25.NOV.03	-33
2320	FRC Walls From Low - High Lvl GF Slab GL 12,14&K	6	0	6	26.NOV.03	03.DEC.03	-33
2330	FRC High Level Slab GL 11-14/A-K	8	0	8	27.NOV.03	08.DEC.03	-33
2340	FRC High Level Slab GL 11-12/K-M	5	0	5	08.DEC.03	12.DEC.03	-33
2350	FRC Ground Floor Slab GL 15-17/F-R	14	0	14	24.NOV.03	11.DEC.03	-33
2360	FRC Walls / Columns Ground - 2nd Floor	57	0	57	29.SEP.03	16.DEC.03	-33
2380	FRC Mezzanine Slab GL 13-17/C-R	11	0	11	17.DEC.03	14.JAN.04	-33
2390	FRC 2nd Floor Slab GL 7-9/A-J	12	0	12	08.OCT.03	23.OCT.03	-33
2420	FRC Remainder Of 2nd Floor Slab	12	0	12	15.JAN.04	30.JAN.04	-33

The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

As Built: as of 4 May.2003
end of WINDOW 5
The Critical Path

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APPENDIX 5G b

Activity ID	Activity Description	Orig Dur	% Comp	Rem Dur	Early Start	Early Finish	Total Float
2430	FRC Walls / Columns 2nd - 3rd Floor	71	0	71	24.OCT.03	13.FEB.04	-33
2440	FRC 3rd Floor Slab GL 7-9/L-R	20	0	20	03.DEC.03	13.JAN.04	-33
2450	FRC 3rd Floor Slab GL 9-14/H-R	17	0	17	13.JAN.04	04.FEB.04	-33
2460	FRC 3rd Floor Slab GL 14-17/F-R	24	0	24	28.JAN.04	01.MAR.04	-33
2510	FRC 4th Floor Slab GL 9-15/F-R	18	0	18	11.FEB.04	05.MAR.04	-33
2570	Concrete Studio Theater Roof	5	0	5	22.MAR.04	26.MAR.04	-33
2620	Steelwork & Decking Level 4	10	0	10	08.MAR.04	19.MAR.04	-33
2830	Roofing Roof Finishes Lvl 4 & 5	61	0	61	05.MAR.04	09.JUN.04	-33
2880	Rooflights Fitness Centre	15	0	15	29.MAR.04	26.APR.04	-33
3060	Barriers/Markings	40	0	40	10.DEC.04	17.FEB.05	-33
3110	Barriers & Marking	20	0	20	21.JAN.05	17.FEB.05	-33
INTERNAL FINISHES							
2940	Blockwork Partitions/Builders Work	100	0	100	15.MAR.04	11.AUG.04	-33
2960	Service Installations/Commission	186	0	186	18.MAY.04	17.FEB.05	-33
2980	Specialist Fit Out Works	153	0	153	05.JUL.04	17.FEB.05	-33
3050	Walls/Finishes & S	49	0	49	01.NOV.04	20.JAN.05	-33
3070	Office Area Fit Out	99	0	99	20.SEP.04	17.FEB.05	-33
3080	Remaining Retail Areas	1	0	1	17.FEB.05	17.FEB.05	-33
3100	Finishes & Service	79	0	79	20.SEP.04	20.JAN.05	-33
EXTERNAL WORKS							
3140	External Pavings Remainder (By Others)	30	0	30	24.DEC.04	17.FEB.05	-33
SECTIONAL COMPLETIONS							
SECT08	All Others Areas	0	0	0		17.FEB.05	-33

The critical path
Progress Bar
Critical Activity

MIXED-USE DEVELOPMENT

**As Built: as of 4 May.2003
end of WINDOW 5
The Critical Path**

APPENDIX 5G b

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