# CONSTRUCTION DELAY ANALYSIS SIMPLIFIED

A Step-by-Step Guide for the Analysis and Formulation of Delay Claims

# CONSTRUCTION DELAY ANALYSIS & EXTENSION OF TIME

## 6.1. If work is delayed due to two or more competing causes of delay, often referred to as concurrent delays, one of which is the responsibility of the contractor/subcontractor or a neutral event and the other is a result of some fault of the architect, engineer or employer, is there an entitlement to an extension of time and loss and expense?

**6.1.1.** Delays can be excusable delays, which may be either due to fault by the employer or his agents, such as late access, or delay in issuing drawings, or on the other hand delays due to a neutral event, such as excessively adverse weather or *force majeure*. Inexcusable delays are those which are due to fault on the part of the contractor or his agents. When it occurs, the contractor is usually entitled to an extension of time when delay to completion is caused by an excusable delay, but not when the delay is inexcusable.

**6.1.2.** Most of the standard forms of contract provide for financial recovery in addition to an extension of time, where events stated in the contract occur which give rise to additional cost: for example, late issue of instructions from the architect under a JCT contract. A great amount of confusion and muddled thinking has been experienced by judges in trying to unravel the effect in terms of additional time and cost entitlements under the standard forms of contract where concurrent delays have occurred. Does 'concurrent' refer to delays which start and finish on the same dates, or does it provide for some element of overlap? Do different rules apply in respect of extension of time entitlements from additional cost claims which arise from concurrent delays? These sort of questions have been examined in some detail by the courts in attempting to ascertain the entitlement of the parties where concurrent delays occur. Decisions of the judges as to what constitutes a concurrent delay have not been consistent.

**6.1.3.** Lord Osborne, in the case of *City Inn Ltd* v. *Shepherd Construction* (2010), offered the following advice as to what constitute concurrent delays, which he considered could apply to any of the following:

- The delays occur in a way in which they have common features.
- The delays share a common start and finish date.

*200 Contractual Problems and their Solutions*, Third Edition. Roger Knowles.

- The delays share either a common start or finish date.
- For a part of the time, the delays overlap.

**6.1.4.** The case of *Wells* v. *Army and Navy Co-operative Society* (1903) is an early case which provides assistance relating to concurrent delays, where the judge stated:

> . . . the fact that delay has been caused by matters for which the contractor is responsible will not deprive the contractor of his right to claim an extension of time for delay caused by a relevant event.

*Peak Construction (Liverpool) Ltd* v. *McKinney Foundations Ltd* (1976) was a helpful decision, in that judge Salmon LJ was of the view that an extension of time should be available in cases where delay has been caused partly by the fault of the contractor and partly by the fault of the employer.

**6.1.5.** Judge Dyson, in the case of *Henry Boot Construction (UK) Ltd* v. *Malmaison Hotel (Manchester) Ltd* (1999), was even more generous to contractors when, without dissent, he included the following matters which had, surprisingly, been agreed by both parties:

> . . . it was 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 delays 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 a 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 work 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. He cannot refuse to do so, on the grounds that the delay would have occurred in any event by reason of the shortage of labour.

**6.1.6.** Arguments as to a contractor's or subcontractor's entitlements where two competing causes of delay occur which affect the completion date have been addressed in *Keating on Building Contracts*, 6th edition, which suggests that the law is unclear on this matter, but has offered assistance at 8.015 by suggesting as a solution:

> Where a contractor claims payment under the contract, e.g. for delay resulting from variation instructions and there is a competing cause of delay. The competing cause of delay could be . . . no one's fault e.g. bad weather or . . . the contractor's own delay in breach of contract.
>
> the claimant succeeds . . . if he establishes that the cause on which he relies, was the effective dominant cause of delay.

Keating goes on to state, in 8.018, that there is authority – of varying weights – for a number of disjointed propositions, which include:

> The Devlin approach: 'If a breach of contract is one of two causes of a loss, both causes co-operating and both of approximately equal efficacy, the breach is sufficient to carry judgment for the loss.

This would apply where, for example, there were two competing causes of delay which entitled a contractor to an extension of time, one a neutral event, such as excessively adverse weather, and the other being a breach such as late issue of instructions by the architect. Following the Devlin approach, the contractor would be entitled to extra time and loss and expense due to the late issue of instructions.

> The dominant cause approach: 'If there are two causes, one the contractual responsibility of the defendant and the other the contractual responsibility of the plaintiff, the plaintiff succeeds if he establishes that the cause for which the defendant is responsible is the effective, dominant cause.

Which cause is dominant is a question of fact, which is not solved by the mere point of order in time, but is to be decided by applying commonsense standards. In the case of *H Fairweather and Co Ltd* v. *London Borough of Wandsworth* (1987), 'dominant' was said to have a number of meanings, such as 'ruling, prevailing and most influential'.

> The burden of proof approach: 'If part of the damages is shown to be due to a breach of contract by the plaintiff, the claimant must show how much of the damage is caused otherwise than by his breach of contract, failing which he can recover nominal damages only.

An example would be a delay caused by the contractor having to correct defective work, occurring at the same time as a delay caused by the employer. To succeed, the contractor would have to demonstrate that his losses were due to the employer's actions and not his own.

**6.1.7.** The 'dominant cause of delay' theory was rejected by the court in the case of *H Fairweather & Co Ltd* v. *London Borough of Wandsworth* (1987). H Fairweather and Co Ltd were the main contractors for the erection of 478 dwellings for the London Borough of Wandsworth, employing JCT 63 conditions. Long delays occurred and liability for those delays was referred to arbitration. With regard to the delays the architect granted an extension of time of 81 weeks under clause 23(d), by reason of strikes and combination of workmen. The *quantum* of extension was not challenged, but Fairweather contended before the arbitrator that 18 of those 81 weeks should be reallocated under clause 23(e) or (f). The reasoning behind the contention was that only if there was such a reallocation could Fairweather ever recover direct loss and expense under clause 11(6) in respect of those weeks reallocated to clause 23(e), or clause 24(1)(a) in respect of those weeks reallocated to clause 23(f). The arbitrator's reasoning is to be found in sections 6.11 and 6.12 of his interim award, which state as follows:

> 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 the events of this contract, nobody would say that the delays which occurred in 1978 and 1979 were caused by reason of the Architect's instructions given in 1975 to 1977. 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).

In a later paragraph of his award, paragraph 6.14, the arbitrator declared:

> 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. The judge in the case disagreed with the arbitrator's ruling that the extension of time should relate to the dominant cause of delay. He 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.

He went on to say:

> The arbitrator erred in law in his award in relation to the strikes in holding… that as between the various heads under clause 23 pursuant to which an extension of time may be granted, the extension should be granted in respect of the dominant reason, whereas he should have held that where the reasons for delay correspond with more than one head, the extension may be granted under either or both heads.

This decision is in contrast to Keating's 'Dominant Cause' theory.

**6.1.8.** The dominant cause approach, however, received the following support in *Leyland Shipping* v. *Norwich Union* (1918).

> Which cause is dominant is a question of fact which is not solved by mere point of order in time, but is to be decided applying common sense standards.

**6.1.9.** Where an employer delays the contractor, he will not be entitled to deduct liquidated damages, even though the contractor is also in default: *Wells* v. *Army & Navy Co-operative Society* (1903). However, just because the employer is prevented from deducting liquidating damages in respect of a delay because of the concurrency of delays does not mean the contractor is entitled to recover financial loss. With this in mind, Keith Pickavance, in the second edition of his book *Delay and Disruption in Construction Contracts*, at p. 352, states:

> Lastly, and this is a legal conceptual problem, the rules which apply to recovery of actual damages for delay are not the same rules that apply to the relief of liquidated damages for delay. If C's progress on the critical path has been interfered with by D's act of prevention, then

> C must be given sufficient time to accommodate the effects of that and be relieved for LADs [liquidated and ascertained damages] for a commensurate period.
>
> On the other hand if, during the period of disruption to progress or prolongation for which an EOT [extension of time] has been granted, the predominant cause of C's loss and expense is disruption, or prolongation caused by a neutral event or his own malfeasance (for which he bears the risk), then he will not be able to recover damages for the compensable event unless he can separate those costs flowing from the compensable event from those costs which are at his own risk.

In other words, if two delays are running in parallel, one cause being the contractor's default and the other a breach by the employer, an extension of time should be awarded to the contractor, but no monetary reimbursement.

**6.1.10.** A simplistic approach sometimes taken is the 'first past the post' approach. This adopts the logic that, where delays are running in parallel, the cause of delay which occurs first in terms of time will be used for adjustment of the contract period. Other causes of delay will be ignored unless they affect the completion date and continue on after the first cause has ceased to have any delaying affect. In this case only the latter part of that second cause of delay will be relevant to the calculation of an extension of time. For example, delays may run in parallel because of the late issue of drawings and inclement weather. If the late issue of drawings causes a delay commencing on 1 February and inclement weather makes work impossible from 14 February, the late issue of drawings is the 'first past the post' and will take precedence over inclement weather until the drawings are issued. If drawings are issued on 21 February, but the inclement weather continues until 28 February, the contract completion date will be adjusted in respect of weather for the latter period.

The Australian Building Works Contract, JCC-E 1994, published by the Joint Contracts Committee, under clause 10.11, 'Predominant Causes of Delay', applies the 'first past the post' approach to delays caused by the proprietor's default.

**6.1.11.** It has been suggested that, when delays are concurrent, some form of apportionment may be appropriate. The matter of allocating or apportionment was referred to in *Keating on Building Contracts*, 6th edition, p. 213:

> Where the loss or damage suffered by the plaintiff results partly from his own conduct and partly from the defendant's breach of contract, it is correct in principle for the damages to be apportioned.

This seems to be at variance with Keating's own 'burden of proof' approach, referred to above. In the case of *Tennant Radiant Heat Ltd* v. *Warrington Development Corporation* (1987), a warehouse roof collapsed because of an accumulation of rainwater, due to blocked outlets. The landlord had a liability for damages and the tenant the responsibility for repair, both of which could have caused the collapse. The court, under the circumstances, apportioned the loss between both of the matters which could have contributed to the cause of the collapse. Lord Justice Dillon explained the rationale as follows:

> The problem which this court faces, on the claim and counterclaim alike, is in my judgment a problem of causation of damages. On the claim, the question is how far the damage to its goods which the lessee has suffered was caused by the corporation's negligence, notwithstanding the lessee's own breach of covenant. On the counterclaim, the question is how far the damage to the corporation's building which the corporation has suffered was caused by the lessee's breach of covenant, notwithstanding the corporation's own negligence. The effect is that on each question, apportionment is permissible.

**6.1.12.** In the case of *John Doyle Ltd* v. *Laing Management (Scotland) Ltd* (2004) the court had another opportunity of giving its opinions concerning concurrent delays. It seemed to favour the 'dominant cause' approach. However, if the dominant cause approach could not be applied, then it considered apportionment might be appropriate. The court, in explaining the significance of dominant cause and apportionment, stated as follows:

> '[14] . . . it may be possible to identify a causal link between particular events for which the employer is responsible and individual items of loss. On occasion that may be possible, where it can be established that a group of events, for which the employer is responsible, are causally linked with a group of heads of loss, provided that the loss has no other significant cause. In determining what is a significant cause, the 'dominant cause' approach described in the following paragraph is of relevance. Determining a causal link between particular events and particular heads of loss may be of particular importance, where the loss results from mere delay, as against disruption; in cases of mere delay such losses as the need to maintain the site establishment for an extended time can often readily be attributed to particular events, such as the late provision of information or design changes . . .
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> [15] . . . the question of causation must be treated by the application of common sense to the logical principles of causation . . . In this connection, it is frequently possible to say that an item of loss has been caused by a particular event notwithstanding that other events played a part in its occurrence. In such cases, if an event or events for which the employer is responsible can be described as the dominant cause of an item of loss, that will be sufficient to establish liability, notwithstanding the existence of other causes that are to some degree at least concurrent. . . .
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> [16] . . . even if it cannot be said that events for which the employer is responsible are the dominant cause of the loss, it may be possible to apportion the loss between the cause for which the employer is responsible and other causes. In such a case it is obviously necessary that the event or events for which the employer is responsible should be a material cause of the loss. Provided that condition is met, however, we are of the opinion that apportionment of loss between the different causes is possible in an appropriate case. Such a procedure may be appropriate in the case where the causes of the loss are truly concurrent, in the sense that both operate together at the same time to produce a single consequence.

**6.1.13.** The decision in the case of *City Inn* v. *Shepherd Construction* (2010) seems to approve of both the dominant cause and apportionment methods, where Lord Osborne stated:

> In the fourth place, if a dominant cause can be identified as the cause of some particular delay in the completion of the works, effect will be given to that, but leaving out of account any cause

> or causes which are not material. Depending on whether or not the dominant cause is a relevant event, the claim for extension of time will or will not succeed.
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> In the fifth place, where a situation exists in which two causes are operative, one being a relevant event and the other some event for which the contractor is to be taken to be responsible and neither of which could be described as the dominant cause, the claim for extension of time will not necessarily fail. In such a situation, which could as a matter of language, be described as one of concurrent causes, in a broad sense… it will be open to the decision maker, whether the architect, or other tribunal, approaching the issue in a fair and reasonable way, to apportion the delay in the completion of the works occasioned thereby as between the relevant event and the other event.

**6.1.14.** A 'but for' test has been developed, which can be advantageous to contractors. The argument often runs that 'but for' the architect's instruction, the delay would not have occurred. In the Australian case of *Quinn* v. *Burch Brooks (Builders) Ltd* (1966), auditors failed to identify that a company was in a substantial loss position. It was argued that, but for the auditor's errors, the loss-making company would have ceased trading and subsequent trading losses would therefore have been avoided. In the UK case of *Turner Page Music Ltd* v. *Torres Design Associates Ltd* (1997) an action was brought against an architect for negligence, when there was a severe financial overrun on a construction project. The employer subsequently sold the building and alleged that, but for the architect's negligence, the sale would not have been necessary. The courts in both cases, however, rejected the 'but for' argument.

**6.1.15.** The Society of Construction Law Delay and Disruption Protocol 2002 presents a view which is similar to the 'burden of proof approach' referred to in 3.5.2, when it states:

> 1.10.4 Where an Employer Risk Event and a Contractor Risk Event have concurrent effect, the Contractor may not recover compensation in respect of the Employer Risk Event unless it can separate the loss and/or expense that flows from the Employer Risk Event from that which flows from the Contractor Risk Event. 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. In most cases this will mean that the Contractor will be entitled to compensation only for any period by which the Employer Delay exceeds the duration of the Contractor Delay.
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> 1.10.5 The loss and/or expense flowing from an Employer Delay cannot usually be distinguished from that flowing from Contractor Delay without the following:
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> 1.10.5.1 an as-planned programme showing how the Contractor reasonably intended to carry out the work and the as-planned critical path;
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> 1.10.5.2 an as-built programme demonstrating the work and sequence actually carried out and the as-built critical path;
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> 1.10.5.3 the identification of activities and periods of time that were not part of the original scope;
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> 1.10.5.4 the identification of those activities and periods of time that were not part of the original scope and that are also at the Contractor's risk as to cost; and
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> 1.10.5.5 the identification of costs attributable to the two preceding sub-sections.

periods of delay against the nine delaying matters. By way of justification, the arbitrator, in his findings, said:

> The result, in terms of delay and disorganisation, of each of the matters referred to above was a continuing one. As each matter occurred its consequences were added to the cumulative consequences of the matters which had preceded it. The delay and disorganisation which ultimately resulted was cumulative and attributable to the combined effect of all these matters. It is therefore impracticable, if not impossible, to assess the additional expense caused by delay and disorganisation due to any one of these matters in isolation from the other matters.

The respondent contested that the arbitrator was wrong in providing a lump-sum delay of 31 weeks, without giving individual amounts in respect of each head of claim. Mr Justice Donaldson, however, agreed with the arbitrator, saying:

> I can see no reason why he (the arbitrator) should not recognise the realities of the situation and make individual awards in respect of those parts of individual items of claim which can be dealt with in isolation and a supplementary award in respect of the remainder of these claims as a composite whole.

A similar award occurred in *London Borough of Merton* v. *Stanley Hugh Leach* (1985), where Mr Justice Vinelott said:

> The loss or expense attributable to each head of claim cannot in reality be separated.

**6.2.3.** This type of claim is now referred to as a 'global' or 'rolled up' claim. These decisions were thrown into question by *Wharf Properties Ltd and Another* v. *Eric Cumine Associates and Others* (1991). In this case the plaintiff made no attempt to link the cause with the effect in respect of a claim by the employer against his architect for failure properly to manage, control, co-ordinate, supervise and administer the work of the contractors and subcontractors, as a result of which the project was delayed. Six specific periods of delay were involved, but the statement of claim did not show how they were caused by the defendant's breaches. The plaintiff pleaded that, because of the complexity of the project, the interrelationship and very large number of delaying and disruptive factors and their inevitable knock-on effects and so on, it was impossible at the pleadings stage to identify and isolate individual delays in the manner the defendant required and that this would not be known until the trial. The defendant succeeded in an application to strike out the statement of claim. The Court of Appeal in Hong Kong decided that the pleadings were hopelessly embarrassing as they stood (some seven years after the action began) and an unparticularised pleading in such a form should not be allowed to stand. The matter was, nevertheless, referred to the Privy Council in view of the apparently differing view taken by the courts in *Crosby* and *London Borough of Merton*. The Privy Council, however, rejected the assertion that these two decisions justified an unparticularised pleading. Lord Oliver said:

> Those cases establish no more than this, that in cases where the full extent of extra cost incurred through delay depend upon a complex interaction between the consequence of various events,

This advice, however, only applies to financial reimbursement of additional costs resulting from delays.

**SUMMARY**

There is no hard and fast rule concerning which delay takes precedence, where concurrent delays are affecting the completion date. The courts have been inconsistent with regard to this matter. There is judicial approval for stating that when one delay is the responsibility of the employer and the other the contractor's fault or a neutral event, the contractor becomes entitled to an extension of time, but not necessarily additional cost. There is support for the dominant cause of delay to be the subject of an extension of time, whilst apportionment has met with some success. The 'first past the post' and the 'burden of proof' approach also have their supporters.

Each case has to be judged on its own merits, when judgments concerning extensions of time are decided. One rule which is not the subject of disagreement is that the architect, engineer or other person responsible for making extension of time decisions must act in a fair and reasonable manner.

## 6.2. Will a claim for an extension of time and the recovery of loss and expense which does not precisely detail the period of delay and the amount claimed in respect of each claim matter causing delay (i.e. a failure to link cause and effect), sometimes referred to as a global claim, fail?

**6.2.1.** The proper manner of presenting a claim before a court or arbitrator is to link the cause of delay and extra cost with the effect. For example, if the architect or engineer is six weeks late in issuing the drawings for the foundations (cause), the date for completion of the work may, as a consequence, be delayed by six weeks (effect). In recent times, contractors and subcontractors have been ever willing to shortcut the need to link cause and effect by the use of the global claim. All causes of delay and additional cost under the 'global claim' method, are lumped together and one overall delay and monetary claim given as a consequence. The usual requirement to link each cause of delay and monetary claim with the effect is ignored. The preparation of claims on a global basis has been the subject of considerable controversy for a number of years. Cost savings can arise because of not having to retain copious records, analyse them meticulously and spend time on research. It is, however, a difficult and developing area of law, the subject of a great deal of court scrutiny.

**6.2.2.** In support of the global claim, contractors and subcontractors draw comfort from the dicta in a number of legal cases. In *J. Crosby & Sons Ltd* v. *Portland Urban & District Council* (1967), the contract overran by 46 weeks. The arbitrator held that the contractor was entitled to compensation in respect of 31 weeks of the overall delay, and he awarded the contractor a lump sum by way of compensation, rather than giving individual

> so that it may be difficult to make an accurate apportionment of the total extra costs, it may be proper for an arbitrator to make individual financial awards in respect of claims which can conveniently be dealt with in isolation and a supplementary award in respect of the financial consequences of the remainder as a composite whole. This has, however, no bearing upon the obligations of a plaintiff to plead his case with such particularity as is sufficient to alert the opposite party to the case which is going to be made against him at the trial. [The defendants] are concerned at this stage not so much with quantification of the financial consequences – the point with which the two cases referred to were concerned – but with the specification of the factual consequences of the breaches pleaded in terms of periods of delay. The failure even to attempt to specify any discernible nexus between the wrong alleged and the consequent delay provides, to use [counsel's] phrase 'no agenda' for the trial.

**6.2.4.** The editors of *Building Law Reports*, vol. 52, at p. 6 say, by way of observation:

> It must therefore follow from the decision of the Privy Council in *Wharf Properties* v. *Eric Cumine Associates* that *Crosby* and *Merton* are to be confined to matters of *quantum* and then only where it is impossible and impracticable to trace the loss back to the event. The two cases are not authority for the proposition that a claimant can avoid providing a proper factual description of the consequences of the various events upon which reliance is placed before attempting to quantify what those consequences were to him. Thus, taking the example before the Privy Council, it seems that it will in future be necessary for a plaintiff to be quite specific as to the delay which it is alleged was caused by an event such as a breach of contract, or an instruction giving rise to a variation. This in turn will mean that those responsible for the preparation and presentation of claims of this kind will need to work hard with those who have first-hand knowledge of the events, so as to provide an adequate description of them. Equally, it will mean that proper records will need to be kept, or good use will have to be made of existing records to provide the necessary detail. It will no longer be possible to call in an outsider who will simply list all the possible causes of complaint and then by use of a series of chosen 'weasel' words try to avoid having to give details of the consequences of those events before proceeding to show how great the hole was in the pocket of the claimant. There must be, as the Privy Council points out an 'agenda' for the trial: there must be a discernible connection between the wrong and, where delays are relied on, the consequent delay.

**6.2.5.** The Scott Schedule was originally designed to set out relevant points concerning defects in a manner which would easily be digested. It can, however, be adapted to suit any particular form of dispute, where a great many disputed facts are involved. In the case of *Imperial Chemical Industries* v. *Bovis Construction Ltd and Others* (1992), Judge Fox-Andrews QC ordered the plaintiff to serve a Scott Schedule containing:

- the alleged complaint;
- the defendant against whom the claim was made;
- which clause in the contract had been breached; and
- alleged failure consequences of such breach.

The Scott Schedule is not, however, a formula that can be applied to every case.

**6.2.6.** The whole subject came under review by the Court of Appeal in *GMTC Tools & Equipment Ltd* v. *Yuasa Warwick Machinery Ltd* (1994). This case, relating to a defective

computer-controlled precision lathe (to be used in the manufacture of blanks, which in turn were machined to become rotary cutters), had nothing to do with construction work, but nonetheless the principles on which the decision was made will apply. The lathe did not operate as intended and the plaintiff prepared and submitted a claim based on the number of management hours involved in dealing with the problem and the number of hours during which the lathe was inoperable. Difficulties arose when the defendants sought further and better particulars of the claim. The judge ordered that a Scott Schedule should be drawn up providing detailed information attempting to link the cause (the malfunctioning of the lathe, which caused down time) with its effect (the wasted management hours and the purchase of blanks to replace lost production). Following attempts to re-amend the Scott Schedule, the matter came before the Court of Appeal after the plaintiff's failure to comply with an Unless Order.

The Court of Appeal was sympathetic to the plaintiff's situation. Lord Justice Leggatt said the defendant's argument presupposed that the plaintiff's production process was so flexible and instantaneously reactive to a period of down time that it would be possible to link each incident of down time with the purchase of a precise number of blanks to replace lost production. The opinions of the defendant were not accepted. It was the view of Lord Justice Leggatt that a judge is not entitled to prescribe the way in which the *quantum* of damage is pleaded and proved. No judge, he said, is entitled to require a party to establish causation and loss by a particular method. Lord Justice Leggatt, by way of conclusion, said:

> I have come to the clear conclusion that the plaintiff should be permitted to formulate their claims for damages as they wish, and not be forced into a strait-jacket of the judge's or their opponent's choosing.

**6.2.7.** A further review of global claims occurred in *British Airways Pension Trustees Ltd* v. *Sir Robert McAlpine & Sons* (1994), where a dispute arose out of the development of a site in Croydon. There were defects in the work alleged to be due to faults by the architect, the contractor and others involved in the construction of the project and it was argued that the diminution in value of the property because of the defects was £3.1 m, which formed the basis of the claim, plus the cost of investigating the defects. The defendants requested that further and better particulars be provided in respect of the claim. They asked to be given detailed information as to how much of the diminution in the value of the property could be attributed to each and every defect. For example, if two windows were defective, how did it affect the price paid for the property? They justified this type of question by asserting that until such details are given, the defendant does not know the case to be answered and so faces an unfair hearing. On behalf of the plaintiff, it was argued that all the defects had been identified and therefore, due to their existence, the project was worth £3.1 m less than it would have been without the default. An application was made by the defendants to strike out the claim and dismiss the action, as they had been seriously prejudiced through a failure on the part of the plaintiffs properly to particularise their claim. Judge Fox-Andrews ordered that the claim be struck out and the action dismissed. However, this decision was overruled by the Court of Appeal; Lord Justice Saville in summing up said:

> The basic purpose of pleadings is to enable the opposing party to know what case is being made in sufficient detail to enable that party properly to answer it. To my mind, it seems that, in recent years, there has been a tendency to forget this basic purpose and to seek particularisation even when it is not really required. This is not only costly in itself, but is calculated to lead to delay and to interlocutory battles in which the parties and the courts pore over endless pages of pleadings to see whether or not some particular points have or have not been raised or answered, when in truth each party knows perfectly well what case is made by the other and is able properly to prepare to deal with it. Pleadings are not a game to be played at the expense of citizens nor an end in themselves, but a means to the end, and that end is to give each party a fair hearing.

This attitude is a precursor of the sweeping Woolf reforms which, from April 1999, rewrote the court procedural rules to give judges a much more proactive role in the management of cases and cut down interlocutory delaying tactics of the type described by Lord Justice Saville.

**6.2.8.** From the decision in *Amec Building Ltd* v. *Cadmus Investment Co Ltd* (1996), it seems that courts in the future will judge each case on its merits, without laying down principles as to whether global claims will or will not be accepted. In this case, the judge's remarks as to the arbitrator's approach to global claims seem relevant:

> Certainly, it seems to me that there is no substance in the complaint that the arbitrator had set his face against global claims and that, thereby, prejudiced Amec. What appears to have happened, is that, upon justifiable complaint of lack of particularity, the arbitrator insisted upon an allocation of the overall claim to particular heads which was attempted by Amec and, when these matters were investigated by the accountants and in evidence and cross-examination, it clearly became quite clear to the arbitrator that there were occasions of duplications, matters compensated elsewhere and a general lack of particularisation. In those circumstances, it seems to be what the arbitrator concluded was that the plaintiff had not proved the costs incurred were due to the fault by Cadmus. . . . As is clear from the careful judgment of the arbitrator, he proceeded to analyse each of the claims made by Amec and decided each upon the evidence that was before him.

**6.2.9.** In *Inserco Ltd* v. *Honeywell Control Systems* (1996), the court made an award based upon a global claim. The judge's comments make interesting reading:

> Inserco's pleaded case provided sufficient agenda for the trial and the issues are about quantification. Both *Crosby* [*Crosby* v. *Portland Urban District Council* (1977)] and *Merton* [*London Borough of Merton* v. *Stanley Hugh Leach* (1985)] concerned the application of contractual clauses. However, I see no reason in principle why I should not follow the same approach in the assessment of the amounts to which Inserco may be entitled. There is here, as in *Crosby*, an extremely complex interaction between the consequences of the various breaches, variations and additional works and, in my judgement, it is 'impossible to make an accurate apportionment of the total extra cost between the several causative events'. I do not think that even an artificial apportionment could be made – it would certainly be extremely contrived – even in relation to the few occasions where figures could be put on time etc. . . . It is not possible to disentangle the various elements of Inserco's claims from each other. In my view, the cases show that it is legitimate to make a global award of a sum of money in the circumstances of

> this somewhat unusual case, which will encompass the total costs recoverable under the February agreement, the effect of the various breaches which would be recoverable as damages, or which entitle Inserco to have their total cost assessed, to take account of such circumstances, and the reasonable value of the additional works similarly so assessed.

**6.2.10.** In *How Engineering Services Ltd* v. *Linder Ceilings and Partitions plc* (1999) the arbitrator, Mr Jupp, awarded a sum in respect of loss and expense based upon a global assessment. The dispute arose out of two contracts, the Atrium and the Station. In finding for the claimant, the arbitrator accepted the claimant's costs as set out in the points of claim and arrived at a figure of £130,346. From this he deducted £4,186 in respect of work carried out prior to the receipt of the notice, £32,611 in respect of realignment of ceilings, which was treated as a variation order, and £3,155 for remedial work. The award was thus based on a total cost claim calculated on a global basis, against which the defendant appealed on the basis that the arbitrator had not ascertained the sum as required by the arbitration clause. It was the view of the court that, in some cases, the facts are not always clear. Different tribunals would reach different conclusions and an arbitrator is entitled to assess loss and expense in the same way as a court assessing damages. The court upheld the arbitrator's award.

**6.2.11.** In the case of *Berhards Rugby Landscapes Ltd* v. *Stockley Park Consortium* (1997), the plaintiff landscape contractor entered into an agreement under seal with Trust Securities Holdings (TSH) for the construction of a golf course on a landfill site, under a contract which incorporated the ICE 5th Edition conditions. The work was subject to delay, and detailed and lengthy claims were submitted. It was alleged by the defendant that the claims were bound to fail because of a number of reasons, one of which was that they contained global delay claims for variations. It was held by the court that the global claim was a total cost claim. The plaintiff had quantified its alleged loss by subtracting the expected cost of the works from the final costs. Such a claim was permissible, if it was impractical to disentangle that part of the loss attributable to each head of claim and the situation had not been caused by the plaintiff's conduct. In such circumstances, the inference was that the employer's breaches had led to additional costs and that the cause nexus was to be inferred rather than demonstrated.

**6.2.12.** The case of *John Doyle Construction Ltd* v. *Laing Management (Scotland) Ltd* (2004) was heard in the Scottish Inner House, Court of Session, and dealt with whether, in principle, global claims were bound to fail. Laing Management was the management contractor for the construction of a new corporate headquarters for Scottish Widows in Edinburgh. A number of works packages were contracted out to John Doyle. An action was brought by John Doyle, seeking an extension of time of 22 weeks, together with loss and expense. John Doyle admitted that, despite their best efforts, it was impossible to identify cause and effect in respect of each item which caused delay and disruption and that was why the claim had been prepared on a global basis. It was argued on behalf of Laing that the basis of the global claim was that all the additional costs incurred by John Doyle resulted from the delay and disruption caused by Laing. This being the case, if one of the events relied upon by Doyle was shown not to have been caused by Laing, then the case would be undermined. The judge was sympathetic to this view when he said:

> . . . if a global claim is to succeed, whether it is a total cost claim or not the contractor must eliminate from the causes of his loss and expense all matters that are not the responsibility of the employer.

The judge felt, however, that the whole matter should be treated with common sense. He considered global claims to be a risky business, but nonetheless allowed proceedings to continue.

**6.2.13.** It is often argued by contractors that a requirement for strict particularisation places upon them a heavy evidential burden, which defendants know is difficult if not impossible to produce. Defendants in so doing are therefore seeking to profit from their own wrongs. The response by Judge Wilcox in the case of *Skanska Construction UK Ltd* v. *Eggar (Barony) Ltd* (2004) to this assertion was:

> Whilst it is unattractive that the party who has created the difficulty should be its beneficiary, nonetheless the evidential burden upon the claimant to adequately prove its case should not be diluted. The logic of a global claim demands that all events which contribute to causing the global loss are events for which the defendant is liable. If causal events include events for which the defendant bears no liability, the effect of upholding a global claim is to impose on the defendant a liability in part not legally his.

**6.2.14.** It is not unknown for contractors to submit a claim based upon the total costs for the project, sometimes referred to as a total cost claim. This occurred in the case of *Petromec Inc* v. *Petroleo Brasileiro SA* (2007), where the claimant was contracted to construct an oil rig. Because of a change in specification, the claimant submitted a claim being the difference between the total cost of constructing the rig to the new specification, less what the cost would have been if there had been no specification change. The court held that it was necessary to demonstrate that the costs were reasonable; it was not sufficient merely to assert what costs had been incurred; and therefore the claim failed. It is usually unwise to submit a claim based upon the total cost of the project. A claim submitted in this manner assumes that there was no loss due to underpricing, correcting poor workmanship, or general inefficiency. Most involved in the construction industry would consider that a situation such as this rarely arises.

**6.2.15.** The case of *London Underground Ltd* v. *Citylink* (2007) is another example of a global claim which finished up in court. The claim was rejected by both the adjudicator and the arbitrator. It was the court's view that a tribunal could accept a lesser claim, but only if the surviving claim was implicit in the case and it was fair to do so without seeking further submissions.

**6.2.16.** The Society of Construction Law Delay and Disruption Protocol 2002 provides the following view concerning global claims:

> 1.14.1 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.
>
> 1.14.2 If the Contractor has made and maintained accurate and complete records, the Contractor should be able to establish the causal link between the Employer Risk Event and the resultant loss and/or expense suffered, without the need to make a global claim.

1.14.3 In what should only be rare cases where the financial consequences of the various causes of compensation are impossible to distinguish, so that an accurate apportionment of the compensation claimed cannot be made between the several causative events, then in this rare situation it is acceptable to quantify individually those items of the claim which can be dealt with in isolation and claim compensation for the remainder as a composite whole.

1.14.4 The Contractor will nevertheless need to set out the details of the Employer Risk events relied on and the compensation claimed with sufficient particularity so that the employer knows the case that is being made against it.

**SUMMARY**

The complexity of contemporary claims sometimes needs to be dealt with by a 'global' approach, but this is not a *carte blanche* for the plaintiffs to put in any figure. Detail needs to be provided where it is available and the contractor can be asked and/or ordered to produce information in a specific form, e.g. a Scott Schedule. However, demands for particulars are not to be used as a delaying tactic or as an end in themselves. Will a claim which fails to link cause and effect, fail? The answer must be that it depends upon the circumstances. It is unlikely, however, that the claim will be rejected entirely by the courts merely on the grounds that it has been prepared on a global basis. It must be demonstrated, however, that the items which form the basis of the global claim cannot be separated one from another. The claimant must ensure that problems of the claimant's own making are eliminated from the claim. A total cost claim which is based upon the total cost of the project is likely to fail, as it ignores any element of under-pricing, cost of correcting poor workmanship, or general inefficiencies. Finally, the rules of common sense will normally be applied when a tribunal is dealing with any claim which is calculated on a global basis.

## 6.3. What is meant by a contractor or subcontractor having to 'use constantly his best endeavours to prevent delay'; does it differ from 'reasonable endeavours'?

**6.3.1.** Many contracts require a contractor or subcontractor to use constantly his best endeavours to prevent delay. For example, JCT 2011, clause 2.28.6.1, states:

> the Contractor shall use constantly his best endeavours to prevent delay in the progress of the Works.

'Best endeavours' means that all steps to achieve the objective must be taken. *Keating on Building Contracts*, 5th edition, at page 575, has this to say with regard to the wording as it appears in the JCT forms of contract:

> This proviso is an important qualification of the right to an extension of time. Thus, for example, in some cases it might be the contractor's duty to reprogramme the works either to

> prevent or to reduce delays. How far the contractor must take the other steps depends upon the circumstances of each case, but it is thought that the proviso does not contemplate the expenditure of substantial sums of money.

**6.3.2.** The wording of I Chem E, clause 14.3, is a little different, where it states that the contractor shall at all times use his best endeavours to minimise any delay in the performance of his obligations under the contract.

**6.3.3.** GC/Works/1, in condition 36(6), states that the contractor must endeavour to prevent delays and to minimise unavoidable delays.

**6.3.4.** In the case of *IBM UK Ltd* v. *Rockware Glass Ltd* (1980), Rockware agreed to sell IBM some land for development, and the sale was conditional upon planning permission being obtained, with a further proviso that IBM 'will make an application for planning permission and use its best endeavours to obtain the same'. The local authority refused planning permission. IBM did not appeal against that decision to the Secretary of State. The parties disagreed on whether, by not appealing, IBM had failed to use its best endeavours to obtain planning permission. The project was a substantial one, in which the purchase price of the land alone was £6,250,000. It was accepted that making an appeal to the Secretary of State would cost a significant amount of money. The court said that, taking into account the background to the matter and the amount of money involved, it was not likely that the parties would have considered a refusal of planning permission at a local level to be the end of the matter, but that they must have had in mind the prospect of an appeal to the Secretary of State. The test of 'best endeavours' which was approved was that the purchasers of the land were bound to take all those steps in their power which are capable of producing the desired results, namely the obtaining of planning permission, being steps which a prudent, determined and reasonable owner, acting in his own interests and desiring to achieve that result, would take. It was expressly stated that the criterion was not that of someone who was under a contractual obligation, but someone who was considering his own interests. Whilst it seems clear a contractor or subcontractor may be required to expend some money to meet the obligation to 'use constantly his best endeavours' to prevent delay, the intention is not to expend large sums, particularly where the delay has been caused by the engineer or architect.

**6.3.5.** In the case of *Victor Stanley Hawkins* v. *Pender Bros Pty Queensland* (1994), it was held that the term 'best endeavours' should be construed objectively. The test as to whether it had been fulfilled would be that of prudence and reasonableness.

**6.3.6.** Two cases have involved the court in having to decide the meaning of best endeavours. In *Midland Land Reclamation Ltd* v. *Warren Energy Ltd* (1997), the judge in deciding the case said:

> I reject the submission made on behalf of the defendant that a best endeavours obligation is the next best thing to an absolute obligation or guarantee.

In *Terrell* v. *Maby Todd & Co* (1952), the judge held that a 'best endeavours' obligation only required a party to do what was commercially practicable and what it could reasonably do in the circumstances.

**6.3.7.** In an article in *Building* (10 September 1999), Neil White explained:

> A best endeavours clause means that you do what a reasonable person would to achieve an objective – it is not a guarantee, it may be overruled by conflicting obligations and it doesn't apply to intangible outcomes such as an agreement.

In the final analysis, a contractor will be expected to do what is commercially practicable and what it could reasonably do in the circumstances.

**6.3.8.** There is a difference between the meaning of 'best endeavours' and 'reasonable endeavours'. In the case of *Rhodia* v. *Huntsman* (2007), Huntsman agreed to buy Rhodia's chemical business. As part of the sale agreement, the parties undertook to use their 'reasonable endeavours' to ensure that all supply contracts were transferred from Rhodia to Huntsman, which included an energy supply contract with a firm called Cogen. Some of the energy supply contracts were to be transferred to subsidiaries of Huntsman. Unfortunately, Cogen proved difficult and insisted upon a parent company guarantee being provided by Huntsman; otherwise, it would not agree to the novation of its energy supply contract from Rhodia to Huntsman. The novation did not take place, as Huntsman refused to provide a parent company guarantee. Rhodia finished up with a liability in the sum of £14.8 m for energy use, which had to be paid to Cogen. This sum was claimed by Rhodia from Huntsman, on the basis that it had failed to use reasonable endeavours by refusing to provide a parent company guarantee. The court found that Huntsman had, in not providing a company guarantee, failed to use 'reasonable endeavours'. The judge considered that there was a difference between 'reasonable endeavours' and 'best endeavours'. He said:

> An obligation to use reasonable endeavours to achieve the aim probably only requires a party to take one reasonable course, not all of them, whereas an obligation to use best endeavours probably requires a party to take all reasonable courses he can.

Reasonable endeavours, the judge considered, would not involve a party doing something which was contrary to its commercial interests.

## SUMMARY

Where a contract requires the contractor to use his 'best endeavours' to prevent delay, he is expected to keep the effect of any matters which could cause delay down to a minimum, or to eliminate them if possible. This would include an obligation to reprogramme, if appropriate. If the delay is the contractor's responsibility, he may consider it financially more advantageous in the absence of an obligation to use best endeavours, to allow the work to overrun the contract period and to pay liquidated damages. This will be particularly relevant if the liquidated damages figure is modest. Some standard forms of contract, for example JCT 2011, allow the employer to determine the contractor's employment if he fails to proceed regular and diligently with the works, which would make it unwise for the contractor to fail to use his best endeavours to prevent

delay. If the delay is the responsibility of the architect/engineer or employer, the contractor is not required to expend substantial amounts of his own money to reduce the delay.

The courts have differentiated between 'reasonable endeavours' and 'best endeavours'. An obligation to use 'reasonable endeavours' probably requires a party to take one of a range of possible reasonable courses of action, whereas an obligation to use 'best endeavours' probably requires a party to go further and to pursue all reasonable alternatives.

## 6.4. What is meant by 'Time is of the Essence'?

**6.4.1.** The term 'time is of the essence' appears from time to time in bespoke conditions and alterations to standard conditions which apply on construction projects. This term, however, does not appear in any commonly used standard conditions. Those who use the term often do not fully understand its purpose. Where time is of the essence, is a condition of the contract and a date for completion is stated, a failure to complete by the stated date can result in the contract being terminated. In the Australian case of *Carr* v. *Berriman Pty Ltd* (1953), an owner on a construction project was under an obligation to make the site available on a stated date. The site was not made available on that date, and the contractor claimed that time was of the essence and, hence, he was entitled to terminate the contract and claim for his loss of profit. The judge had this to say with regard to 'time being of the essence':

> Where a contract contains a promise to do a particular thing on or before a specified day, time may or may not be of the essence. If it is, the promisee is entitled to rescind, but he may elect not to exercise the right and an election will be inferred from any conduct which is consistent with the contract remaining in being.

**6.4.2.** Time may be of the essence because there is a clause to that effect in the contract. Alternatively, it may be clear from an examination of the contract documents, as a matter of presumed intention of the parties. Where there has been unreasonable delay in completing within the required time or by the contract completion date, time may become of the essence because of the inconvenienced party serving notice of a revised date for completion. If the revised date is not met, then time may be of the essence. This was summed up in the case of *United Scientific Holdings* v. *Burnley Council* (1978), where it was stated:

> Time will not be considered to be of the essence unless:
> - The parties expressly stipulate that conditions as to time must be strictly complied with, or
> - The nature of the subject-matter of the contract or the surrounding circumstances show that time should be considered to be of the essence, or
> - A party who has been subjected to unreasonable delay, gives notice to the party in default, making time of the essence.

**6.4.3.** In construction contracts, time is not of the essence unless made so in the manner already described. This seems clear, as most construction contracts contain a liquidated damages clause as a means of compensating the employer if work finishes late. There

are, however, rare examples of contracts which contain liquidated damages and extension of time provisions, where time is made of the essence: *Peak Construction* v. *McKinney Foundations* (1971).

**6.4.4.** It is stated in Para 9.014 of *Hudson on Building and Engineering Contracts*, 11th Edition:

> However it has been a characteristic of poor draftsmanship of recent years, in nearly all commercial fields that 'of the essence' wording is frequently used to 'overegg the pudding' in relation to obviously inappropriate contractual obligations, and should not be accorded the same weight as when used in a more considered way.

This was illustrated in the case of *Clear Homes* v. *Sarcon (no 177) Ltd* (2010), where the defendant agreed to construct an apartment block in Belfast, with Gilbert Ash as the contractor. The claimant signed two documents committing it to purchasing an apartment block, with the defendant completing the work by 31 May 2009. Work was not completed on time, because of a combination of poor weather conditions and problems with the foundations. The claimant was notified that a revised completion date would be October/November 2009. The contract, in clause 8, provided for a reasonable extension of time to be given if work was delayed by, *inter alia*, bad weather and causes outside the claimant's control. Clause 23, however, stated:

> In relation to the time limits specified in this agreement time shall be of the essence.

**6.4.5.** The ruling of the court was that the agreement represented the parties' intentions, to the effect that time would not be of the essence. The reference to time limits in clause 23, did not, and was not intended to, apply to the completion dates.

**6.4.6.** An example of a case where the court found that time *was* of the essence is *Charles Rickards Ltd* v. *Oppenheim* (1950). In this case, a car builder undertook to build a body onto a Rolls Royce chassis. The car was to be ready by a specified date, which was held to be the essence of the contract. The date passed but the work was not completed. The purchaser continued to request delivery and new dates were promised and accepted, but still delivery was not forthcoming. Finally, the purchaser gave notice that he would not accept delivery after a specified date. When the car was not delivered by this date, the purchaser cancelled the order. The court held that time had become of the essence when the purchaser served the notice. Under the circumstances, the purchaser was entitled to cancel the order when the car was not delivered by the date for delivery stated in the notice.

## SUMMARY

Time will be of the essence if one of the following applies:

- The parties expressly stipulate that conditions as to time must be strictly complied with; or

- The nature of the subject matter of the contract or the surrounding circumstances show that time should be considered to be of the essence; or
- A party who has been subjected to unreasonable delay gives notice to the party in default, making time of the essence.

If time is, or becomes of the essence, the injured party may terminate the contract, if the date for completion is not met. The injured party will then be entitled to claim damages for breach of contract.

## 6.5. Where delays to completion of the works have occurred and disputes arise as to the appropriate extension of time which should be granted, is the employment of a computer-based critical path analysis essential to establish the true entitlement?

**6.5.1.** The standard forms of contract regularly used on construction projects, are very clear as to who is responsible for making decisions regarding the granting of extensions of time. In the case of most JCT contracts, the architect or contract administrator is responsible for making the decision. Engineers do likewise on ICE contracts and the project manager does so if the contract has been let using the NEC. It needs to be recognised that the skill of those charged with the duty of deciding the extent, if any, to which a contractor may have an entitlement to an extension of time may vary. There is no procedure laid down in the contract which must be followed in arriving at a decision regarding extensions of time. The courts have therefore taken a very general view as to what is required when granting an extension of time. In the case of *City Inn Ltd* v. *Shepherd Construction* (2007), Lord Drummond Young said:

> What is required of clause 25 is that the Architect should exercise his judgement to determine the extent to which completion has been delayed by relevant events. The Architect must make a determination on a fair and reasonable basis.

**6.5.2.** In the case of *Balfour Beatty Building Ltd* v. *Chestermount Properties Ltd* (1993), Coleman J made the following observations, which are somewhat obvious to most charged with the duty of making decisions regarding entitlements to extensions of time:

> 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 non-contractor's risk events and to calculate the excess time, if any, over that period, which the contractor took to complete the works…. the Architect's objective must be 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 of the amount of the 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 means of postponing the completion date.

**6.5.3.** The judge in the case of *John Barker Construction Ltd* v. *London Portman Hotel* (1996) adversely criticised the architect on the grounds that, when arriving at a decision regard-

ing the contractor's entitlement to an extension of time, he had not carried out a logical analysis in a methodical way, of the impact of the relevant events on the contractor's programme and only made an impressionable, rather than a calculated, assessment. The judge said:

> [The Architect] did not carry out a logical analysis in a methodical way of the impact which the relevant matters were likely to have on the plaintiff's 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.

**6.5.4.** In the case of *Royal Brompton Hospital NHS Trust* v. *Frederick Alexander Hammond and Others* (2001), HHJ Richard Seymour stated:

> In order to make an assessment of whether a particular occurrence has affected the ultimate completion of the work, rather than just a particular operation, it is desirable to consider what operations, at the time the event with which one is concerned happens are critical to the forward progress of the work as a whole.

To be able to comply with this judge's requirements would involve producing a critical path analysis.

**6.5.5.** Judge Toulmin, in the case of *Mirant Asia-Pacific Construction (Hong Kong) Ltd* v. *Ove Arup and Partners International Ltd* (2007), which was heard in the TCC, defined a critical path analysis as:

> . . . the sequence of activities through a project network from start to finish, the sum of whose durations determine the overall project duration.

**6.5.6.** Judge Humphrey Lloyd was strident in his comment regarding the evidence required to establish an entitlement to an extension of time, which supports the use of a critical path analysis, when he said:

> By now one would have thought that it is 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.

To say the least, the judge appears to be going over the top. Few architects, contract administrators, engineers or project managers would be likely to go to these extremes when making decisions concerning extensions of time.

**6.5.7.** In the case of *City Inn Ltd* v. *Shepherd Construction* (2007), Lord Drummond Young made the following observations concerning the use of a critical path analysis, which are at odds with the views of Mr Justice Lloyd:

> In my opinion the pursuers clearly went too far in suggesting that an expert could only give a meaningful opinion on the basis of an as-built critical path analysis… The major difficulty it seems to me is that in the type of programme used to carry out a critical path analysis any significant error in the information that is fed into the programme is liable to invalidate the entire programme.

**6.5.8.** Further words of wisdom were expressed by Lord Osborne in a later hearing of the case *City Inn Ltd* v. *Shepherd Construction* (2010), when he said:

> In the second place the decision as to whether the relevant event possesses such causative effect is an issue of fact which is to be resolved, not by the application of philosophical principles but rather by the application of common sense.

## SUMMARY

Lord Drummond Young and His Honour Mr Justice Lloyd are not in accord regarding the value of a critical path analysis in deciding the correct extension of time which should be awarded. Lord Drummond Young is not convinced that the use of a critical path analysis is essential. He considered that, where the information on which the critical path has been built contains a significant error, it would invalidate the entire programme; to use the old adage 'rubbish in, rubbish out'. His Honour Mr Justice Lloyd, however, expressed the view that the use of a critical path analysis has to be established in deciding entitlements to extensions of time on complex projects. In assessing these diametrically opposite views it is necessary to take into account the fact that judges are not experts with regard to construction processes. Their knowledge is based upon the information gleaned from cases brought before them. It is therefore not surprising that two judges should fail to have a similar view on a key matter such as the use of a critical path analysis.

If a dispute arises in respect of an extension of time award and the matter is referred to arbitration or is the subject of litigation, opinions as to the contractor's entitlement are often submitted by expert delay analysts using techniques which are often not available to the architect, contract administrator, engineer or project manager when making the decisions. It is not uncommon for each side to appoint its own delay analyst and quite usual for the experts to disagree with the extension of time which has been granted. Having done so, they proceed to express opposing views as to the correct extension of time which they consider should have been granted. The judge or arbitrator is then left to decide which of the experts' opinions he prefers, or whether the architect, contract administrator, engineer or project manager was right all along. This is a far cry from the situation in which the architect, contract administrator, engineer or project manager was placed at the time the decision was made. It must also be borne in mind that these decisions are often required by the terms of the contract to be made within a tight timescale. For example, the architect appointed with regard to a JCT contract has 12 weeks from receiving details from the contractor to arriving at a decision.

It is clear that there is no one system which should apply to analysing delays and making decisions as to the contractor's entitlement to extensions of time. It is not an exact science and in all probability, if three experts were presented with the same set of facts concerning delays to a project and asked to determine the contractor's entitlement to an extension of time, they would produce three completely different answers. Whoever makes the decision must be able to demonstrate that there has been a full examination of the facts, based upon what actually happened and establish the effect of the delaying events on the progress and completion of the work. Overriding all this is the requirement that common sense must prevail. A cynic, however, may wish to add the rider that common sense is not all that common.

## 7.1. Does a contractor or subcontractor lose entitlements to extensions of time if he fails to submit the appropriate notices and details required by the contract?

**7.1.1.** Most of the standard forms of main contract and subcontract require the contractor and subcontractor to give notice when delays occur to the progress or completion of the works. A question often asked is whether, in the absence of notice, the contractor or subcontractor loses his rights to have the completion date extended. In other words, is the service of notice a condition precedent to the right to an extension of time?

**7.1.2.** The matter was considered by the House of Lords in the case of *Bremer Handelsgesellschaft mbh* v. *Vanden Avenne-Izegem* (1978), which arose out of a dispute over the sale of soya bean meal. Lord Salmon, referring to how the rights of the parties were affected by the lack of a proper notice, had this to say:

> In the event of shipment proving impossible during the contract period, the second sentence of clause 21 requires the seller to advise the buyers without delay of the impossibility and the reasons for it. It has been argued by the buyers, that this is a condition precedent to the sellers' rights under that clause. I do not accept this argument. Had it been a condition precedent, I should have expected the clause to state the precise time within which the notice was to be served and to have made plain by express language, that unless the notice was served within the time, the sellers would lose their rights under the clause.

**7.1.3.** From what Lord Salmon has said it seems clear that, for notice to be a condition precedent to a right for more time, the wording of the clause would need to be such that a failure to serve notice would result in loss of rights. The situation of lack of notice was examined in the decision in *Stanley Hugh Leach* v. *London Borough of Merton* (1985) in relation to JCT 63, where Mr Justice Vinelott summarised the position as follows:

> The case for Merton is that the architect is under no duty to consider or form an opinion on the question whether completion of the works is likely to have been, or has been, delayed for any of the reasons set out in clause 23 unless, and until, the contractor has given notice of the cause of a delay that has become 'reasonably apparent' or, as it has been put in argument, that

*200 Contractual Problems and their Solutions*, Third Edition. Roger Knowles.

> the giving of notice by the contractor is a condition precedent, which must be satisfied before there is any duty on the part of the architect to consider and form an opinion on these matters.
>
> I think the answer to Merton's contention is to be found in a comparison of the circumstances in which a contractor is required to give notice, on the one hand, and the circumstances in which the architect is required to form an opinion, on the other hand. The first part of clause 23 looks to a situation in which it is apparent to the contractor that the progress of the works is delayed, that is, due to an event known to the contractor, which has resulted, or will inevitably result in delay. The second part looks to a situation in which the architect has formed an opinion that completion is likely to be, or has been delayed, beyond the date for completion. It is possible that the architect might know of events (in particular 'delay on the part of artists, tradesmen or others engaged by the employer in executing work not forming part of this contract') which is likely to cause delay in completion, but which has not caused an actual or prospective delay in the progress of the work which is apparent to the contractor. If the architect is of the opinion that because of an event falling within sub-paragraphs (a) to (k) progress of the work is likely to be delayed beyond the original, or any substituted completion date, he must estimate the delay and make an appropriate extension to the date for completion. He owes that duty not only to the contractor, but also to the building owner. It is pointed out in a passage from *Keating on Building Contracts*, 4th Edition at page 346, which is cited by the arbitrator, that if the architect wrongly assumes that a notice by the contractor is a condition precedent to the performance of the duty of the architect to form an opinion and take appropriate steps:
>
> . . . and in consequence refuses to perform such duties, the Employer loses his right to liquidated damages. It may therefore be against the Employer's interests for an Architect not to consider a cause of delay of which late notice is given, or of which he has knowledge despite lack of notice.

**7.1.4.** In *Maidenhead Electrical Services* v. *Johnson Controls* (1996) the terms of the contract laid down that any claim for an extension of time had to be made within ten days of the event for which the claim arises. It was held that a failure to comply with the notice provisions did not render a claim invalid.

**7.1.5.** The GC/Works/1 contract is somewhat out of line with the other standard forms of main contract in that it refers, in condition 28, to the contractor's written notice being a condition precedent to a right to an extension of time, unless otherwise directed by the Authority. However, the later GC/Works/1 (1998) version does not provide for the delay notice required by condition 36 to be a condition precedent to an entitlement to an extension of time.

**7.1.6.** JCT 2011 and the ICE 6th and 7th Editions make no reference to a delay notice being a condition precedent to the contractor's entitlement to an extension of time.

**7.1.7.** The Engineering and Construction Contract (NEC 3), however, takes a different stance. Clause 61.3 requires the contractor to notify the project manager of a compensation event as a condition precedent to an entitlement to an extension of time, where it states:

> if the contractor does not notify a compensation event within eight weeks of becoming aware of the event, he is not entitled to a change in the Prices, the Completion Date or a Key Date . . .

**7.1.8.** The MF/1 and IChemE conditions make no reference to a delay notice being a condition precedent to an extension of time.

**7.1.9.** The interpretation of the various subcontracts runs in parallel with the main contracts. An exception is the CECA blue form subcontract, for use with the ICE main contract. Clause 6(2) stipulates that it is a condition precedent to the subcontractor's right to an extension of time for a notice to be served within 14 days of a delay first occurring, for which the subcontractor considers himself entitled to extra time.

**7.1.10.** The Australian case *Turner Corporation Ltd (Receiver and Manager Appointed)* v. *Austotal Pty Ltd* (1998) dealt with the situation of a delay caused by the employer, where the conditions of contract required a written delay notice as a condition precedent to an extension of time. The lack of notice lost the contractor the right to an extension of time. The judge stated:

> If the builder, having a right to claim an extension of time, fails to do so, it cannot claim that the act of prevention, which would have entitled it to an extension of time for practical completion, resulted in its inability to complete by that time. A party to a contract cannot rely on preventing conduct of the other party, where it failed to exercise a contractual right, which would have negated the effect of that preventing conduct.

**7.1.11.** Following the *Turner Corporation* case, the Australian courts seem to have undergone a change of heart. The principle of prevention became relevant to extensions of time, following the Australian case of *Gaymark Investments Pty Ltd* v. *Walter Construction Group Ltd* (1999). In basic terms, the prevention principle states that one cannot benefit from one's own errors. Where an employer includes in a contract a clause which states that a written notice from the contractor is a condition precedent to the right to an extension, it could come into conflict with the prevention principles. A delay which is caused by the employer is obviously an employer's breach of contract. If the contract denies the contractor an entitlement to an extension of time due to a failure to serve a written notice, this could leave the employer with the benefit of being paid liquidated and ascertained damages which result from its own delays. In the *Gaymark* case, the contract required the contractor to serve a written notice within 14 days of the delay arising. The clause went on to stipulate that the contractor would not be entitled to an extension of time if it failed to serve a proper written notice. The court found in favour of the contractor, even though there had been no written notice served, as it considered it would be unmeritorious to award the employer liquidated and ascertained damages where the delays were of its own making.

**7.1.12.** Another Australian case, *Abigroup Contractors* v. *Peninsula Balmain* (2002) also involved the workings of an extension of time clause. The wording of the contract made the service of a written notice a condition precedent to the contractor's right to an extension of time. No notice was given, but because the contract gave the superintendent power to grant an extension of time, whether or not a notice had been served, it was held that he was wrong in not exercising the discretion and making an appropriate award.

**7.1.13.** A situation may arise where the contractor is delayed by the employer and loses rights to an extension of time, due to the lack of a written notice which is expressed in the

contract to be a condition precedent. The employer will then become entitled to deduct liquidated damages. The delay, however, may result in the contractor incurring additional cost, which he will still be entitled to recover from the employer, either under the terms of the contract or as a common law damages claim. The odd situation will have then arisen whereby the contractor loses a right to an extension of time, pays liquidated damages to the employer, but is reimbursed the delay costs he incurs.

**7.1.14.** The case of *City Inn* v. *Shepherd Construction* (2003) arose out of the construction of a hotel in Bristol. A dispute occurred concerning the contractor's entitlement to an extension of time. The contract was JCT 80, but with special amendments inserted at the behest of the employer. One of the amendments dealt with architect's instructions and required the contractor to serve a written notice with regard to an entitlement to an extension of time. The contract stated that the architect could dispense with the contractor's obligations concerning written notice, but in the absence of such a waiver the special amendment stipulated that the contractor would not become entitled to any extension of time if he failed to serve the written notice. Due to a failure on the part of the contractor to serve proper notice following the issue of an architect's instruction, the employer considered he had a right to deduct liquidated and ascertained damages at the rate of £30,000 per week, as stated in the contract. It was argued by the contractor that, even though £30,000 per week represented a reasonable pre-estimate of the employer's loss, the removal of an entitlement to an extension of time due to a failure to serve notice was in itself a penalty. The loss which the employer would incur as a result of a lack of written notice would still be the same. Therefore, a failure by the contractor to serve a written notice had no financial effect upon the employer. The argument was not accepted by the court. If the contractor elects not to comply with the notice requirement, it can properly be regarded as a breach of contract. Should the contractor decide to serve a written notice, then the employer provides an indemnity to the contractor against payment of liquidated and ascertained damages, but only if a written notice is provided. A failure by the contractor to serve a written notice also prevents the architect from reviewing the instruction. For these reasons, the court found against the contractor. The English courts are more likely to follow this decision, which arose from the Scottish courts, and would seem unlikely to adopt the principles established in the Australian *Gaymark* case.

**7.1.15.** The case of *Steria Ltd* v. *Sigma Wireless Communications Ltd* (2007) arose as a result of the provision of a new computerised system for the fire and ambulance services in the Republic of Ireland. The project was known as a Computer Assisted Mobilising Project (CAMP). CAMP East was the name given to the employer on the project. Sigma was the main contractor in connection with the project and Steria the subcontractor. A subcontract was let for the work using a heavily amended MF/1. A dispute arose between Sigma and Steria relating to the release of the final balance of retention, amounting to 153,786 Euros, which was due for payment at the end of the defects liability period. Sigma asserted that Steria had caused delay in completing the sub-contract works, giving them an entitlement to payment or set-off of 307,573 Euros in respect of liquidated damages and general damages in a sum in excess of 380,000 Euros for losses incurred as a result of delay. The dispute was referred to the Technology and Construction Court.

**7.1.16.** Clause 6.1 of the conditions of contract includes the following wording:

> . . . if by reason of any circumstance which entitles the contractor to an extension of time for completion of the works under the main contract, or by reason of a variation to the sub-contract works, or by reason of breach by the contractor, the sub-contractor shall be delayed in the execution of the sub-contract works, then in any such case, provided the sub-contractor shall have given within a reasonable period, written notice to the contractor of the circumstances giving rise to the delay, the time for completion hereunder shall be extended by such period as may in all the circumstances be justified . . .

The court provides a clear ruling of what is required concerning notice to ensure compliance with the provisions of this clause, namely:

1. The notice must make it clear that it is a request for an extension of time under clause 6.1.
2. The notice must explain how and why the relevant circumstances have caused delay.
3. The notice must give an assessment of the delay.
4. The notice must be given within a reasonable period.

The court also stated that the written notice must emanate from Steria. A note in the minutes of a site meeting prepared by the main contractor, or the employer, to the effect that the subcontract works had been delayed and the reason for the delay, would not in itself amount to a good notice under clause 6.1. It was successfully argued by Sigma that the wording of Clause 6.1 made the sending of a proper written notice by Steria a condition precedent to the right to an extension of time. In other words, in the event of non-compliance with clause 6.1, Steria would lose the right to an extension of time. The judge considered that the wording provided a right to an extension of time:

> . . . provided that the sub-contractor shall have given within a reasonable time written notice to the contractor of the circumstances giving rise to the delay.

This wording makes the provision of a notice a condition precedent to the right to an extension of time. This case is important, because the judge decided that the wording of clause 6.1 makes the giving of a written notice a condition precedent, even though those specific words are not included in the clause.

**7.1.17.** We, as a country, seem to be obsessed by the wording in the small print. This is well illustrated by the decision in the case of *Education 4 Ayrshire Ltd* v. *South Ayrshire Council* (2009). This case arose out of a PPP arrangement for schools in Ayrshire. All the work was subcontracted to Carillion. The contract under which the dispute arose was not one of the standard construction contracts, but one designed for PPP projects. A contract was entered into for the design and construction work at six schools. The work included the removal of asbestos. A survey was carried out and the contract provided for the removal of the asbestos identified by the survey. Once work got under way,

the contractor encountered more asbestos than was shown by the survey. Removing the additional asbestos caused delay and additional cost. The contractor claimed the additional work had caused a delay of 16 weeks and additional cost amounting to £815,792 and looked to the contract for a remedy. The contract notice requirements were extremely strict and required the contractor to serve a notice within 20 business days after he became aware of the event giving rise to delay and additional cost. This notice was required to include the reasons for the delay and also a claim for any extension of time and payment of compensation. The contract made it crystal clear that in the event of a failure to comply with this requirement, the contractor would not become entitled to more time or money. The contract stipulated that the notice must be sent to the Chief Executive of the authority by first class post, fax, or by hand.

**7.1.18.** A dispute arose in respect of the notice of delay. The contractor became aware of the additional asbestos and the likely effect on the completion date on 6 April 2007. A notice was submitted on 2 May 2007, which just met the time scale. However, the notice reported the delay and went on to express an intention to submit a claim. This did not meet the contractual obligations, which required the actual claim to be submitted. The court had no hesitation in finding against the contractor. He had failed to comply with the contract provisions with regard to what should be included in the notice.

**SUMMARY**

A failure on the part of a contractor or subcontractor to serve a proper delay notice will not result in the loss of rights to an extension of time, unless the conditions of contract expressly state that the service of a notice is a condition precedent to such rights.

## 7.2. What is the Prevention Principle – does it provide a contractor with assistance in avoiding the payment of liquidated or delay damages where he fails to serve a delay notice, which the contract states is a condition precedent to the granting of an extension of time?

**7.2.1.** The Prevention Principle was defined in the case of *Barque Quilpe Ltd* v. *Brown* (1904), as follows:

> There is an implied contract by each party that he will not do anything to prevent the other party from performing a contract or to delay him in performing it. I agree that generally such a term is by law imported into every contract.

In the more recent Canadian case of *Perini Pacific Ltd* v. *Great Vancouver Sewerage and Drainage District* (1996), it was said:

> Since the earliest times it has been clear that a party to a contract is exonerated from performance of a contract when that performance is prevented or rendered impossible by the wrongful act of the other party.

**7.2.2.** The principle can be traced back in construction contracts as far as *Holme* v. *Guppy* (1838). This case involved the construction of a brewery in Liverpool. The employer failed to provide access to the site on the contractual date and this was regarded as an act of prevention. This has led to the general view that when acts of the employer prevent the contractor from achieving completion by the date of completion, if there is no contractual machinery to extend the date for completion:

- The contractor is excused from completing by the date for completion.
- There is no date from which to calculate liquidated or delay damages.
- Time is left at large and the contractor is obliged to complete within a reasonable time.
- Whilst the employer will be unable to levy liquidated or delay damages, unliquidated damages may be charged, in other words, such costs and losses which the employer can demonstrate resulted from the failure on the part of the contractor to complete within a reasonable time.

Contracts which have been drafted with no provision for granting the contractor an entitlement to extensions of time due to delays caused by the employer or his architect or engineer may attract the Prevention Principle.

**7.2.3.** The Prevention Principle has been used in recent cases where the contract provisions stipulate that the service of a delay notice on the part of the contractor is a condition precedent to the granting of an extension of time. Loss of the right to an extension of time due to the absence of a timely delay notice resulting in the application of liquidated or delay damages, has been met by the argument that such deduction falls foul of the Prevention Principle. If delays are caused by the employer, it has been argued that it cannot be right for such delays to be used to entitle the employer to deduct damages on the ground of lack of a delay notice. If the employer were allowed to deduct liquidated damage in respect of delays which he or she had caused, it would be difficult to relate to the decision in the case of *Alghussein Establishment* v. *Eton College* (1988), where it was stated:

> It has been said as a matter of construction, unless the contract clearly provides to the contrary, it will be presumed that it was not the intention of the parties that either should be entitled to rely on his own breach of duty to avoid the contract, or bring it to an end or to obtain a benefit under it.

**7.2.4.** There is conflicting case law on the matter of the application of the Prevention Principle, as it is applied where a contractor fails to serve a delay notice which the contract states to be a condition precedent to the contractor's right to an extension of time. In the Australian case of *Turner Corporation Ltd (Receiver and Manager Appointed)* v. *Austotal Pty* (1998), the judge found against the principle applying, when he stated:

> If a builder, having a right to claim an extension of time, fails to do so, it cannot claim that the act of prevention which would have entitled it to an extension of time for practical completion

resulted in its ability to complete by that time. A party to a contract cannot rely on preventing-conduct of the other party where it failed to exercise a contractual right which would have negated the effect of that preventing conduct.

**7.2.5.** The Prevention Principle was, however, argued successfully in Australia in the later case of *Gaymark Investments Pty Ltd* v. *Walter Construction Ltd* (1999). In this case, the contract conditions provided for the contractor to serve a written notice as a condition precedent to an entitlement to have the completion date adjusted. There were several actions on the part of the employer which resulted in delays to completion. In some instances the contractor complied with the notice provisions, whilst in others he failed to do so. The matter was referred to arbitration, where it was found that the Prevention Principle applied and thus the employer had no right to deduct liquidated damages. On referral to the court, the decision of the arbitrator was upheld. The court considered that if the employer were allowed to deduct liquidated damages, it would receive an entirely unmerited award in respect of delays of its own making.

**7.2.6.** In the Australian case of *Wunda Products Australia P/L* v. *Kyren P/L* (2010), the judge was of the view that if the contract contains a provision enabling the contractor to gain an extension of time in consequence of the employer's delay, it will have the effect of nullifying the Prevention Principle.

**7.2.7.** The Prevention Principle has been referred to in the following UK cases

- *Multiplex* v. *Honeywell* (2007).
- *Steria Ltd* v. *Sigma Wireless* (2007).
- *City Inn* v. *Shepherd Construction Ltd* (2007).

The Prevention Principle, however, has not as yet been adopted in the UK as overcoming a condition precedent notice provision, but it seems that it is likely to make further appearances in the courts. It leaves open the debate as to whether a contract which states that a delay notice is a condition precedent has the general effect of excluding the Prevention Principle.

## SUMMARY

The Prevention Principle stipulates that a party to a contract cannot insist on compliance with its provisions, if the reason for the non compliance is some action or omission of the party insisting on compliance. For example, if the employer delays the contractor, it cannot insist on completion by the contractor on time. This argument has been used where a contract requires the contractor as a condition precedent to the right to an extension of time to serve a delay notice and it fails to do so. To apply liquidated damages in these circumstances would, it is argued, be a breach of the Prevention Principle. There have been two cases in Australia which address this matter, one of which supported the view that allowing an employer to levy liquidated damages in respect of employer-created delays would be a breach of the Prevention Principle. The other case supported the opposite view. In the UK courts the Prevention Principle has been discussed, but no firm decision has been made as to its application in respect of delay notices.

## 7.3. Are minutes of site meetings considered by the courts to be adequate notices of delay required by extension of time clauses?

**7.3.1.** Most standard forms of construction contracts provide in the extension of time clauses for the contractor and subcontractor to serve delay notices. ICE 6th and 7th Editions, in accordance with clause 44(1), require the contractor, within 28 days after the cause of delay has arisen, or as soon thereafter as is reasonable, to deliver to the engineer full and detailed particulars in justification of any claim to an extension of time. JCT 2011, in accordance with clause 2.27.1, requires the contractor to provide a written notice, together with particulars of the expected effects and an estimate of the expected delay, with regard to any relevant event. GC/Works 1/, condition 36, includes a requirement for the contractor to serve a notice requesting an extension of time, which shall include grounds for the request. Engineering and Construction Contract (NEC 3) in clause 61.3 requires the contractor to notify the project manager of an event which has happened, or which he expects to happen, if he believes that the event is a compensation event.

**7.3.2.** Before giving a definitive answer to the problem, it is necessary to decide whether a failure to serve a notice will lose the contractor or subcontractor his entitlement to an extension of time. The circumstance whereby a written notice becomes a condition precedent can be found in 7.1, above. If a formal notice is expressed as a condition precedent to the contractor's right to an extension of time, the question is often asked whether minutes of site meetings can constitute good notice.

**7.3.3.** In the Scottish case of *John L. Haley Ltd* v. *Dumfries & Galloway Regional Council* (1988), the court had to decide whether site meetings minutes constituted a good notice. The contract in this matter was let employing the JCT 63 standard form of contract, under which the claimants undertook certain building works to a school, with the contract period set at 78 weeks. This was overrun by 31 weeks, in respect of which a six-week extension of time was granted. When further extensions requests were refused, the matter was referred to arbitration. The claimants argued that they were entitled to an extension as the cause of delay fell within clauses 23(e), (f) and (h). The respondents maintained that the claimants were not entitled to an extension as they had not given written notice of the delay as required under clause 23. The arbiter, following proof before answer, had granted a four-week extension on the basis of site meeting minutes. At the respondent's instigation, the arbiter stated a case for the opinion of the Court of Session as to whether the minutes constituted a good notice under clause 23. The court held that the minutes did not constitute good notice. Unfortunately, the claimants had conceded that notice was a condition precedent to an entitlement to an extension of time and lost their case.

**7.3.4.** Nevertheless the parties to a contract often agree at the outset that the obligation to submit written notices will be waived and delays will be recorded in the site meeting minutes instead. Where this occurs, the employer would be estopped from denying the contractor an entitlement to an extension of time through lack of written notice.

**7.3.5.** The court had to decide in the case of *Steria Ltd* v. *Sigma Wireless Communications Ltd* (2007), details of which are provided in 7.1, whether site meeting minutes provided an

adequate notice to comply with the contract requirements. The court stated that the written notice must emanate from Steria. A note in the minutes of a site meeting prepared by the main contractor or the employer, to the effect that the subcontract works had been delayed and the reason for the delay, would not in itself amount to a good notice under clause 6.1. It left unanswered as to whether site meeting minutes written by the claimant, or for that matter a written progress report, would suffice. If a court were to hold that the minutes or progress report constituted good notice, they would be required to include the level of detail needed to satisfy the requirements of the conditions of contract relating to the delay notice.

**SUMMARY**

Whether site meetings minutes constitute a good delay notice will depend upon the precise wording of the contract. It would seem, however, following the Scottish decision of *John L. Haley Ltd* v. *Dumfries & Galloway Regional Council* (1988) that in the case of the majority of the standard forms of contract, the site meeting minutes will not constitute good notice, unless the parties specifically amend the contract in this respect. The decision in the case of *Steria Ltd* v. *Sigma Wireless Communications Ltd* (2007) held that the notice must emanate from the claimant, and therefore minutes of a meeting which were not written by Steria did not constitute good notice. It left unanswered whether minutes written by the claimant would qualify.

## 7.4. Can an architect/engineer grant an extension of time after the date for completion has passed?

**7.4.1.** It is desirable for extensions of time to be granted at such times that contractors always know in advance the date for completion to which they are working. Some contracts will be precise as to when an architect/engineer must deal with extensions of time. JCT 2011, clause 2.28.2, is precise in stating:

> Whether or not an extension is given, the Architect/Contract Administrator shall notify the contractor of his decision in respect of any notice under clause 2.27 as soon as 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.

The ICE 7th Edition states under clause 44(5):

> The Engineer shall within 28 days [14 days in the 6th Edition] of the issue of the Certificate of Substantial Completion for the Works or any Section thereof review all the circumstances of the kind referred to in sub-clause (1) of this Clause and shall finally determine and certify

> to the Contractor with a copy to the Employer the overall extension of time (if any) to which he considers the Contractor entitled . . .

GC/Works/1, condition 36, requires the project manager to grant extensions of time 'as soon as possible and in any event within 42 days from the date any such notice is received . . . '

**7.4.2.** The question of the timing of an extension of time award has been discussed in the following legal cases, where the contracts were not precise as to the timing of an extension of time award.

**7.4.3.** In *Miller* v. *London County Council* (1934), the express wording of the contract provided:

> It shall be lawful for the Engineer, if he thinks fit, to grant from time to time, and at any time or times, by writing under his hand such extension of time for completion of the work and that either prospectively or retrospectively and to assign such other time or times for completion as to him may seem reasonable.

It was held that the words 'either prospectively or retrospectively' did not give the engineer power to fix a new date for completion after the completion of the works.

**7.4.4.** In *Amalgamated Building Contractors Ltd* v. *Waltham Holy Cross Urban District Council* (1952) the wording in the contract, which was the then current RIBA contract, provided in clause 18 that 'the Architect shall make a fair and reasonable extension of time for completion of the works'. Lord Denning, with regard to the time within which the architect would be required to make a decision, had this to say:

> The contractors say that the words in clause 18 mean that the architect must give the contractors a date at which they can aim in the future, and that he cannot give a date which has passed, I do not agree with this contention. It is only necessary to take a few practical illustrations to see that the architect as a matter of business, must be able to give an extension even though it is retrospective – in such a case, seeing that the cause of the delay operates until the last moment, when the works are completed, it must follow that the architect can give a certificate after they are completed . . .

Lord Denning distinguished the decision in *Miller* v. *LCC* in the following terms:

> These practical illustrations show that the parties must have intended that the architect should be able to give a certificate which is retrospective, even after the works are completed . . . *Miller* v. *London County Council* (1934) is distinguishable. I regard that case as turning on the very special wording of the clause which enables the engineer 'to assign such other time or times for completion as to him may seem reasonable'. Those words, as Mr Justice du Parcq said, were not apt to refer to the fixing of a new date for completion *ex post facto*. I would also observe that on principle there is a distinction between cases where the cause of delay is due to some act or default of the building owner, such as not giving possession of the site in due time, or ordering extras, or something of that kind. When such things happen the contract time may well cease to bind the contractors, because the building owner cannot insist on a condition if it is his own fault that the condition has not been fulfilled.

**SUMMARY**

The timing of the architect/engineer's decisions concerning the granting of an extension of time may be stipulated in the contract. This being the case, the architect/engineer will be required to comply with the requirements. If no time is laid down in the contract for the decision to be made, there seems no impediment to the Architect or Engineer making a decision after the date for completion has passed.

## 7.5. If the architect/engineer issues a variation after the extended completion date but before practical completion, should an extension of time be granted employing the date the variation is issued or by adding the net period of delay resulting from the variation to the existing completion date? Alternatively, does the issue of a variation at this time render time at large?

**7.5.1.** Architects and engineers should issue variations for extra work at times appropriate to the progress of the works. Often, where delays have occurred, variations are issued after the date has passed when work should have been completed. Contractors frequently argue that, due to the timing of the variation, an extension of time should be granted up to the date the variation was issued plus adequate time to carry out the extra work. A contrary argument is often made: that the issue of a variation after the completion date in the contract has passed which causes delay does not rank for an extension of time but leaves time at large, requiring the contractor to finish in a reasonable time.

**7.5.2.** The case *Balfour Beatty Building Ltd* v. *Chestermount Properties Ltd* (1993), heard before Mr Justice Colman of the Commercial Court, arose out of an appeal against an award of Christopher Willis, a well-known and respected arbitrator, and deals with the subject matter in question.

**7.5.3.** The works, employing JCT 80, comprised the construction of the shell and core of an office block. Work commenced in September 1987, the completion date being 17 April 1989, later extended to 9 May 1989. As work was not completed by this date, a certificate of non-completion was issued by the architect under clause 24.1. By January 1990 the work had still not been completed. During the period 12 February 1990 to 12 July 1990, the architect issued instructions for the carrying out of fit-out works as a variation to the contract. Practical completion of the shell and core was achieved on 12 October 1990 with the fit-out works not finished until 25 February 1991. The architect issued two extensions of time, to give a revised completion date of 24 November 1989. The variations with regard to the fit-out works were issued after the revised completion date but prior to practical completion, during a period of culpable delay. The architect then revised the non-completion certificate to reflect the extended completion date.

**7.5.4.** The contractor argued that the effect of the issue of variations during a period of culpable delay was to render time at large, leaving the contractor to complete within a reasonable time. This being the case, the employer would lose his right to levy liquidated

damages. Alternatively, the contractor contended that the architect should have granted an extension of time on a gross basis. In this case it was argued that the fit-out work should have taken 54 weeks, this period to be added to 12 February 1990, when the fit-out variation was issued. It was the employer's contention that the correct approach should be a net extension of time, that is to say, one which calculated the revised completion date by taking the date currently fixed for completion and adding to it the 18 weeks that the architect considered to be fair and reasonable for completing the fit-out work. The main plank in support of the contractor's argument was that if the net method was adopted, the extended completion date would expire before the variation giving rise to the extension had been instructed, which was logically and physically impossible. If the contractor's line were followed, it would provide him with a windfall which swept up his delays. While recognising this, the contractor considered the problem resulted from the employer's own voluntary conduct in requiring a variation during a period of culpable delay.

**7.5.5.** Mr Justice Colman did not agree with the contractor and found in favour of the employer, providing the following reasons:

> When the architect reviews extensions of time under clause 25.3.3.2 following practical completion, he is entitled to reduce the extended contract period to take account of omissions. These may have been issued during a period of culpable delay. It would, therefore, be illogical for the architect to have to deal with additions differently to the way he deals with omissions.
>
> The objective of clause 25.3.1 is for the architect to assess whether any of the relevant events have caused a delay and if so by how much. He must then apply the result of his assessment to give a revised completion date. It would need clear words in the contract to allow the architect to depart from a requirement to postpone the completion date by the period of delay caused by the relevant event.

Mr Justice Colman finally concluded by saying:

> 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.

**7.5.6.** This decision is likely to apply to a contract where the conditions of contract are JCT 2011, as the wording relating to extension of time entitlements is similar to that in JCT 98. However, a disagreement could take place where the Engineering and Construction Contract (NEC 3) conditions apply. It is the contractor's duty to submit quotations for additional work, which are required to include proposed adjustments to the time for completion and the contract sum. The quotation is required to be submitted for agreement by the project manager in advance of instructions being issued for the work to be undertaken. It is feasible that, in submitting the quotation, the contractor would apply the gross method, as did Balfour Beatty, as few contractors bother to research legal cases when seeking extensions of time. The project manager may, on the other hand, apply the net method.

**7.5.7.** This decision is unlikely to apply to ICE 6th and 7th Editions, where under clause 47(6) liquidated damages are suspended during a period of delay resulting from variations, a clause 12 situation, or any other delaying event outside the control of the contractor.

**SUMMARY**

Where an architect/engineer issues a variation after the contract completion date has passed, but before practical completion, it is appropriate where resultant delays occur for an extension of time to be granted. Such extension of time will be calculated by extending the completion date by the net period of delay. This is unlikely to apply to ICE 6th and 7th Editions, which provide for the suspension of liquidated damages during a period of delay caused by variations which are issued after the contract date for completion has passed.

## 7.6. When an architect/engineer is considering a contractor's application for an extension of time, can he reduce the period to which the contractor is entitled to reflect time saved by work omitted?

**7.6.1.** Architects and engineers when issuing variations which omit work often consider that, where the variation shows a saving in time, they are entitled to reduce the contract period or reissue an extension of time already granted but showing a shorter period.

**7.6.2.** Some contracts deal with this question. For example, JCT 2011 states in clause 2.28.6.3:

> No decision of the Architect/Contract Administrator under clause 2.28.4 or clause 2.28.5.2 shall fix a Completion Date for the Works or any Section earlier than the relevant Date for Completion.

From the wording in this clause it is clear that the architect cannot reduce the contract period, irrespective of how many omissions he issues. Where, however, practical completion takes place after the completion date in the contract the situation is different, as the architect or contract administrator may, in accordance with clause 2.28.5.2:

> . . . fix a Completion Date earlier than that previously fixed, if in his opinion that is fair and reasonable having regard to any instruction for Relevant Omissions issued after the last occasion on which a new Completion Date was fixed for the Works or Section.

**7.6.3.** The ICE 6th and 7th Editions, in clause 44(5), state in the following terms that the engineer cannot decrease an extension of time already granted:

> No such final review of the circumstances shall result in a decrease in any extension of time already granted by the Engineer pursuant to sub-clauses (3) or (4) of this Clause.

There is no reference to taking into account time saved by omissions when granting extensions of time, but this may be implicit in 'all the circumstances known to him' which the engineer considers in assessing the delay under 44(2)(a).

**7.6.4.** GC/Works/1 states, under condition 36(4):

> The PM shall not in a final decision, withdraw or reduce any interim extension of time already awarded, except to take account of any authorised omission from the Works or any relevant Section that he has not already allowed for in an interim decision.In this case, the project manager cannot reduce the contract period, but can subsequently reduce an extension of time already granted to take account of omissions.

**7.6.5.** GC/Works 1/Edition 2 states, under condition 28:

> In determining what extension of time the contractor is entitled to the Authority shall be entitled to take into account the effect of any authorised omissions from the Works.

**7.6.6.** MF/1, IChemE and the Engineering and Construction Contract (NEC3) make no reference to taking into account omissions when extensions of time are considered. It would seem reasonable, however, for the engineer or supervising officer to take into account omissions when making a decision concerning an extension of time. The contractor, however, having been given a period within which to carry out the work, e.g. the contract period or an extended contract, should not see the period subsequently reduced in the absence of express provision in the contract.

**SUMMARY**

Some forms of contract deal specifically with the question. In the absence of specific wording in the contract, it is unlikely that a court would accept that an architect or engineer has power to reduce the contract period or any extension of time already granted. Nevertheless, the contractor should continue to proceed diligently with the work, despite there being surplus time due to omissions, since such periods of surplus time can be taken into account, if the need arises, when further extensions of time are being considered.

## 7.7. Where a contractor's progress is behind programme, will he be entitled to an extension of time where progress and completion is affected by exceptionally adverse weather, but would not have been so affected if work had been on programme?

**7.7.1.** Many standard forms of contract, for example JCT 2011 clause 2.29.8, ICE 7th Edition clause 44(1)(d), and FIDIC 1999 Edition clause 8.4(c), include provisions which allow the contractor an extension of time for completion of the work where affected by exceptionally adverse weather or climatic conditions. In the case of *Walter Lawrence and Son*

*Ltd* v. *Commercial Union Properties (UK) Ltd* (1984), the progress and completion of the work was delayed due to exceptionally adverse weather conditions. The progress of the work was behind programme and it was argued by the architect that, had work been carried out in accordance with the programme, the weather would not have affected the progress or completion of the works.

**7.7.2.** The court did not accept the architect's interpretation of the contract. It is clear from the wording of the contract, which was JCT 63, that if the delaying event, which in this case was exceptionally adverse weather, affects progress and, as a consequence, the completion date, then a right to an extension of time arises. There is no reference in the extension of time clause in the contract to the programme and, therefore, the contractor's entitlement should not be affected if he is behind programme. The wording of JCT 2011, ICE 7th Edition and FIDIC 1999 Edition is similar to that of JCT 63 and, if applied to the circumstances which prevailed in this case, would produce a similar result.

**SUMMARY**

If a contractor's progress is behind programme, it will not affect an entitlement to an extension of time where completion is delayed due to exceptionally adverse weather conditions. The governing factor is whether the exceptionally adverse weather delayed the actual progress and in turn the completion date.

## 7.8. Some standard forms of contract, such as the JCT contracts, provide for extensions of time where work is delayed due to '*force majeure*'. What is *force majeure*?

**7.8.1.** Some contracts provide a definition as to the meaning of *force majeure*. The standard forms of contract produced by the JCT use the term *force majeure*, but include no such definition. The presence in JCT contacts of *force majeure* is important, as it is one of the relevant events which provides contractors and subcontractors with an entitlement to extensions of time for completion. By way of contrast, the ICE conditions make no reference to *force majeure*.

**7.8.2.** The FIDIC conditions of contract are one of the few standard conditions which include a definition of *force majeure*. It is defined as an exceptional event or circumstance:

- Which is beyond a party's control;
- Which such party could not reasonably have provided against before entering into the contract;
- Which having arisen, such party could not reasonably have avoided or overcome;
- Which was not substantially attributable to the other party.

**7.8.3.** *Force majeure* does not have a precise meaning, nor does it give rise to any legal doctrine under the laws which apply in the UK; it is a legal concept developed under French law.

Under the French Civil Code, *force majeure* is a good defence to a claim for breach of contract; however, to succeed, convincing evidence must be produced to demonstrate that:

- Performance was impossible;
- The event was unforeseen and unavoidable.

**7.8.4.** In the absence of a definition in the contract and the lack of a legal doctrine under English law, the parties to a contract which includes a *force majeure* clause are left to search through case law for assistance. From the few cases where *force majeure* has been interpreted in the English courts, it is considered that *force majeure* involves matters which are outside the control of the parties. It includes Act of God and also events such as strikes and breakdown of machinery. The edict by the Government in the UK in the 1970s that electricity supplies would be limited during a coal miners' strike was generally regarded as *force majeure*. Another example is the effect on air transport which occurred due to a volcano which erupted in Iceland in 2010. A pandemic was predicted to occur because of swine flu in 2009 and 2010 which, had it occurred, would in all probability have been *force majeure*.

**7.8.5.** It was held in the case of *Matsoukis* v. *Priestman* (1915), which related to the application of a liquidated damages clause in a shipbuilding contract, that the universal coal strike and breakdown of machinery amounted to *force majeure*, but not bad weather. In the case of *Hackney Borough Council* v. *Dore* (1922), the defendant was responsible for supplying electricity. A clause in the contract provided a get-out if the supply was interrupted by *force majeure*. The court had to decide whether the clause came in aid of the defendant where the supply was interrupted because of two of the workmen refusing to do the work necessary to maintain the supply. It was argued that if the men were dismissed, which would have overcome the problem, there would have been a strike. The Court of Appeal dismissed this argument. It took the view that *force majeure* applied only to strikes which actually proceeded; it did not apply to fear, no matter how reasonable, of a threatened action. When interpreting a *force majeure* clause it was said in the case of *Lebeaupin* v. *Crispin* (1920) that:

> a *force majeure* clause should be construed in each case with close attention to the words which precede or follow it and with due regard to the nature and general terms of the contract . . .

**7.8.6.** In the case of *Trandin Aviation Holdings Ltd* v. *Aero Toy Store LLC* (2010), the court had to decide whether a change in economic circumstances fell within the definition of *force majeure*. The case arose out of a contract to sell a jet aircraft. The price for the aircraft was $31.75 m. A down payment of $3 m was made at the outset, with the balance due on delivery of the aircraft. When construction of the aircraft had been completed, the defendant refused to take delivery or to pay the balance of money which was due. The claimant determined the contract with the result that, under the terms of the contract, the deposit was not returned to the defendant. The contract made it clear that the

deposit represented liquidated damages, with no obligation on the part of the claimant to make a repayment.

**7.8.7.** The contract contained a *force majeure* clause, which stated that neither party would be liable to the other for a number of reasons, including Act of God and any other cause beyond the seller's control. It was argued by the defendant that the unanticipated unforeseeable and cataclysmic downward spiral of the world's financial markets triggered the operation of the *force majeure* clause. The judge held that it is well established in English law that a change in economic/market circumstances affecting the profitability of a contract, or the ease with which the parties' obligations can be performed, is not generally regarded as being a *force majeure* event. The court gave as an example the facts and decision in the case of *Thames Valley Power Ltd* v. *Total Gas and Power Ltd* (2006).

**7.8.8.** How *force majeure* should be interpreted under the EU Regulations was the subject of the decision in *Dairyvale Foods Ltd* v. *Intervention Board of Agriculture Produce* (1982), where the court had to consider whether industrial action came within the definition of *force majeure*. It was held that to be effective, the occurrence had to be:

- An external event beyond the control of the party relying on it, and
- Have consequences which could not be avoided.

**7.8.9.** In the Singaporean case of *RDC Concrete PTE Ltd* v. *Sato Kogoyo (S) Pte Ltd* (2007), the court held that the non- or short supply of concrete between 18 November 2004 and 5 April 2005 did not constitute *force majeure*.

**7.8.10.** Just prior to Christmas 2010, torrential rains fell in Queensland, Australia, which caused major flooding. In fact, an area the size of France was badly affected by the floods, to such an extent that it virtually brought the coal industry, which supplies 60% of the global coal consumption, to a halt. The mining companies relied upon *force majeure* to save them from legal actions being brought by their customers. Rio Tinto, which has major coal interests in the region, invoked the *force majeure* clause in its contracts, and issued the following press release:

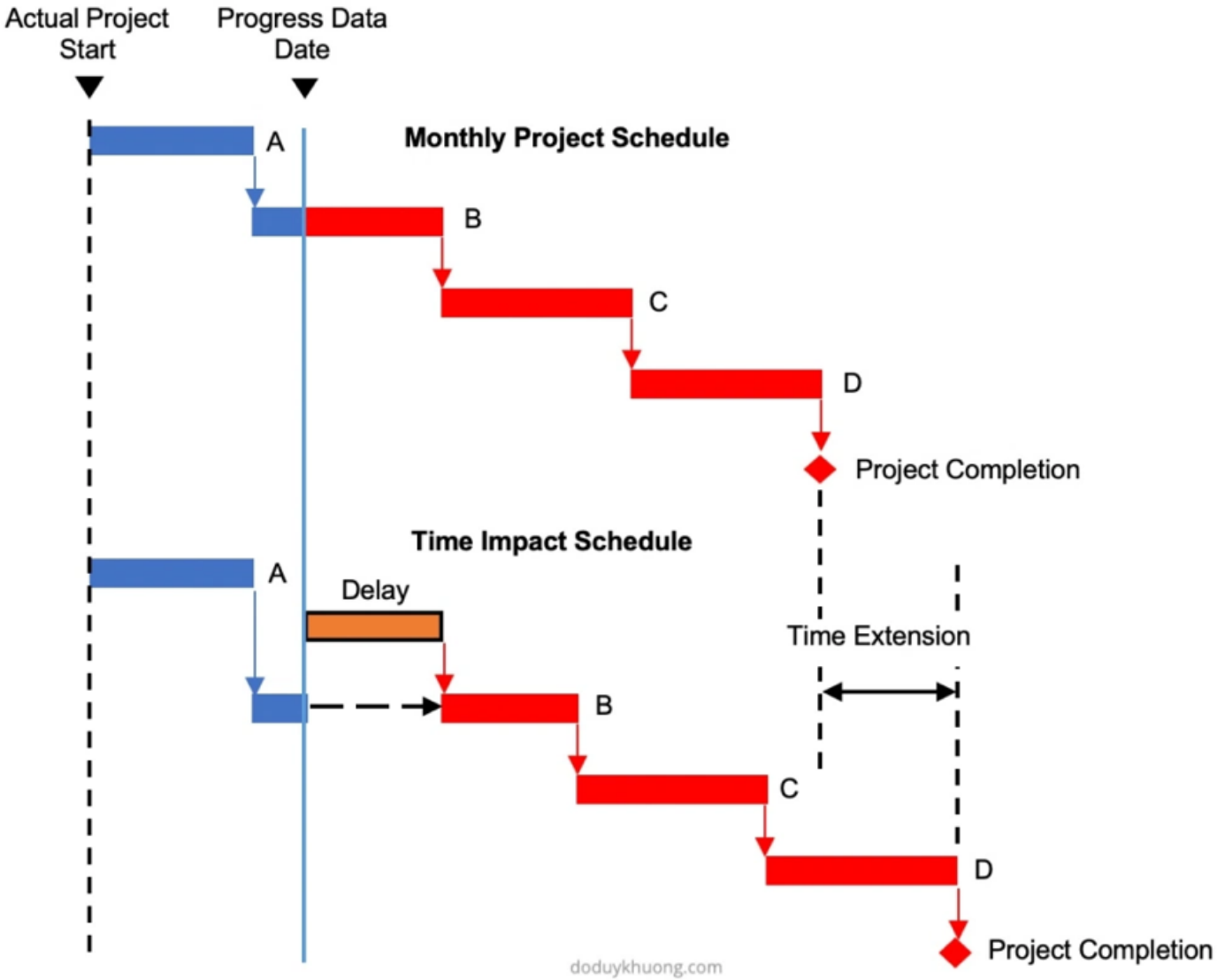
> The severe monsoonal rain, on top of the significant rainfalls in November and December, has had an adverse impact on mining operations and has cut access roads and rail networks.

## SUMMARY

Where *force majeure* is included in a contract which excuses one of the parties from performance, its meaning should ideally be defined in the contract. A rare example of a standard form which includes a definition of *force majeure* is the FIDIC conditions. If there is no definition in the contract, then in the event of a dispute, the court will be left to decide whether the events which have prevented performance are in fact a *force majeure*. Under UK law, there is no legal doctrine which applies to *force majeure*; the courts are therefore left to their own devices as to whether an event constitutes a *force*

*majeure*. Acts of God, strikes and breakdown of machinery have been held to be a *force majeure*. Shortages of materials and the downward spiral of world financial markets have been considered not to be *force majeure*. Events such as a pandemic and interruption of air traffic due to a volcano eruption, whilst not tested in court, are considered to be further examples of a *force majeure*.

# Typical Delay Analysis Methods inConstruction Claims



# Why do we need Delay Analysis in Construction Claims?

## Because The Delay Must Affect The Critical Path

The Construction Contracts often state that no adjustment to the critical milestones dates or the scheduled completion dates would be made unless the delay affects a critical path activity.

This concept is consistent with industry practice, as stated in the SCL Delay and Disruption Protocol 2nd Edition, page 6: *"Unless there is express provision to the contrary in the contract, where there is remaining total float in the programme at the time of an Employer Risk Event, an EOT [Extension of Time] should only be granted to the extent that the Employer Delay is predicted to reduce to below zero the total float on the critical path affected by the Employer Delay to Completion (i.e. if the Employer Delay is predicted to extend the critical path to completion)."*

AACE (International Recommended Practice No. 29R-03 Forensic Schedule Analysis, April 25, 2011, Section 1.5, B.6 Delay Must Affect the Critical Path, page 18) addresses this requirement: *"In order for a claimant to be entitled to an extension of contract time for a delay event (and further to be considered compensable), the delay must affect the critical path. This is because before a party is entitled to time-related compensation for damages it must show that it was actually damaged. Because conventionally a contractor's delay damages are a function of the overall duration of the project, there must be an increase in the duration of the project."*

So, if the effect of adding any delays to the schedule is that float is consumed, but no actual delay to the completion of the project results from adding the delays, then the Contractor has no time extension entitlement.

# Delay Analysis Methods

Delay analysis can be performed by a few methods.

The Society of Construction Law (SCL) Protocol 2nd Edition (Guidance Part B, paragraph no. 11) lists six common methods described in the table below.

| Method of Analysis | Analysis Type | Critical Path Determined | Delay Impact Determined | Requires |
|---|---|---|---|---|
| Impacted As-Planned Analysis | Cause & Effect | Prospectively | Prospectively | • Logic linked baseline programme.<br>• A selection of delay events to be modelled. |
| Time Impact Analysis | Cause & Effect | Contemporaneously | Prospectively | • Logic linked baseline programme.<br>• Update programmes or progress information with which to update the baseline programme.<br>• A selection of delay events to be modelled. |
| Time Slice Windows Analysis | Effect & Cause | Contemporaneously | Retrospectively | • Logic linked baseline programme.<br>• Update programmes or progress information with which to update the baseline programme. |
| As-Planned versus As-Built Windows Analysis | Effect & Cause | Contemporaneously | Retrospectively | • Baseline programme.<br>• As-built data. |
| Retrospective Longest Path Analysis | Effect & Cause | Retrospectively | Retrospectively | • Baseline programme.<br>• As-built programme. |
| Collapsed As-Built Analysis | Cause & Effect | Retrospectively | Retrospectively | • Logic linked as-built programme.<br>• A selection of delay events to be modelled. |



Delay Analysis methods according to SCL Delay & Disruption Protocol

AACE International's Recommended Practice No.29R-03 for Forensic Schedule Analysis (RP 29R-03) lists nine different methods described in the table below.

| Taxonomy | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | RETROSPECTIVE | | | | | | | | | | | | | | |
| 2 | OBSERVATIONAL | | | | | | | MODELED | | | | | | | |
| 3 | Static Logic | | | Dynamic Logic | | | | Additive | | | | Subtractive | | | |
| 4 | 3.1 Gross | 3.2 Periodic | | Contemporaneous Updates (3.3 As-is or 3.4 Split) | | 3.5 Modified / Reconstructed Updates | | 3.6 Single Base | | 3.7 Multi Base | | 3.8 Single Simulation | | 3.9 Multi Simulation | |
| 5 | | Fixed Periods | Variable Windows | All Periods | Grouped Periods | Fixed Periods | Variable Windows | Global Insertion | Stepped Insertion | Fixed Periods | Variable Windows or Grouped | Global Extraction | Stepped Extraction | Fixed Periods | Stepped Extraction |
| Common Names | As-Planned vs As-Built | Window Analysis | | Contemporaneous Period Analysis, Time Impact Analysis, Window Analysis | Contemporaneous Period Analysis, Time Impact Analysis, Window Analysis | Contemporaneous Period Analysis, Time Impact Analysis | Window Analysis, Time Impact Analysis | Impacted As-Planned, What-If | Time Impact Analysis, Impacted As-Planned | Time Impact Analysis | Window Analysis, Impacted As-Planned | Collapsed As-Built | Time Impact Analysis, Collapsed As-Built | Time Impact Analysis, Collapsed As-Built | Time Impact Analysis, Window Analysis, Collapsed As-Built |



Delay Analysis methods according to AACE International's Recommended Practice No.29R-03

# Concepts of Typical Delay Analysis Methods

## 1. Time Slice Windows Analysis

### What is Time Slice Windows Analysis:

Time Slice Windows Analysis is an observational, windows-based methodology that focuses on comparing as-planned, updated and as-built project schedules to identify and quantify delays to the critical path of the project.

### The Purpose of the Analysis:

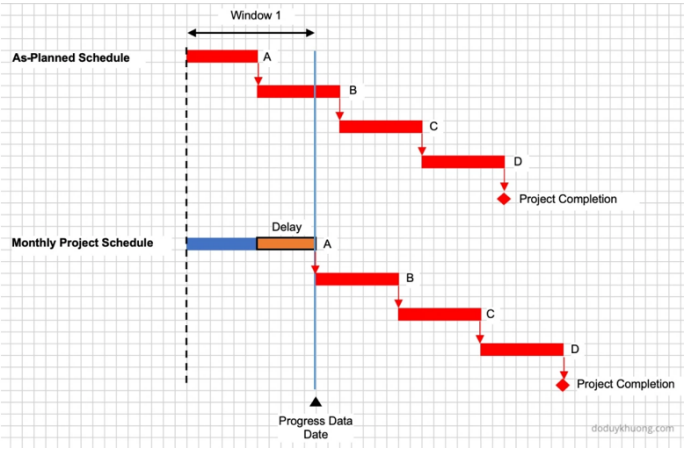
- This methodology is a retrospective analysis that uses the project schedule updates to quantify the slippage to the critical path during a select period of time;
- Once all critical path activity delays have been quantified, the origins and causes of each delay are determined. The responsibility for each delay is then apportioned to either the Contractor, Owner, a third party, if appropriate, and to force majeure or other excusable delays defined by the contract.

## Steps For Performing:

- Select schedule windows;
- Identify the critical path;
- Perform a detailed review of the schedules selected for the analysis;
- Determine the changes made between the schedules selected for the schedule windows;
- Develop variance tables to calculate date and duration variances;
- Research activity impacts and allocate responsibility for delays.

## Time Slice Windows Analysis Illustration:

The figure below illustrates how the Time Slice Windows Analysis method work. In the first window, the delay is quantified by comparing the planned finish date and the actual finish date of Activity A.




Time Slice Windows Analysis Illustration

# 2. Time Impact Analysis

## What is Time Impact Analysis:

Time Impact Analysis is a schedule delay analysis technique that adds delays or changes to the schedule which are updated up to the day before the delay occurred.

## The Purpose of the Analysis:

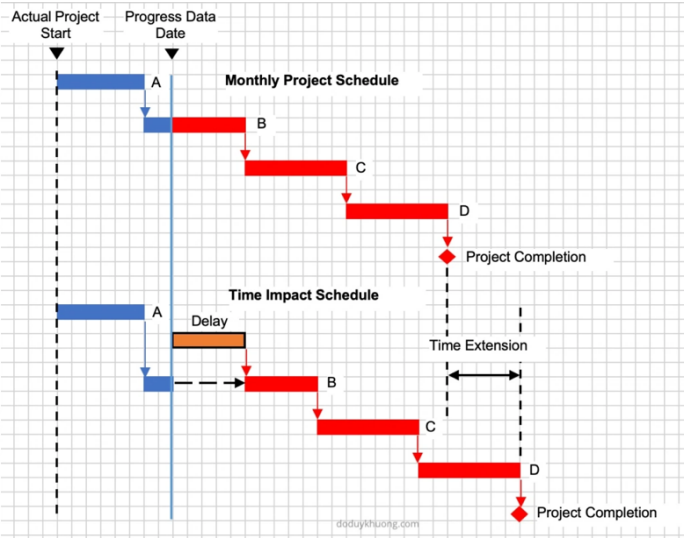
- To determine whether the overall completion date of the project is delayed, or remains the same as a result of the delays;
- To demonstrate a Contractor's entitlement to a time extension;
- To demonstrate a potential schedule acceleration;
- To demonstrate an Owner's entitlement to receive liquidated damages.

## Steps For Performing:

- Develop a fragnet to model the delay;
- Obtain the approved schedule which is updated up to the day before the delay occurred;
- Insert the fragnet into the approved schedule update and link to the impacted activities;
- Recompute the schedule and note a change in the project completion date;
- Determine the amount of project delay.

## Time Impact Analysis Illustration:

The figure below illustrates how the TIA method work. After identifying the right Monthly Project Schedule, the delay is added to the schedule to impact the project completion date. The variance of project completion date between the Monthly Project Schedule and the Time Impact Schedule is the Time Extension.




Time Impact Analysis Illustration

# 3. Collapsed As-Built / As-Built But-For Analysis

## What is Collapsed As-Built Analysis:

Collapsed As-Built Analysis is a retrospective schedule delay analysis technique that determines the earliest date that the project completion date, or a required milestone could have been achieved but-for the owner-caused / contractor-caused delays that occurred during the project.

## The Purpose of the Analysis:

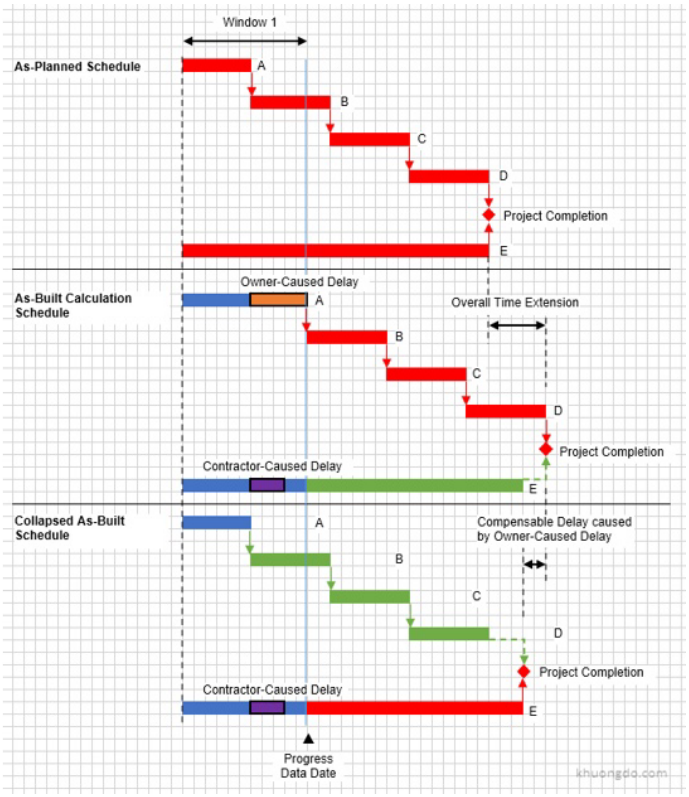
- To determine the compensable time extension by taking into account the concurrent delay situation;
- The Collapsed As-Built Analysis that removes contractor-caused delays is used to determine the time period between the actual completion date and the Collapsed As-Built completion date for assessment of liquidated damages by the owner.

## Steps For Performing:

- Develop a model of the as-built schedule, which is called the As-Built Calculation Schedule;
- Identify the owner-caused or contractor-caused delay;
- Interpret the results of removing delays from the As-Built Calculation Schedule.

## Collapsed As-Built Analysis Illustration:

The figure below illustrates how the Collapsed As-Built Analysis method work. The As-Built Calculation Schedule incorporates both owner-caused and contractor-caused delays. The period between the As-Planned Schedule and the As-Built Calculation Schedule is “Overall Time Extension”. After removing the Owner-caused Delay, the As-Built Calculation Schedule completion date collapses to an earlier completion date. The period between the As-Built Calculation Schedule and the Collapsed As-Built Schedule is the “Time Extension caused by the Owner-caused Delay”.


Window 1
As-Planned Schedule
A
B
C
D
Project Completion
E
Owner-Caused Delay
As-Built Calculation Schedule
A
Overall Time Extension
B
C
D
Project Completion
Contractor-Caused Delay
E
Collapsed As-Built Schedule
A
Compensable Delay caused by Owner-Caused Delay
B
C
D
Project Completion
Contractor-Caused Delay
E
Progress Data Date
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*Review*

# Construction Delay Analysis Techniques—A Review of Application Issues and Improvement Needs

**Nuhu Braimah**

Civil Engineering Department, School of Engineering and Design, Brunel University, Uxbridge, Middlesex UB8 3PH, UK; E-Mail: nuhu.braimah@brunel.ac.uk; Tel.: +44-0-1895-265-919; Fax: +44-0-1895-269-782

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**Abstract:** The time for performance of a project is usually of the essence to the employer and the contractor. This has made it quite imperative for contracting parties to analyse project delays for purposes of making right decisions on potential time and/or cost compensation claims. Over the years, existing delay analysis techniques (DATs) for aiding this decision-making have been helpful but have not succeeded in curbing the high incidence of disputes associated with delay claims resolutions. A major source of the disputes lies with the limitations and capabilities of the techniques in their practical use. Developing a good knowledge of these aspects of the techniques is of paramount importance in understanding the real problematic issues involved and their improvement needs. This paper seeks to develop such knowledge and understanding (as part of a wider research work) via: an evaluation of the most common DATs based on a case study, a review of the key relevant issues often not addressed by the techniques, and the necessary improvements needs. The evaluation confirmed that the various techniques yield different analysis results for the same delay claims scenario, mainly due to their unique application procedures. The issues that are often ignored in the analysis but would also affect delay analysis results are: functionality of the programming software employed for the analysis, resource loading and levelling requirements, resolving concurrent delays, and delay-pacing strategy. Improvement needs by way of incorporating these issues in the analysis and focusing on them in future research work are the key recommendations of the study.

**Keywords:** delay analysis; construction claims; extension of time; scheduling; damages

## 1. Introduction

The duration of contract performance has a direct effect on the profitability of construction projects from the perspective of all stakeholders [1,2]. For project owners, lost profits or benefits stem from being unable to make use of the project at the agreed date whilst to the contractor, extra cost will be incurred due to prolonged stay on site. Most standard forms of contract thus have provisions that anticipate delay brought about by the actions and/or inactions of the contractor, the owner or are outside the control of both parties. The contractor is often excused from the consequences and/or allowed compensation for any costs due to delays resulting from events or circumstances that are beyond its control. Contractual provisions also allow the owner to recover liquidated damages from the contractor for failure to deliver the project within the contract performance period. Liquidated damages clauses entitle the owner to recovery of a specified sum of money for each day or week of culpable delay. In both instances, a detailed schedule analysis is required to investigate the events that have actually caused the project to overrun. Over the years, owners and contractors have used various Delay Analysis Techniques (DATs) to achieve this. However, in the vast majority of cases, the parties are not able to settle delay claims amicably resulting in costly disputes after project completion [3–5].

Consequently, delay claims are now a major source of conflict in the construction industry and also one of the most difficult to resolve [6–8]. This has generated considerable initiatives from researchers and industry practitioners aimed at enhancing the application of existing DATs (see for example, [6,9–15]) and the development of "good practice" documents for providing guidance to practitioners on what the best application of the various techniques entails and the circumstances that dictate their proper use. Of such documents, the most notable are the "Delay and Disruption Protocol" [7] developed by the UK's Society of Construction Law and "Recommended Practice on Forensic Schedule Analysis" by the Association for Advancement of Cost Engineering International [16] of the USA.

In spite of the many contributions, proper analysis of delay claims which take into consideration the effect of a number of scheduling and delay issues is often lacking in practice [8,14,17]. Therefore, the need for greater awareness and incorporation of these issues in delay analysis is crucial to ensuring fairness and amicable resolution of delay claims. As part of a wider study aimed at addressing these issues, the purpose of this paper is to: discuss the most common existing DATs, as well as review the issues that are often missed in the analysis, and the required improvement needs. The scope of this wider study involves investigating the techniques' applications (in theory and in practice) thoroughly with the view to developing an appropriate framework for enhancing their proper usage, in order to help reduce the frequent delay claims resolution difficulties. This paper's presentation on DATs, as detailed in the next section, was done based on a hypothetical case study so as to clearly demonstrate the application processes of the techniques and their weaknesses in presenting (or defending) delay claims.

## 2. Existing Delay Analysis Techniques

The objective of delay analysis is to calculate the project delay and work backwards to try to identify how much of it is attributable to each party (contractor, owner, or neither) so that time and/or cost compensation can be decided. Questions that need to be answered here often include [3,18]:

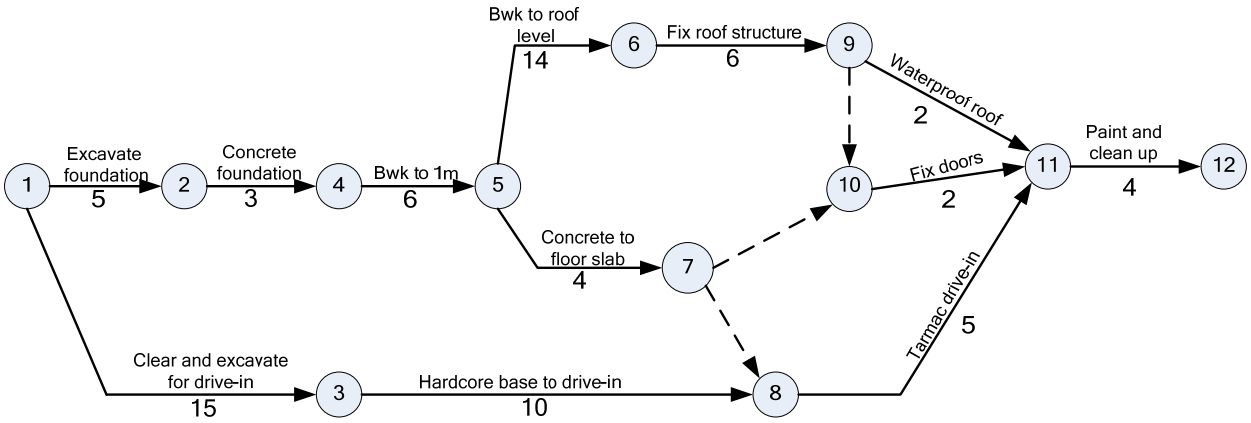
- what was supposed to happen?
- what did actually happen?
- what were the variances?
- how did they affect the project schedule?

The various DATs have varying capabilities in providing sound answers to these questions. The techniques can be grouped under non-Critical Path Method (CPM)-based techniques and CPM-based techniques. They have been reported by different authors in the literature using different names, with the most common techniques being: "as-planned *vs.* As-built", "impacted as-planned", "as-planned but for", "collapsed as-built", "window analysis", and "time impact analysis" (see, for example, [5–8,19–24]).

## 3. A Case Study Project

To critically evaluate the existing techniques, a simple case study has been designed and simulated with various delay scenarios. The case study project involves the construction of a small garage with the necessary approach drive-in, as shown in the network diagram of Figure 1, adopted from Pilcher [25].

**Figure 1.** Arrow diagram of the case-study project.




The as-planned programme of this project (in bar chart format for clarity) is as shown in Figure 2, indicating a total project duration of 40 days. The as-planned critical path, indicated in red bars, flows through activities of the garage structure, with a 5-day float on the path of drive-in activities.

The project started as scheduled but progress was affected by three main types of delay events: (1) Events for which the contractor assumes the risks of costs and the time consequences involved, which are often categorised as "Nonexcusable–Noncompensable" delays (NN); (2) events for which the contractor is entitled to both time extensions and recovery of extra cost consequential upon the delay ["Excusable Compensable" delays (EC)]; and finally, (3) those events for which no party has control over or bears the risks involved, (e.g., acts of God and strikes), which are often termed as "Excusable Non-compensable" (EN) delays.

**Figure 2.** As-planned schedule.

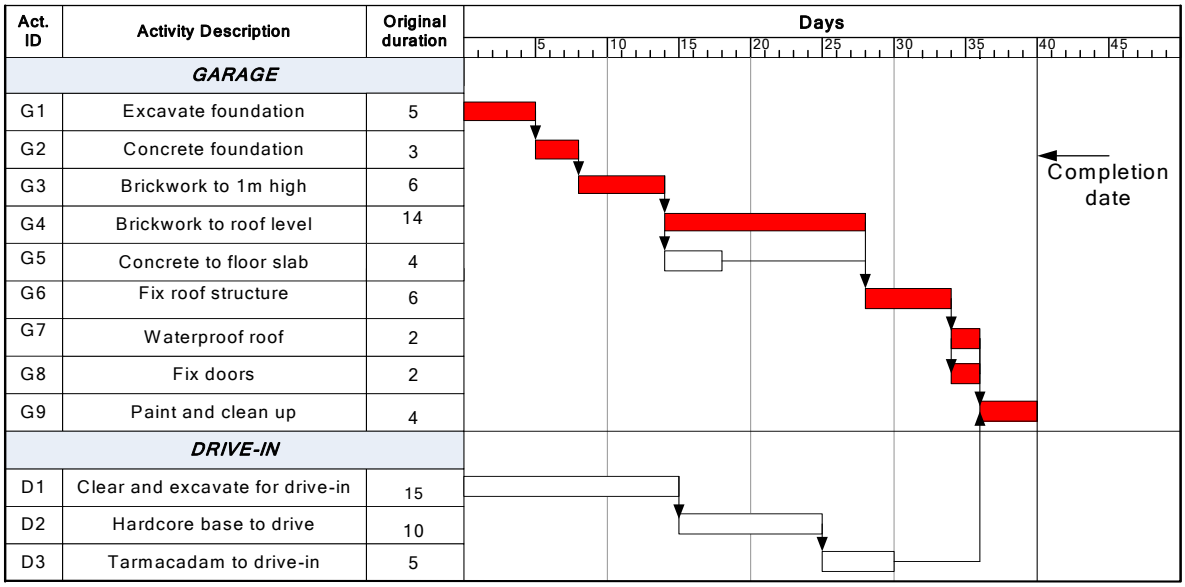



Table 1 below defines the delay scenarios encountered in the hypothetical project. The as-built schedule, which includes all delays that occurred during construction of the project, had total project duration of 51 days and a critical path along the drive-in activities (see Figure 3). To distinguish between the various delays, EC delays are indicated in dark horizontal strips and NN delays in dark diagonal strips. Apart from the delays, there were also changes in the planned sequence between some of the activities. The as-built programme thus shows start–start logic with lag of 2 days between the first two activities of the garage instead of the originally planned finish–start relationship. Similar logic with a lag of 3 days exists between the first two activities of the drive-in.

**Figure 3.** As-built schedule.

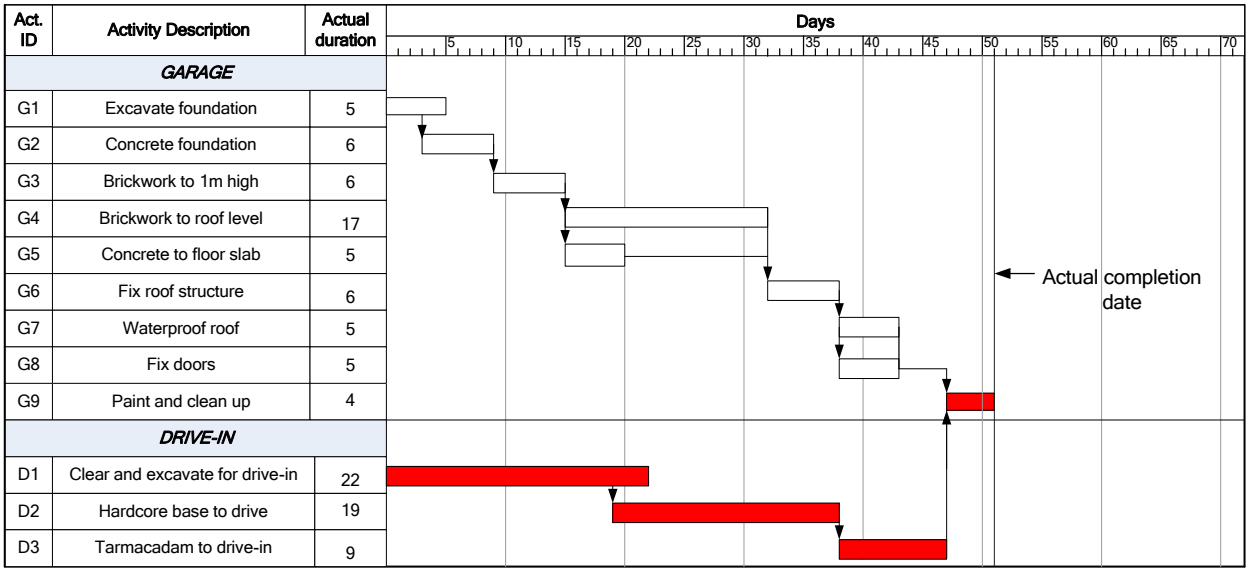


**Table 1.** Delays events that affected the sample project.

| Activity | As planned duration | Chronology of delays | Delay information | | | | |
|---|---|---|---|---|---|---|---|
| | | | Description | Type | Start date (day) | End date (day) | Duration (days) |
| Concrete foundations (G2) | 3 | 1 | Contractor had a labour problem so it took 3 days extra to complete activity G2. | NN | 6 | 9 | 3 |
| Clear and excavate for drive-in (D1) | 15 | 2 | Contractor encountered unforeseen adverse ground condition during excavation of the drive-in. | EC | 10 | 17 | 7 |
| Brickwork to roof level (G4) | 14 | 3 | Activity G4 did not start immediately after completion of its predecessor as-planned due to 1-day delay by the contractor's brick supplier. | NN | 15 | 16 | 1 |
| Concrete to floor slab (G5) | 4 | 4 | Contractor advised the owner on the need to increase the thickness of the floor slab. This change required 1 extra day to accomplish. | EC | 19 | 20 | 1 |
| Hardcore base to drive-in (D2) | 10 | 5 | After 5 days of working on activity D2, the owner suspended works for 3 days as a decision on the suitability of the hardcore material was being made. | EC | 24 | 28 | 4 |
| Brickwork to roof level (G4) | 14 | 6 | The owner ordered the contractor to add an extra window after the completion of G4. This design change caused 2-day delay. | EC | 30 | 32 | 2 |
| Hardcore base to drive-in (D2) | 10 | 7 | A quality control test revealed that certain sections of the drive-in base were poorly constructed. This defective work resulted in 5 days of rework by the contractor. | NN | 31 | 36 | 5 |
| Tarmacadam to drive-in (D3) | 5 | 8 | There was a 4-day delay by the owner in making available to the contractor an owner-furnished equipment for activity D3 | EC | 38 | 42 | 4 |
| Waterproof roof (G7) | 2 | 9 | It took the contractor 3 more days to complete activity G6. | NN | 40 | 43 | 3 |
| Fix doors (G8) | 2 | 10 | The owner changed his mind on the type of door used for the garage so ordered the contractor to make changes. This caused 3 extra days of work. | EC | 40 | 43 | 3 |

## 4. Project Delay Analysis Using the Various Techniques

### *4.1. As-Planned* vs. *As-Built*

Under this method, all delaying events (EC, EN and NN delays) encountered on the project are depicted on the as-built schedule. The difference between the as-planned and as-built completion dates is the amount of time for which the claimant will request for compensation. The critical path is determined once in the as-planned and again in the as-built schedule [8,22]. This technique and the net impact technique utilising bar chart are similar in that they all show the net effect of all claimed delays. By the approach of Stumpf [24], the following illustrates the allocation of delay responsibility between the owner and the contractor for the sample project.

Sum of contractor-caused delays (NN) = $\Sigma NN_i = 3 + 1 + 5 + 3 = 12$ days (see Table 1);

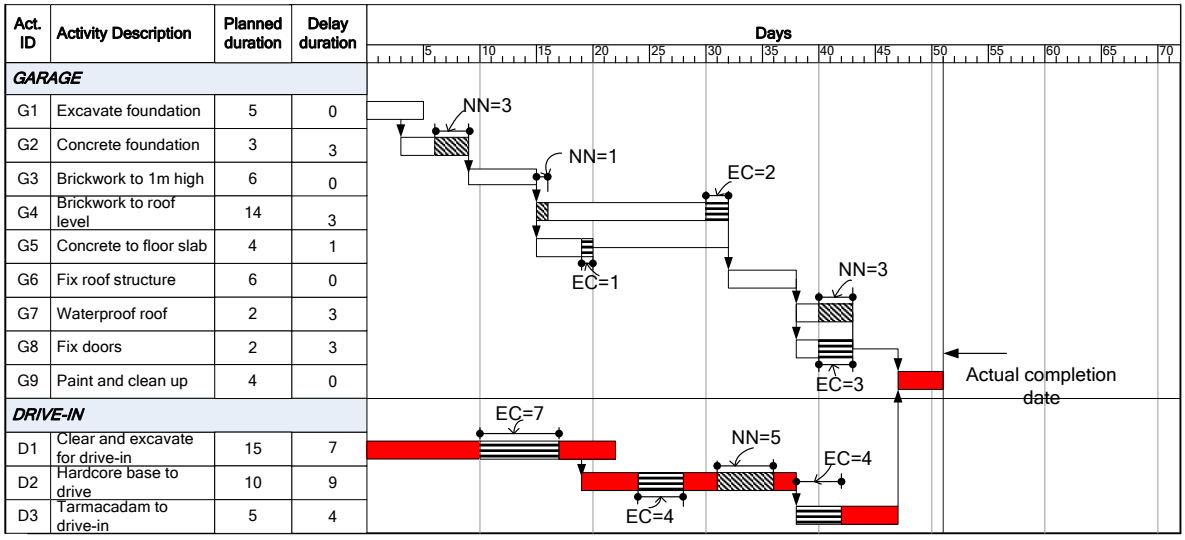
Sum of owner-caused delays (EC) = $\Sigma EC_i = 7 + 1 + 4 + 2 + 4 + 3 = 21$ days (see Table 1).

From the above, the assumption is that concurrent delay due to both parties is 12 days ("*i.e.*", the lower of the above two types of delays). Therefore, net project delays for which the owner is responsible = 21 − 12 = 9 days;

From Figures 2 and 4, the net total project delay = 51 − 40 = 11 days, the balance is the contractor responsibility, which is 11 − 9 = 2 days. The limitations of this methodology are:

- it does not scrutinize delay types and this makes it easy for it to be manipulated and distorted to reflect either the position of the claimant or the defendant;
- it ignores the dynamic nature of the critical path and any changes in schedule logic [20,24,26];
- no attempt is made to determine the individual impact of each delay on the project completion. All delays, including delays on non-critical path, were summed up and their net effect calculated.

**Figure 4.** As-built schedule with delays.



### *4.2. Impacted As-Planned*

This method measures the impact of the delays on the contractor's as-planned CPM schedule. The various delays are formulated as activities and added to the as-planned network in a chronological order showing the effect of each delay at a time and demonstrating how the project is being delayed [27]. The amount of delay equals the difference in completion dates between the schedules before and after the impacts. The technique can be used for analysis of delay during and after project completion.

Delay analysis of the sample project using this technique was carried out by sequential addition of the delays to the as-planned schedule. The impact of each delay is as shown in Figures 5–13 below.

**Figure 5.** Impact of first delay.

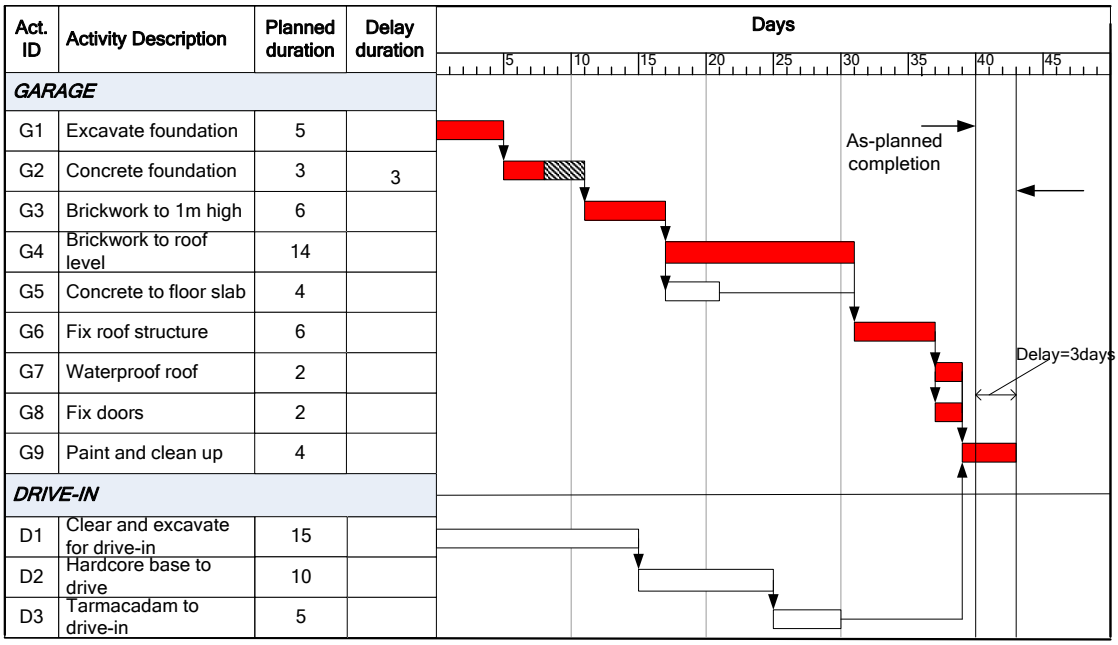



**Figure 6.** Impact of second delay.

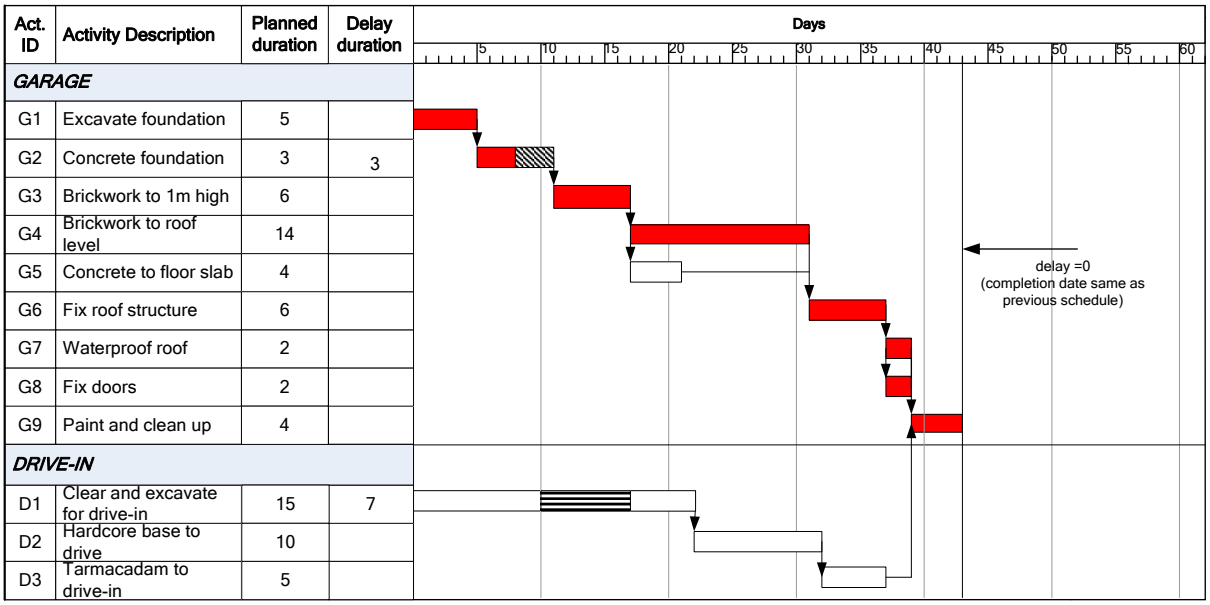


**Figure 7.** Impact of third delay.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1 |
| G5 | Concrete to floor slab | 4 | |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | |
| D3 | Tarmacadam to drive-in | 5 | |

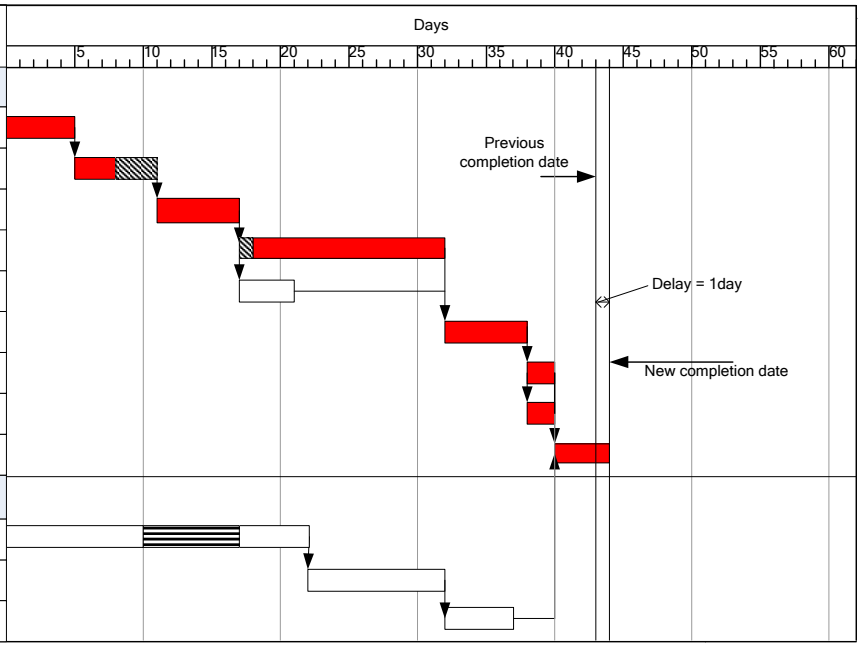



**Figure 8.** Impact of fourth delay.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | |
| D3 | Tarmacadam to drive-in | 5 | |

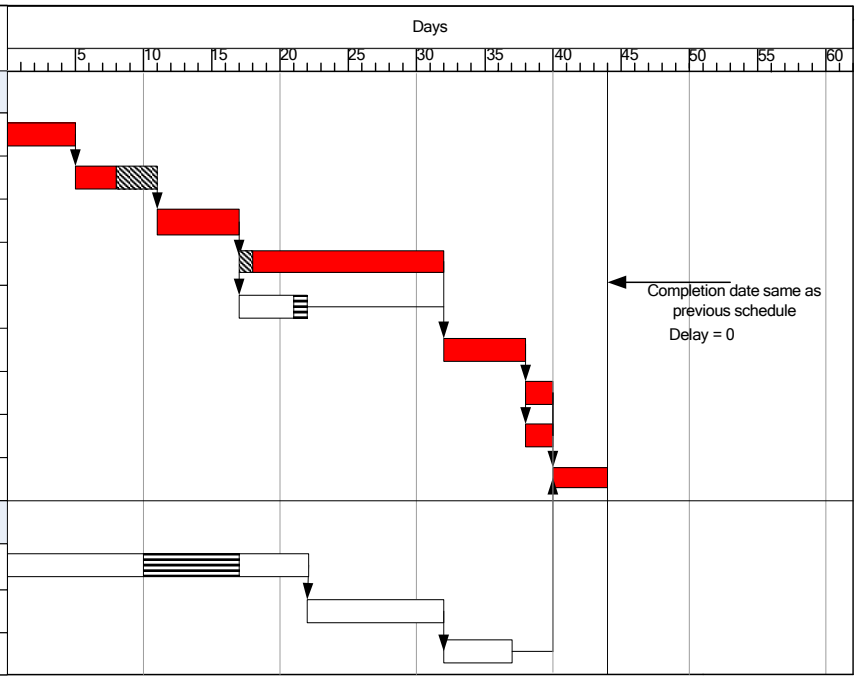
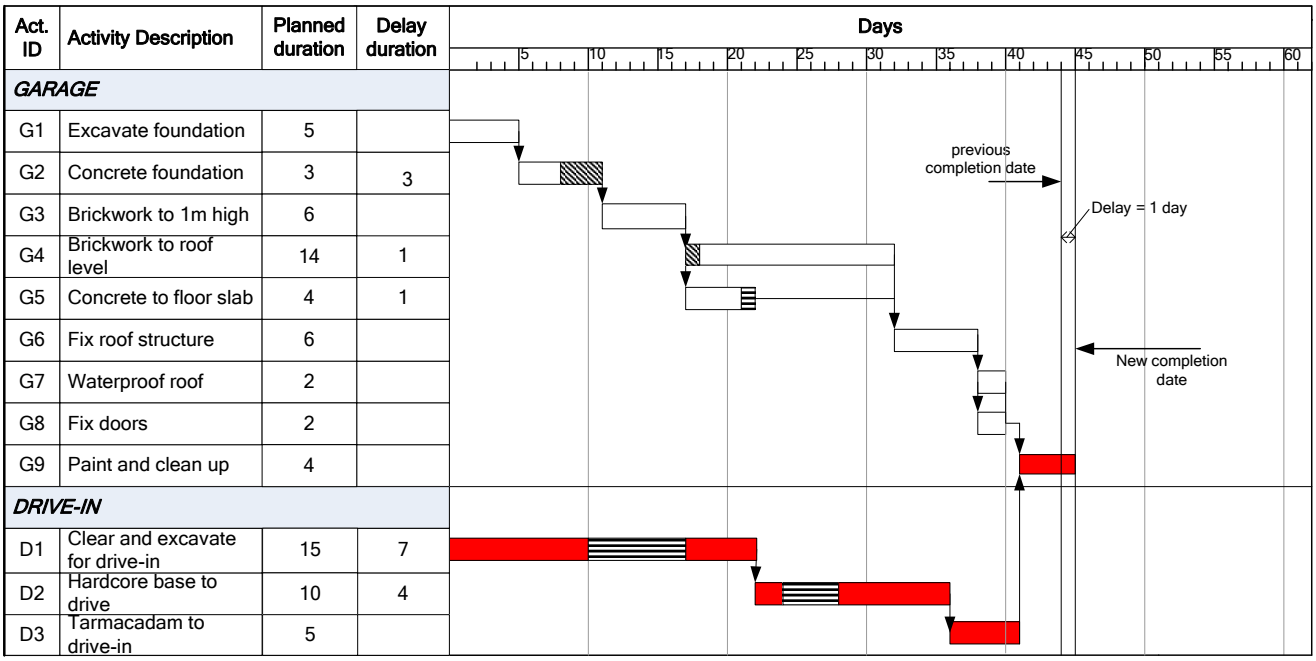


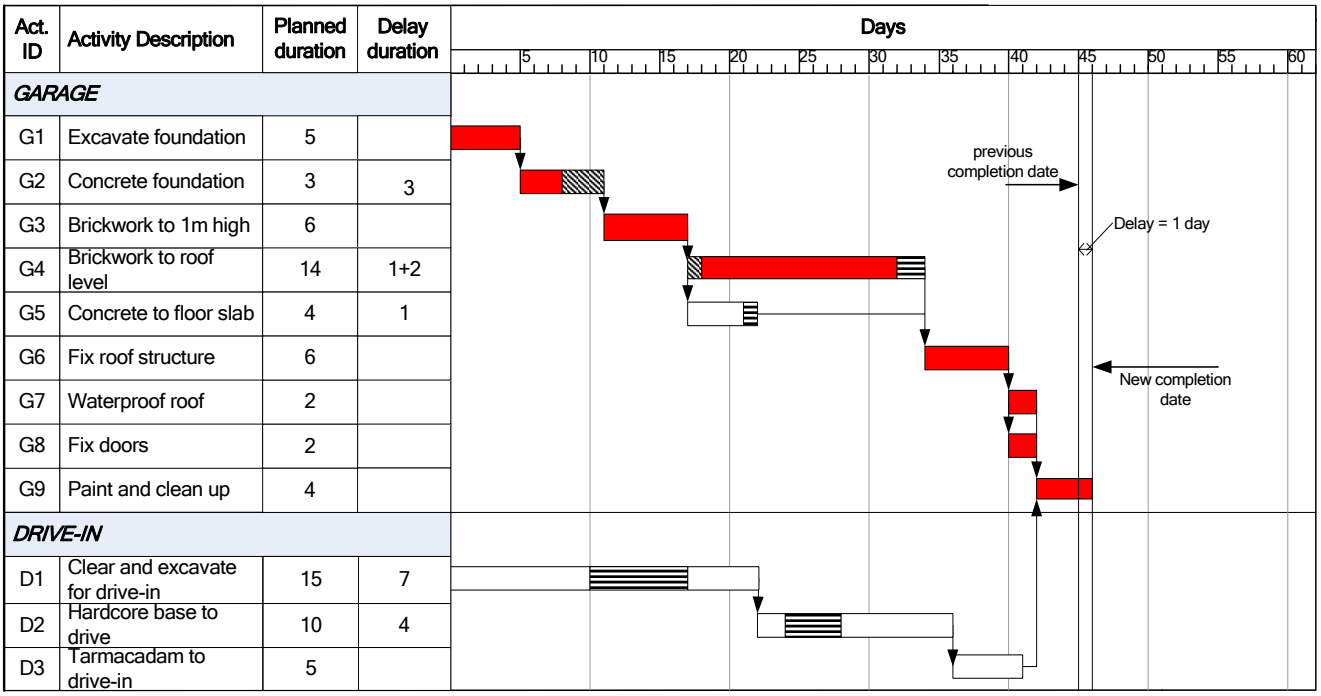
**Figure 9.** Impact of fifth delay.



| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4 |
| D3 | Tarmacadam to drive-in | 5 | |



**Figure 10.** Impact of sixth delay.



| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1+2 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4 |
| D3 | Tarmacadam to drive-in | 5 | |

**Figure 11.** Impact of seventh delay.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1+2 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4+5 |
| D3 | Tarmacadam to drive-in | 5 | |

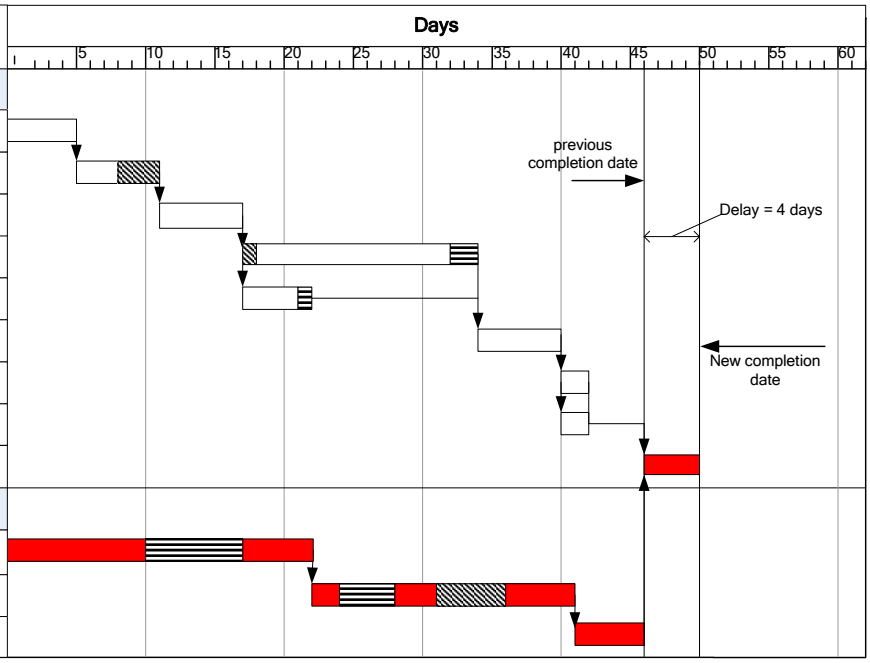



**Figure 12.** Impact of eighth delay.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| *GARAGE* | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1+2 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| *DRIVE-IN* | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4+5 |
| D3 | Tarmacadam to drive-in | 5 | 4 |

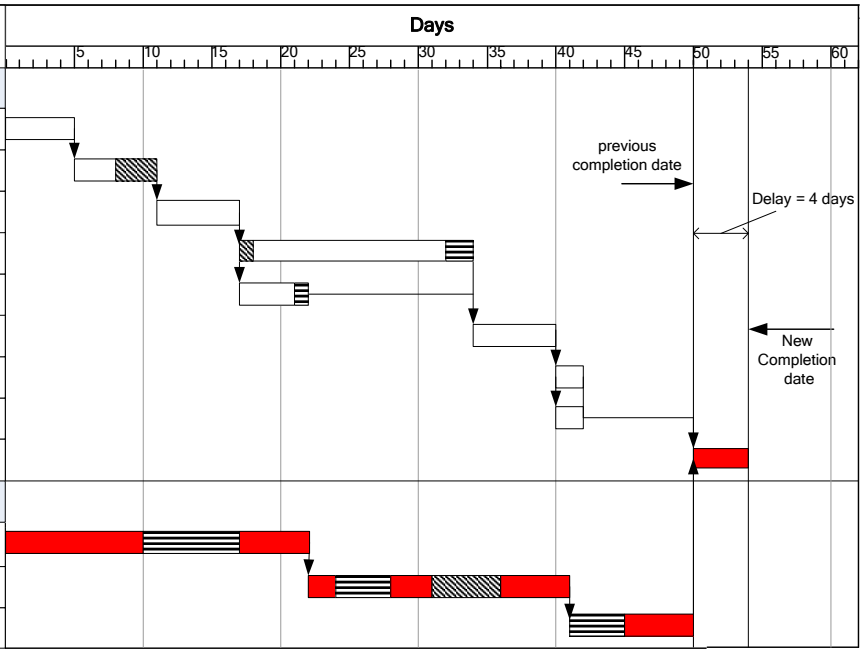
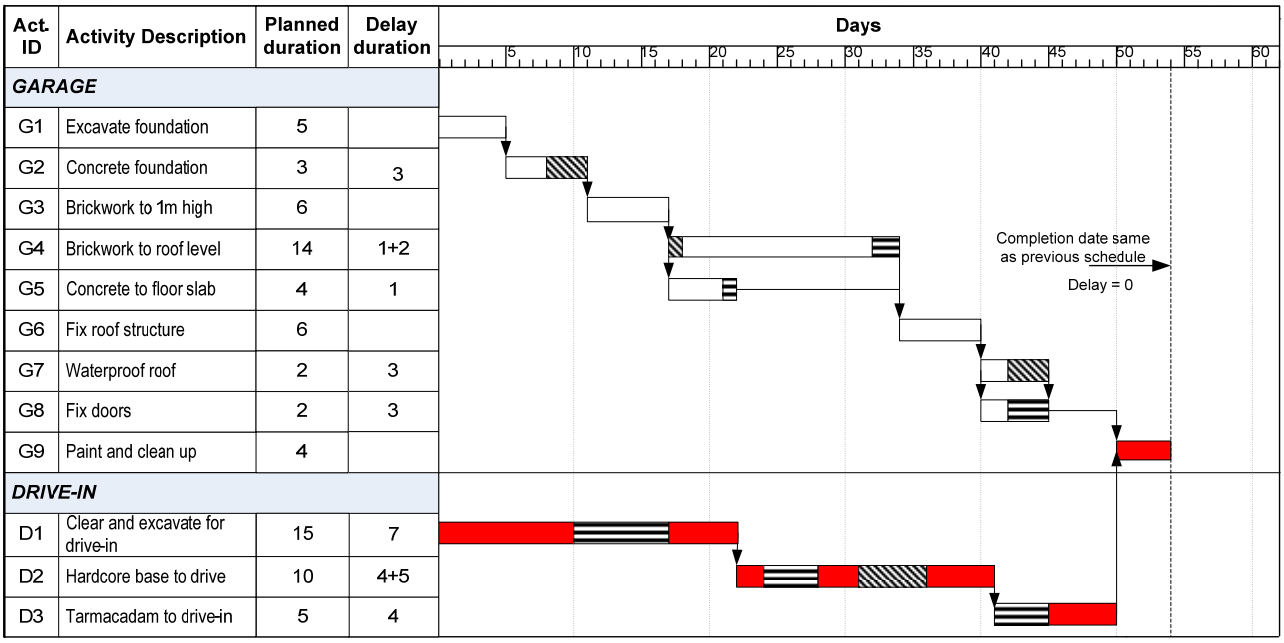


**Figure 13.** Impact of ninth and tenth delays.




The first delay (NN = 3) was on the critical path, G1-G2-G3-G4-G6-G7-G8-G9 so it caused 3 days of slippage to the as-planned programme. The second, fourth, ninth and tenth delays were on non-critical paths so their impacts did not cause any slippage. The impacts of fifth, seventh and eighth delays caused project slippage on the critical path, D1-D2-D3-G9. A summary of the results obtained are as shown in Table 2.

**Table 2.** Impacted as-planned results.

| Chronology of delays | Activity | Delay | | |
|---|---|---|---|---|
| | | Type | Duration (days) | Impact (days) |
| 1 | G2 | NN | 3 | 3 |
| 2 | D1 | EC | 7 | 0 |
| 3 | G4 | NN | 1 | 1 |
| 4 | G5 | EC | 1 | 0 |
| 5 | D2 | EC | 4 | 1 |
| 6 | G4 | EC | 2 | 1 |
| 7 | D2 | NN | 5 | 4 |
| 8 | D3 | EC | 4 | 4 |
| 9 and 10 | G7 and G8 | NN and EC | 3 and 3 | 0 |

From Table 2, the owner is responsible for six days of delay to the project whilst the contractor is responsible for 8 days. The sum of these delays is greater than the actual project delay of 11 delays because of the failure of this technique to consider any changes in the as-planned programme, which is by maintaining the original finished–start relationship of all activities in the analyses.

The limitations of this method include the following:

- it uses fixed as-planned schedule to analyse delays out of context and time [24,26];

- the original baseline programme may not be a realistic model on which to base the whole analysis;
- it has the potential of failing to consider the delays of all parties especially that of the claimant ("*i.e.*", being one-sided);
- potential disputes over the adequacy of the as-planned schedule because it is not economically possible, nor does it makes sense, to schedule the entire project in detail at its inception [3].

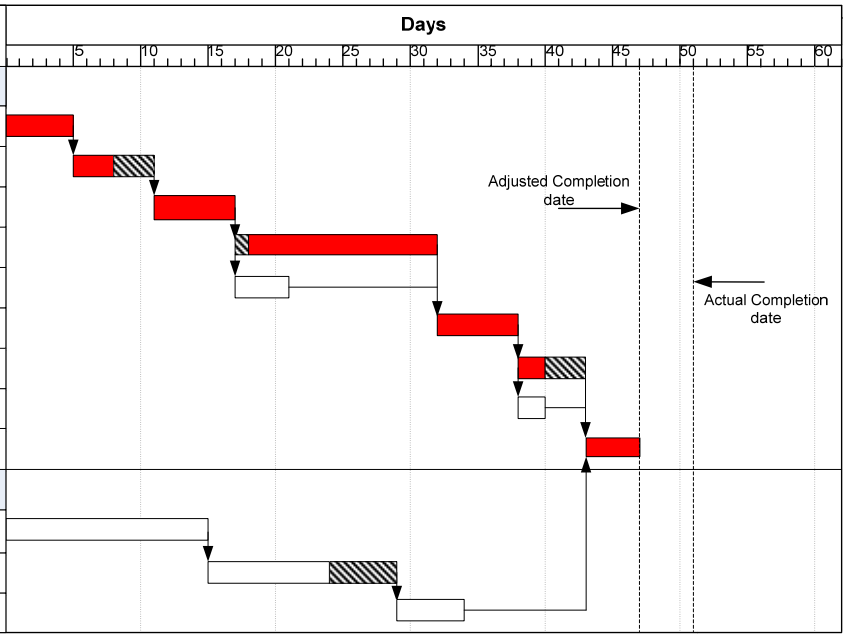
### *4.3. As-Planned But for*

This method entails injecting the as-planned schedules with all the delays of a particular party to form an adjusted schedule. The completion date of this adjusted as-planned schedule compared with the actual completion date gives the amount of delay for which the other party is responsible [8,19,22]. A contractor using this method would identify and add all non-excusable delays to the as-planned schedule, whereas the owner would add all excusable delays. The advantage of this method is that it can be performed quickly because there is no need to consider actual progress of the work. This technique is applied to the sample project first for contractor's point of view and then for owner's point of view.

*Contractor's point of view*: Under this, all the contractor-caused delays were impacted on the as-planned schedule. This resulted in an adjusted as-planned schedule with completion date as day 47 and G1-G2-G3-G4-G6-G7-G8-G9 as the critical path (see Figure 14 below). With the actual completion date as day 51, the owner is responsible for 4 days' project delay, which could be charged as compensable delay. The amount of delay for which the contractor is responsible is 47 − 40 = 7 days, where 40 is the original as-planned completion date.

**Figure 14.** As-planned schedule impacted with contractor's delays.

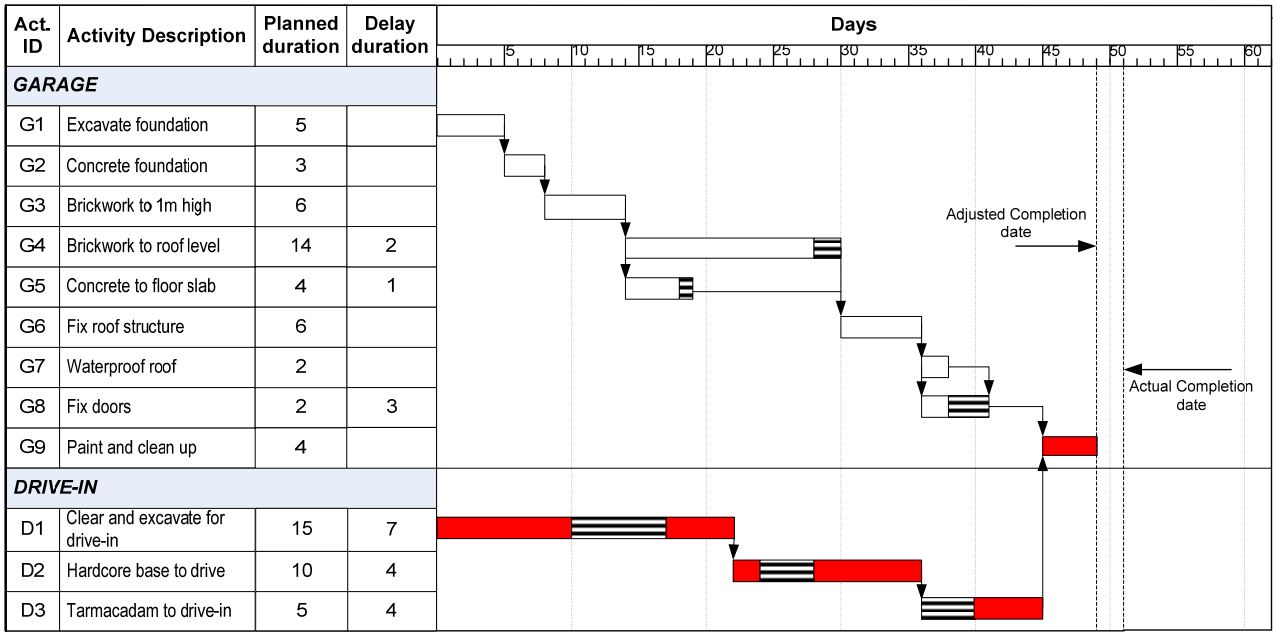
| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| ***GARAGE*** | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1 |
| G5 | Concrete to floor slab | 4 | |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | 3 |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| ***DRIVE-IN*** | | | |
| D1 | Clear and excavate for drive-in | 15 | |
| D2 | Hardcore base to drive | 10 | 5 |
| D3 | Tarmacadam to drive-in | 5 | |




*Owner's point of view*: Under this, all the owner-caused delays were impacted on the as-planned schedule. This resulted in an adjusted as-planned schedule with completion date as day 49

and D1-D2-D3-G9 as the critical path (see Figure 15 below). With actual completion date as day 51, the contractor is responsible for 2 days' project delay, which could be charged for liquidated damages by the owner. The owner is then responsible for the difference between the adjusted schedule and the original completion date, *i.e.*, 49 − 40 = 9 days.

**Figure 15.** As-planned schedule impacted with owner's delays.




The limitations of this method include the following:

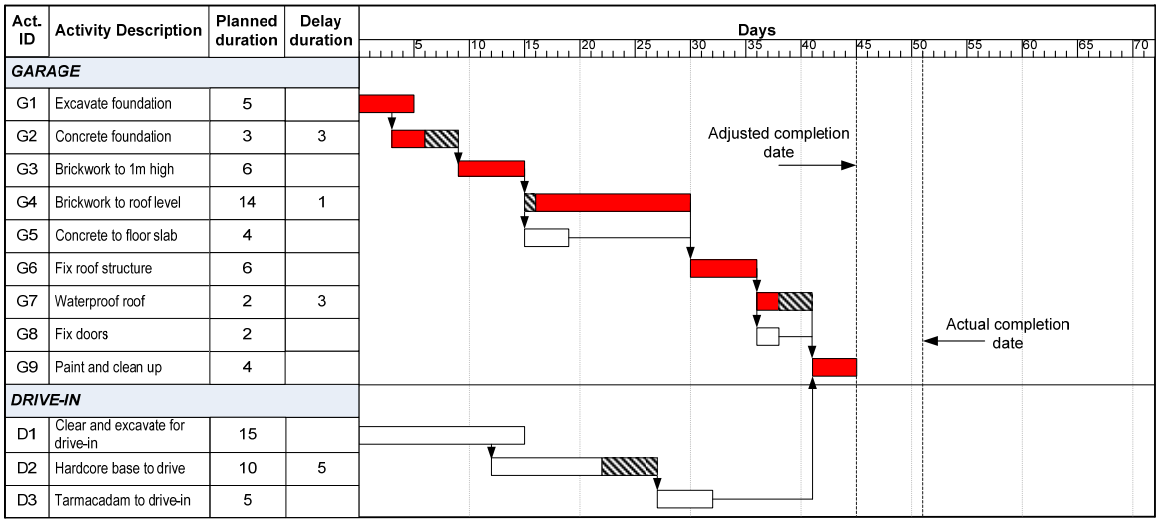
- it does not take into account any changes in the critical path schedule during the course of the project [19];
- it assumes that the planned construction sequence remains valid during the project duration [5];
- owner's point of view and contractor's point of view may yield different results resulting in disputes (as this case shows).

### *4.4. Collapsed As-Built*

In principle, this method is a form of "but for" which does not use the as-planned as a baseline schedule, but rather uses the as-built schedule (and thus also referred to as "as-built but for" technique). It involves removing the delays of each party from the as-built network so that the resulting schedule will give the completion date of the project but for the delays of the other party [18,24]. Like the previous technique, this technique is applied to the sample project first for contractor's point of view and then for owner's point of view as follows:

*Contractor's point of view*: Under this, all owner-caused delays were subtracted from the as-built schedule resulting in a collapsed as-built schedule of completion date as day 45 and critical path G1-G2-G3-G4-G6-G7-G8-G9 (see Figure 16).

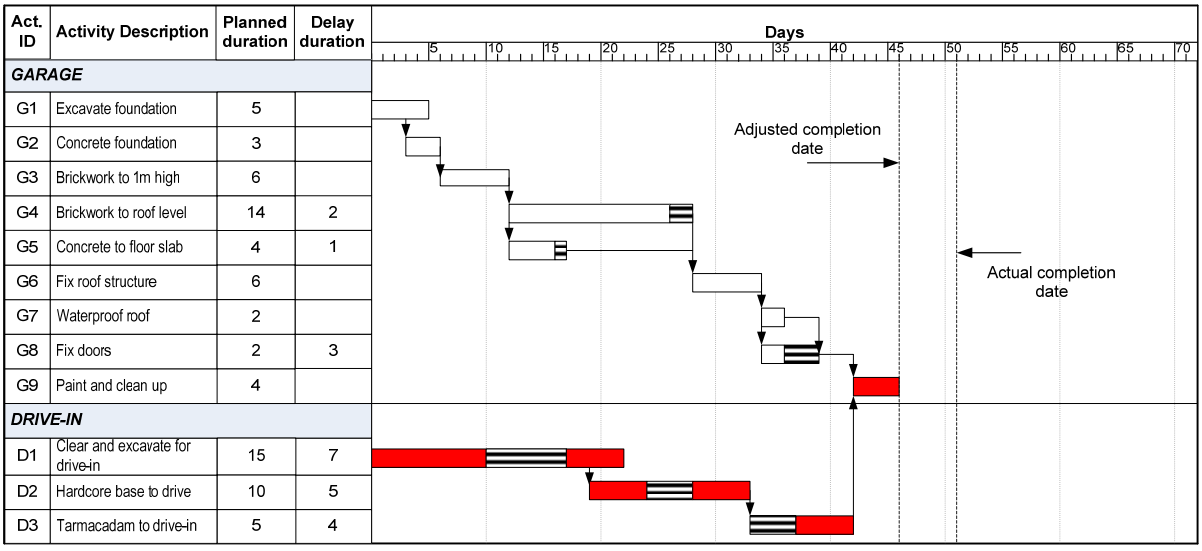
**Figure 16.** As-built schedule with owner's delays subtracted.




With actual completion date as day 51, the owner is responsible for 6 days of the (51–45) project delay, which could be charged as compensable delay. Comparing the collapsed as-built schedule with the original schedule gives 45 − 40 = 5 days project delay, as caused by the contractor.

*Owner's point of view*: Under this, all contractor-caused delays were subtracted from the as-built schedule resulting in a collapsed as-built schedule of completion date as day 46 and critical path D1-D2-D3-G9 (see Figure 17). With actual completion date as day 51, the contractor is responsible for 5 days of project delay, which could be charged for liquidated damages. Comparing the collapsed as-built schedule with the original schedule gives 46 − 40 = 6 days project delay as that caused by the owner.

**Figure 17.** As-built schedule with contractor's delays subtracted.




This technique and the "as-planned but for" could give similar results if the planned logic remains unchanged in the course of the project. The perceived advantage of this technique is that it is based on actual events on the project, making it one of the techniques of high credibility [5]. However, its shortcomings include the following:

- in collapsing the schedule, the analyst is typically forced to insert after-the-fact logic ties which may not reflect the thinking of the executor of the schedule during actual performance [5];
- the removal of the delays from the schedule could result in an unrealistic as-built but-for schedule, particularly when the schedule sequence has been so much impacted by those delays;
- adjusting the collapsed schedule to suit what the contractor is likely to follow requires experience and sound judgement beyond the capability of most analysts [18];
- it ignores the circumstances at the time of the delay and the dynamic nature of the critical path;
- the identification of the as-built critical path requires great deal of effort on judgement and schedule manipulation [20];
- the use of as-built information to prepare the as-built schedule is subjective and highly amenable to manipulation [27].

### *4.5. "Window" Analysis*

This technique involves interim assessment of delay on updated schedules at specific periods of the project. This is similar to the "snapshot technique" described by Alkass [19] and "contemporaneous period analysis" described by Schumacher [2]. First, the total project duration is divided into a number time periods (windows or snapshots) usually based on major changes in planning or major project milestones [6,8]. The schedule within each window is updated to reflect the actual durations and sequence at the time of the delay while the remaining as-planned schedule beyond the window period is maintained. Analyses are performed to determine the critical path and new completion date. This new completion date is compared with the as-planned completion date prior to this analysis to give the amount of delay during that window period.

Applying this technique to the sample project, the total contract period was first broken into discrete time periods at days 10, 21, 32, 40 and 51, resulting in 5 "window" periods. Analysis was carried out for each "window" successively at the various updates as shown in Figures 18–22 below.

**Figure 18.** Updated schedule on day 10.

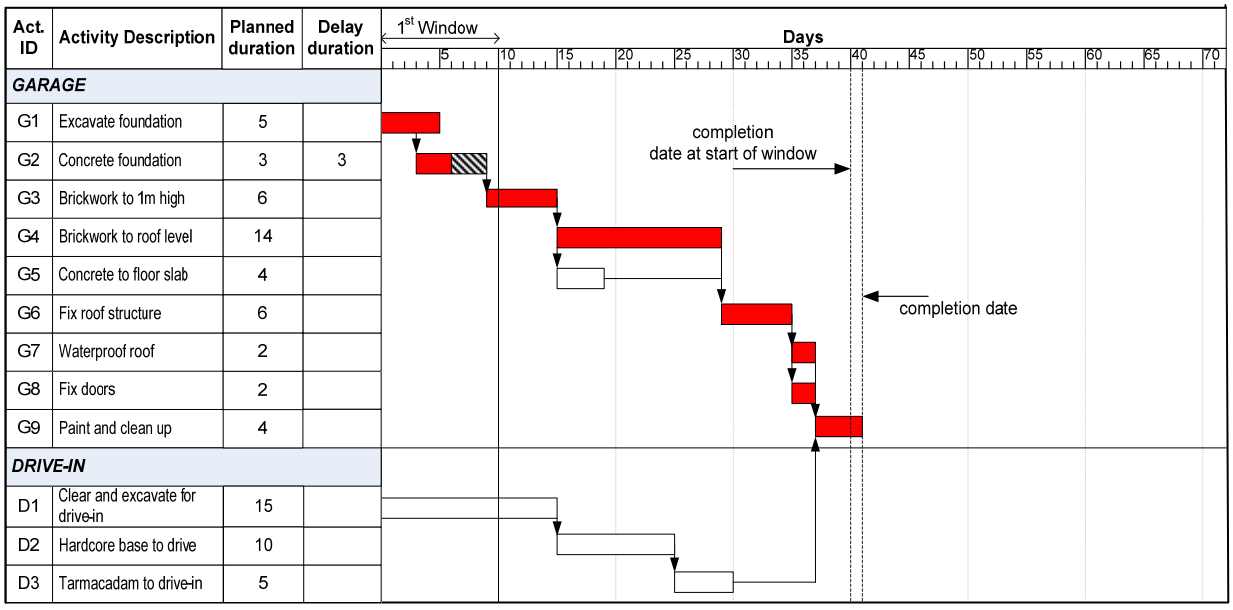


**Figure 19.** Updated schedule on day 21.

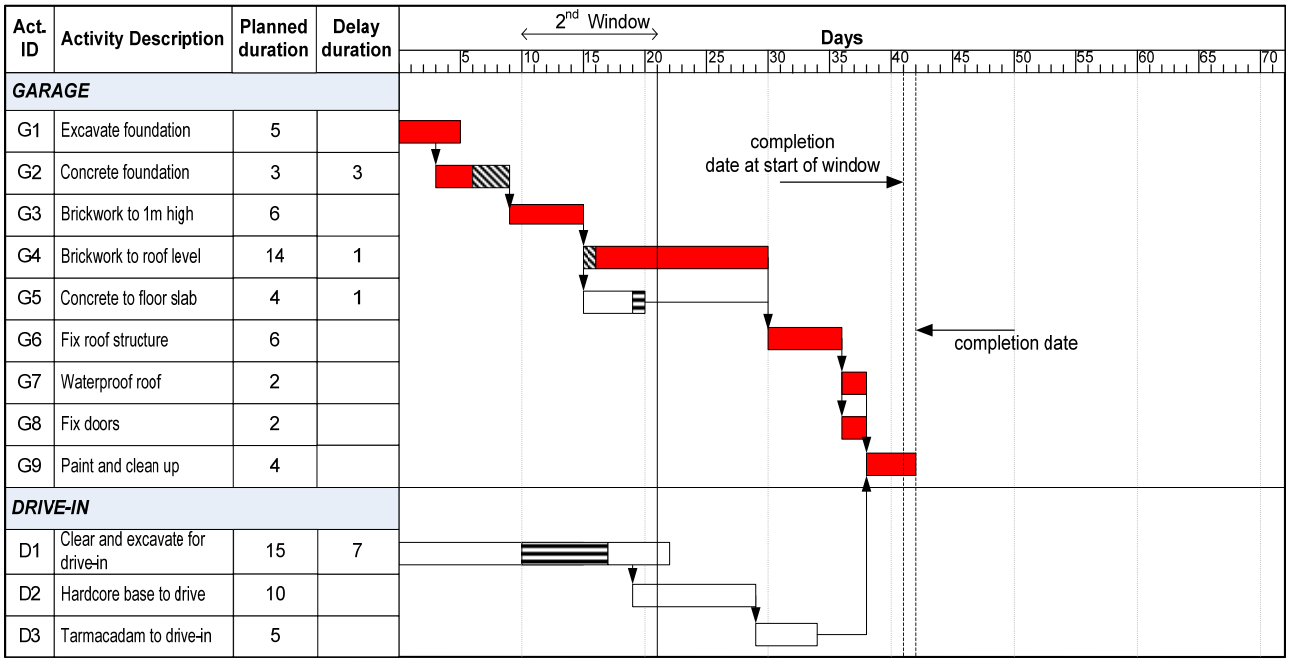



**Figure 20.** Updated schedule on day 32.

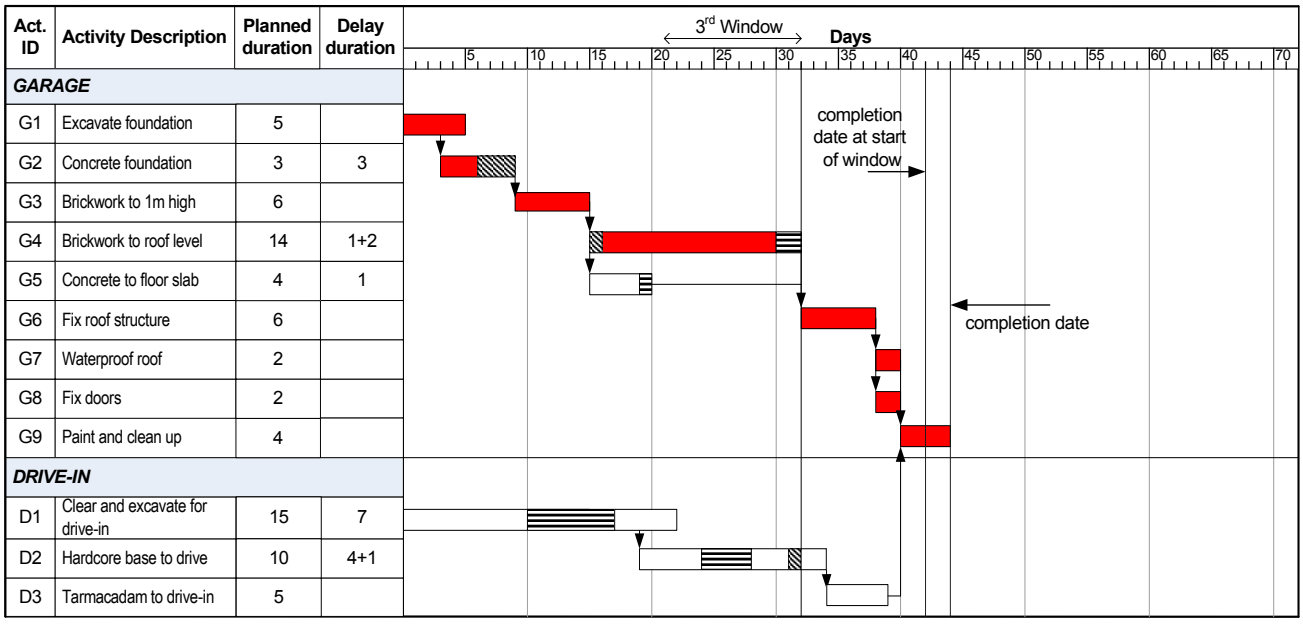


**Figure 21.** Updated schedule on day 40.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| ***GARAGE*** | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1+2 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | |
| G8 | Fix doors | 2 | |
| G9 | Paint and clean up | 4 | |
| ***DRIVE-IN*** | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4+5 |
| D3 | Tarmacadam to drive-in | 5 | 2 |

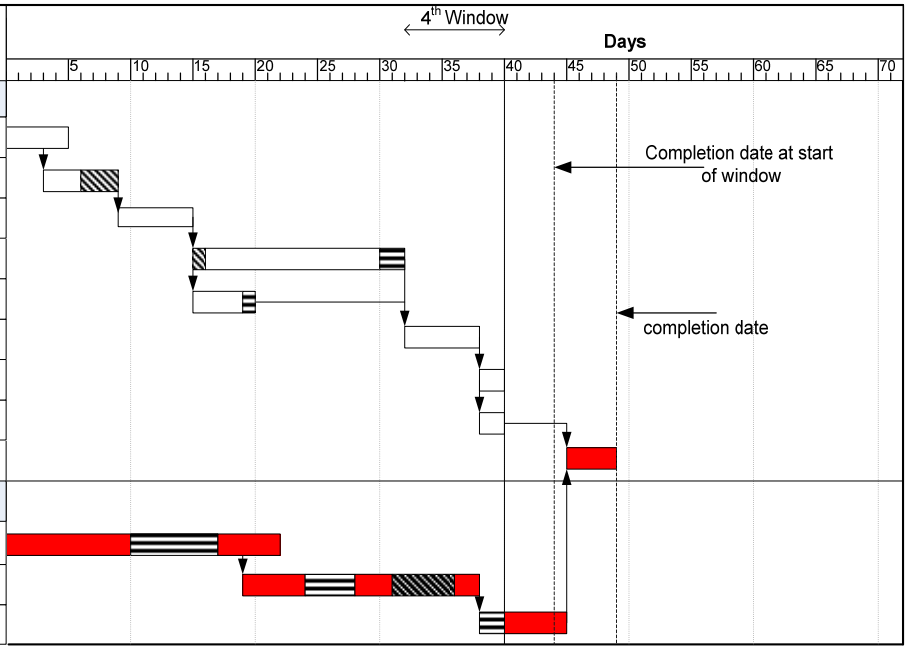
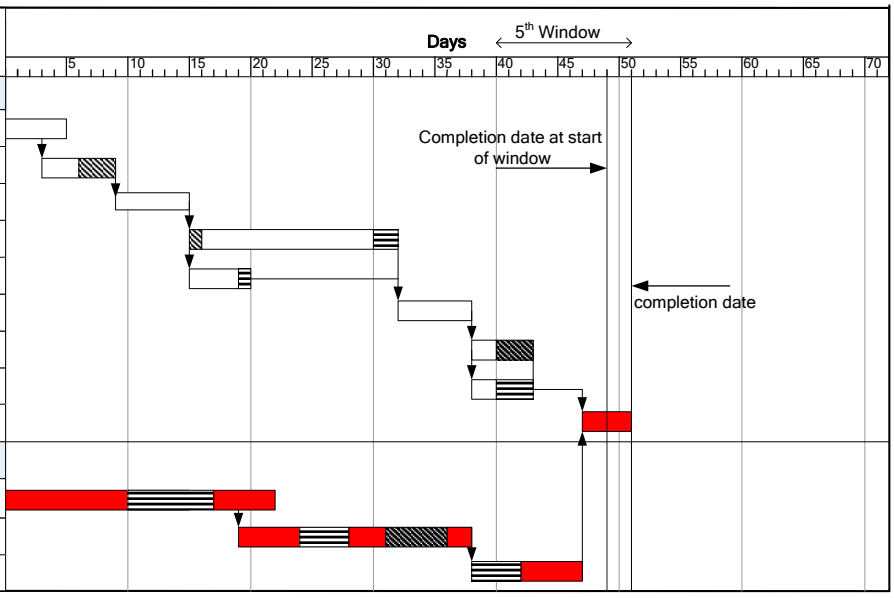



**Figure 22.** Updated schedule on day 51.

| Act. ID | Activity Description | Planned duration | Delay duration |
|---|---|---|---|
| ***GARAGE*** | | | |
| G1 | Excavate foundation | 5 | |
| G2 | Concrete foundation | 3 | 3 |
| G3 | Brickwork to 1m high | 6 | |
| G4 | Brickwork to roof level | 14 | 1+2 |
| G5 | Concrete to floor slab | 4 | 1 |
| G6 | Fix roof structure | 6 | |
| G7 | Waterproof roof | 2 | 3 |
| G8 | Fix doors | 2 | 3 |
| G9 | Paint and clean up | 4 | |
| ***DRIVE-IN*** | | | |
| D1 | Clear and excavate for drive-in | 15 | 7 |
| D2 | Hardcore base to drive | 10 | 4+5 |
| D3 | Tarmacadam to drive-in | 5 | 4 |




There was 1-day slippage at the end of the 1st window due to 3 days' delay by the contractor on the critical path G1-G2-G3-G4-G6-G7-G8-G9. The updated schedule at the end of the 2nd window showed 1 day slippage due to 1-day delay by the contractor on the critical path. There was 2 days of project delay at the end of the 3rd window as a result of 2 days delay by the owner on the critical path. The critical path changed to D1-D2-D3-G9 at the end of the 4th window, resulting in 5 days slippage. By "but for" analysis, the contractor's delay responsibility within this window is 2 days while that of the owner is 3 days. At the end of the last window, further 2 days' slippage was caused by the owner along the critical path, D1-D2-D3-G9. Table 3 below gives a summary of the results of this analysis.

**Table 3.** "Window" analysis results.

| Window number | Schedule update (day No.) | Completion date (day No.) | Delays in window | |
|---|---|---|---|---|
| | | | EC | NN |
| 0 (start) | 0 | 40 | 0 | 0 |
| 1 | 10 | 41 | 0 | 1 |
| 2 | 21 | 42 | 0 | 1 |
| 3 | 31 | 44 | 2 | 0 |
| 4 | 39 | 49 | 3 | 2 |
| 5 (completion) | 51 | 51 | 2 | 0 |
| | Total | | 7 | 4 |

Thus the contractor is responsible for 4 delays to the project whilst the owner is responsible for 7 days' delay. A major advantage of this method is that it divides a complicated network into a manageable one and also takes into account the dynamic nature of the critical path. This method offers a very effective approach to analysing delays and the more snapshots or windows used the better the accuracy of the results. However, the limitations of this technique include:

- it is time consuming and costly to operate and also demands complete project records, which are often not available;
- differences in the time periods (or "windows") can produce different results [14];
- periodic updates may not be existing which may then require the analyst to perform a highly laborious analysis of project records to create updates.

### *4.6. Time Impact Analysis*

This technique is a variant of the window technique described above, with the difference being that the time impact technique concentrates on a specific delay or delaying event but not on time periods containing delays or delaying events [19].

A stop-action picture of the project is developed each time it experiences a major delay situation. The schedule is then updated at this delay period and the effect of the delay is analysed to establish a new completion date. The difference between the new completion date and the date prior to the exercise gives the delay caused by that particular impact. A "fragnet" or subnetworks are sometimes prepared to depict the impact of the delay event, e.g., change orders on the schedule. It is an effective technique because the delays are analysed using real time CPM. It is also applicable to use during project duration and after completion. However its limitations include:

- it may not be practical or realistic to use if there are an overwhelming number of delay causing events [8];
- periodic updates may not be existing which may then require the analyst to perform highly laborious analysis of project records to creates updates;
- the analysis requires intensive effort and is time consuming.

Because of the close similarity of the time impact analysis and the window analysis, the former was not applied to the sample project.

Table 4 below summarises the results of delay responsibilities of the parties as given by the various the techniques.

**Table 4.** Summary of delay analysis results for the case study.

| Delay analysis methodology | Delay | |
|---|---|---|
| | EC | NN |
| As-planned *vs*. As-built | 9 | 2 |
| Impacted As-planned | 6 | 8 |
| As-planned But for | | |
| *(a) contractor's point of view* | 4 | 7 |
| *(b) owner's point of view* | 9 | 2 |
| Collapsed As-built | 6 | 5 |
| "Window"Analysis | 7 | 4 |

### *4.7. Reflection on the Different Results DATs Generate*

Clearly, the main reason responsible for the different results is the different modes of application the various techniques employ. Not only are there wide differences in their applications, the delaying events experienced by real-life projects are often extensive and more complex to deal with [7,19] than the example of this case study portrays. Thus, the analysis results from DATs for real-life cases tend to be staggeringly different and bear a significant amount of time and cost compensations, as well [17,23]. The different modes of application also require varying levels of analysis details in the delay assessment process. DATs that analyse a programme(s) directly as it is, without any major modifications of the programme(s) (e.g., as-planned *vs*. as-built), are often considered "simplistic methods" [20]. On the other hand, those that involve extensive programme modifications, including running of "additive" and "subtractive" simulations (e.g., collapsed as-built and time impact analysis), are termed "sophisticated methods" [20]. Although the latter group require more expense, time, skills, resources and project records to operate, they tend to give more accurate results than the former partly due to the detailed/rigorous analysis they entail [5,20]. In terms of which techniques are favoured by claim parties, the impacted as-planned, as-planned but-for, and collapsed as-built are often preferred by contractors or owners, since these techniques are capable of easily establishing the amount of project delays that could be attributable to the actions or inactions (delays) of a particular party, through just by inserting or removing such delays from relevant programmes [24,25].

In view of the aforementioned differences, the general view amongst practitioners regarding use of DATs is that no single technique is suitable for all delay claims situations and that the most appropriate one for any case is dictated by a number of factors or criteria [7,17]. The need to determine and make use of this appropriate technique is increasingly becoming a crucial issue. For example, in the UK case of *Balfour Beatty Construction Ltd* vrs *The Mayor and Burgesses of the London Borough of Lambeth* [28], the defendant challenged the adjudicator's decision for, *in alia*, not given any opportunity to the parties to comment on the appropriateness of the technique adopted by the adjudicator for determining time extensions and to seek their observations as to its use. The defendant's position was upheld by the judge, who regarded the adjudicator's inaction as a serious

omission. The following sections discuss the factors often mentioned in the literature as being the key criteria that parties need to consider in deciding on the most appropriate technique.

Availability and accuracy of project records have a major influence on the suitability of a technique since the various techniques employ different programming information sources. If a good as-planned network programme exists but has not been updated with progress due to lack of as-built records, *etc.*, then impacted as-planned analysis may be appropriate [8]. Conversely, where there are good as-built records but no as-planned programme or the as-planned programme is not adequately prepared, then the collapsed as-built method may be appropriate [24].

The time of performing delay analysis is an important factor, since some techniques (e.g., time impact analysis, impacted as-planned) are suitable for performing forward or contemporaneous assessment (termed "prospective analysis"), whilst others (e.g., collapsed as-built) can only be used for hindsight assessment (retrospective analysis) [3,7]. The prospective analysis seeks to establish the effect of delays during the currency of the project, particularly when the contract provides that the contractor is entitled to relief from liquidated damages if completion is likely to be delayed. Retrospective analysis, on the other hand, is carried out after the fact (*i.e.*, at the end of the project), where analysts usually have full benefit of hindsight [8,17].

The type of delay claims in dispute influences the type of DAT to be employed. The more theoretical techniques like "impacted as-planned" are helpful for instances where a party is concerned with proving delay time only [8]. Nevertheless, when the claim involves money as well, an approach based on the analysis of what actually transpired on the project (e.g., using "Collapse As-built") is warranted [8]. The cases *McAlpine Humberoak Ltd* vrs *McDermott International Inc.* [29] and *Ascon Contracting Ltd* vrs *Alfred McAlpine Construction Isle of Man Ltd.* [30] have both confirmed that wholly theoretical calculations are unlikely to succeed.

The availability of resources for the analysis is also a relevant issue of consideration [7]. As noted earlier, the sophisticated techniques require more time and resources to use than the simplistic ones and hence the latter group may be suitable for small/medium size projects where management resources are limited and the records are usually inadequate. On the other hand, larger-scale projects with sufficient management resources warrant a more sophisticated method such as the time impact analysis and window analysis [7,17].

## 5. Relevant Issues not Addressed by Existing DATs

In addition to the different results that existing DATs produce when applied to the same set of delay claims data, there are other relevant issues that have the potential of affecting the results but are often not taken into consideration in the techniques applications. These issues include: functionality of the programming software employed, resource loading and levelling requirements, resolving concurrent delays, and delay pacing strategies.

### *5.1. Functionality of the Analysis Software Packages*

Not only do current construction programming software packages have different functionalities and capabilities [31,32], they also lack transparency on certain scheduling operations [33,34]. For instance, when it comes to dealing with programming issues of relevance to delay analysis, such as project

calendars, rescheduling activities with lags, handling of statuses/updates (progress override or retain logic settings) and resource allocation, the packages have different settings and ways of handling them [35–37]. As a result of these features, different software are likely to produce different results when used to analyse a particular delay claim [38] and therefore further exacerbating the difficulties often surrounding the amicable resolution of the delay claims. A possible solution to this issue is to convert the programme being used for the analysis from one software package into another, but this does not offer a viable solution either, as the conversion process is characterised by difficulties and information distortion problems [38]. A notable recommendation for dealing with the software problem is for the disputing parties to agree on a common software for undertaking the delay claims assessment [7], unless the project contract specifies otherwise.

### *5.2. Resource Loading and Levelling Requirements*

The basic assumption underpinning traditional CPM programme that resources are unlimited does not hold in reality as resources tend to be limited in most practical situations [8,39]. It is thus quite important for baseline programmes to be resource-loaded so as to ensure both reliable task duration and network logic, especially when many tasks require the same resources at the same time [40]. Without such loading, the programme to be used for delay analysis would not show realistic float values in its non-critical activities, and would thus affect the outcome of the analysis, especially for cases involving time extensions claims resolutions [41,42]. Therefore, resource loading or levelling considerations in delay analyses is quite crucial to ensuring accurate and trustworthy results [8,15], except for the collapse as-built technique as it does not rely on baseline programmes.

It is noteworthy that the need for analysts to take resource allocations into account in their delay analyses is becoming an increasingly vital requirement. For instance, in the UK case of *McAlpine Humberoak* vrs *McDermott International* [29], the judge disapproved of the plaintiff's delay claim submissions on the basis of not giving consideration on how resource usage was planned for and how they were actually utilized during construction. Wickwire [43] also reviewed legal decisions in the US and noted that "in any analysis of project delays, the contractor is required to take into account realistic resource levelling". Although the incorporation of resource loading effects in the analysis represents a more accurate and rigorous assessment of delay claims, there is very little research on how this consideration can be incorporated in the existing techniques. There is thus the need for further research into this aspect of programming to help enhance the resolution of delay claims in practice.

### *5.3. Resolving Concurrent Delays*

The identification and apportionment of concurrent delays remains a contentious technical subject [7]. More debilitating is the fact that there is no uniformly accepted definition among practitioners as to what it concurrent delay itself means [7]. A reliable approach for analysing concurrent delays would involve using dynamic multiple time periods or windows, as this is capable of tracing changes in the critical path [7,14,24]. However, in such mode of analysis, identifying the concurrency and the type of concurrent delays within a given period will be dependent on the length of time chosen for the analysis period. Therefore analysts using different time intervals are bound to interpret a given concurrent delay situation differently. To enhance amicable settlement of claims,

analysts would have to agree on the analysis time interval to be used, which can either be based on dates at which programme updating occurred or the occurrence of key project events such as project milestone or major changes in the programme. The legal aspects of concurrent delays concerning the kind of remedies to be offered to parties have also continued to remain a highly contentious issue. Scott *et al.* [44], for example, found that UK practitioners hold dissenting views to the SCL's recommended remedies [7], which stipulate that, for employer and contractor delays occurring concurrently, the parties should share the responsibility between them and extension of time without costs also awarded. In addition, existing case laws that could offer some guidance on the remedies do not speak in harmony [45]. This lack of consensus or clearly defined rules/methods for dealing with remedies of concurrent delay types poses great difficultly to practitioners in delay claims resolution. There is therefore the need for research into the underlying principles that govern the legal resolution of concurrent delays to establish clear guidelines for dealing with all possible concurrency situations. Employers may subsequently incorporate these in their contracts for it to guide claim parties during delay claims resolutions.

### *5.4. Pacing Delays*

Zack [46] defined this as "deceleration of the project work, by one of the parties to the contract, due to a delay to the end date of the project caused by the other party, so as to maintain steady progress with the revised overall project schedule". The thinking behind pacing delay is that it is sensible for a party to slow down the working pace if a delay by other party makes it unnecessary for hard or fast working, as often memorably argued, "why hurry up and wait". It enables the contractor or the employer to mitigate or avoid cost that otherwise would have been incurred had the work been done faster. However, there are difficulties in exercising the right to pace delays, which can affect the delay analysis process. For instance, float ownership, will determine whether a particular contractor-caused delay could be a potential employer's defence of concurrent delay or otherwise. Furthermore, as argued by Zack [46], pacing delays tends to minimise compensable delay and this makes it imperative to consider its effect in delay analysis process to ensure fairness in the apportionment of delay responsibility. Further studies are thus needed to offer assistance on how to resolve these issues.

## 6. Conclusions

Delay claims are now a major source of conflict in the construction industry and also one of the most difficult to resolve. Inspired by this, academic researchers and practitioners alike have made numerous attempts by way of developing DATs and good practice documents for guiding practitioners on the proper analyses and resolution of the claims. The knowledge of the application of these techniques is of paramount importance to understanding their limitations and capabilities in practice and areas of improvement needs. As part of a wider research work, this paper seeks to develop such knowledge and understanding via: an evaluation of the most common DATs based on a case study, a discussion of the key relevant issues often not addressed by the techniques and their improvement needs. The evaluation of the techniques confirmed that the various DATs give different allocations of delay responsibilities when applied to the same set of delay claims data, reinforcing the common notion that the most appropriate technique for any claims situation depends on the claims circumstances

and the project. The different results stem mainly from the unique set of requirements and application procedures each technique employs. In addition, there are a number of issues such as: functionality of the programming software employed for the analysis, resource loading and levelling requirements, concurrent delay and delay pacing, which are all vital to ensuring accurate and reliable analysis results but are not addressed by the DATs.

Current programming software packages for analysis delay claims are characterised by different functionalities and capabilities. They also lack transparency on some crucial scheduling operations and employ different settings for dealing with key scheduling issues that affects delay analysis process such as project calendars, rescheduling activities with lags and status updates. These features increase the chance of claimants and defendants at arriving at different delay claim results and thus make it more difficult for amicable settlement of the delay claim disputes. This justifies the need for disputing parties to agree on a common acceptable software package for the analysis and how it should be applied appropriately.

To ensure a more reliable delay analysis results, it is important to use resource-loaded and levelled baseline programmes, as such programmes provide for reliable task duration, network logic, and realistic float values in non-critical activities. Without taking such programming requirements into account in the analysis, the baseline programme would not adequately reflect the plan of work as dictated by the true intent of resource usage in practice, thereby leading to results that are not accurate and trustworthy. Although taking account of resource loading ensures reliable analyses and results thereby contributing to successful claims resolution, there is very little research done on how this consideration can best be incorporated in DATs. This limitation thus calls for the need for further research studies in this area.

Resolving concurrent delays is still considered one of the most difficult issues to address, partly because existing DATs do not take them into account in the analyses. The best approach to handling this challenge is for the analyst to employ dynamic multiple time periods or windows, so as to be able to trace changes in the critical path. Using different time intervals would however produce different results as the extent and type of concurrency are bound to yield difference situations and effect. It is therefore important for disputing parties to agree on the most appropriate time interval to be used for the analysis, either based on status dates or the occurrence of key/milestone project events.

Delay pacing strategy is a relatively new defence strategy often argued by both owners and contractors to demonstrate that their delay was not the dominant or controlling delay. Although each party has the right to pace delays, the process is fraught with difficulties similar to those of concurrent delays and float ownership issue. For instance, the latter will determine whether a particular contractor-caused delay could be a potential employer's defence of concurrent delay or otherwise.

In general, this paper offers valuable insights into the applications of existing DATs, which have important implications for the resolution of construction delay claims and its improvement needs. First, parties involved in such claims should not only be aware of the limitations and capabilities of the techniques, but need to examine the above-highlighted issues as well so as to, as far as possible, take them into account in the analysis. This consideration will hopefully increase the rigour and transparency in the claims analysis, and hence reduce the chances of disputes in the claims settlement. Secondly, the highlighted issues have, however, received very little awareness and research attention thus far, as evidenced by delay analysis literature. Future research thus needs to focus more on these

relatively overlooked issues, in order to extend the limited knowledge and understanding that exist about them such as how best they can be addressed appropriately in delay analysis.

Whilst the case study used was based on a hypothetical project, the proposed claims scenarios largely reflect that of a typical construction delay claims settings, both in relevance and context. However, to strengthen this study, it is recommended that a similar study be undertaken in the future based on real-life project data to validate the case study findings.

## Conflict of Interest

The authors declare no conflict of interest.

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