EVALUATING DISRUPTION COSTS ON MAJOR CONSTRUCTION PROJECTS

A paper based on talks given at the Technology and Construction Bar Association's Annual Conference in London on 29th January 2011 and a meeting of the Society of Construction Law in Sheffield on 22nd March 2011

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July 2011

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Introduction and context

This is a paper about the quantity surveying issues raised by disruption claims, and thus it is concerned with quantum and not time analysis, looked at from the point of view of a quantum expert rather than a lawyer. It is of course not an expert's report: I hope that it asks interesting questions rather than pontificates. If there are any ostensibly firm opinions expressed here I trust that they will not be taken down and used in evidence against me at some future date.

The structure and scope of this paper is as follows:

- Scene-setting: what is disruption, and why is evaluation of disruption costs problematic?
- How *not* to measure disruption
- How *should* disruption be measured?
- How can disruption be measured?
- Particular contractual issues: cost plus arrangements and notice provisions
- Conclusions

What is disruption, and why is evaluation of disruption costs problematic?

Under the heading 'Loss of productivity or uneconomic working', *Keating* describes disruption as:

> '... a head of claim sometimes made where there has been delay in completion or disturbance of the contractor's regular and economic progress even though, on occasion, the ultimate delay in completion is small or does not occur. As regards machinery and plant it is ordinarily comparatively easy to compare the contemplated periods of use with the actual periods ... Labour is more difficult.'[1]

Hudson describes the phenomenon as 'disturbance of the contractor's planned progress with resulting loss of productivity', causing '… additional

1 Stephen Furst QC and Hon Sir Vivian Ramsey (eds), *Keating on Construction Contracts* (London, Sweet & Maxwell, 8th ed 2006), para 8-054.

unreimbursed expenditure on labour and plant, but only rarely of materials'.[2] The author goes on to observe:

> 'While the computation of loss of productivity claims based on disturbance may be somewhat more difficult than direct expenditure claims, construction contracts benefit in this respect by comparison with other types of procurement contract, such as manufacturing contracts, since the period of construction is likely to be relatively long and its history much more fully documented in the form of contemporary interparty records and correspondence during construction. Moreover, it is often possible from records to compare progress during a period of undisturbed construction with a known period of disruption due to the breach. This is particularly true of contracts with a 'linear progress' characteristic, such as road, rail or pipe-line contracts.'[3]

Perhaps by way of contrast, *Keating* says, of delay and disruption claims generally:

> 'Such claims are often for commercial or other reasons greatly exaggerated both as to the extent of delay caused by the employer's breach and in quantification. The basis for calculation is often excessively theoretical, ignoring the principles that damages are to compensate for actual loss and must be proved. "It is not the function of the courts where there is a breach of contract knowingly to put the plaintiff in a better financial position than if the contract had been properly performed".'[4]

Is it really so easy to measure disruption reliably on 'linear' contracts as *Hudson* suggests? Or are disruption claims really so often the product of cynical attempts at unjust enrichment, as so characterised by the dour comments in *Keating*?

Disruption and other types of claim

My view is that disruption is harder to detect, prove and measure than other kinds of financial claims. Comparison with prolongation and acceleration, two other common kinds of claim, illustrates this:

- *Prolongation costs* are comparatively easy to measure because after someone else has done the time analysis and said how many weeks critical delay have occurred, and once issues of liability for that delay have been sorted out, all that is needed is to identify the time-related resources affected. Then the costs of those resources can either be abstracted from an electronic accounting system, quite simply, or if circumstances dictate (or permit) they may be

2 IN Duncan Wallace, *Hudson's Building and Engineering Contracts* (London, Sweet & Maxwell, 11th ed 1995), para 8-181.

3 *Hudson*, note 2, para 8-196.

4 *Keating*, note 1, para 8-049; the quotation is from Ackner LJ in *C & P Haulage v Middleton* (CA) [1983] 1 WLR 1461 at 1467, [1983] 3 All ER 94 at 99.

estimated. There may even be an agreement in advance to liquidate delay costs to avoid having to do either.

- *Acceleration* can also be comparatively easy to measure, if it is managed properly, because it is usually instructed in advance: with adequate forewarning, proper cost records can be kept and ascertainment is a function of analysing those records.

Disruption is different, for many reasons. First of all, it will usually not be detected by the contractor until after it has occurred, and, for those responsible for making claims to recover any financial ill-effects, usually only by reference to cost/value reconciliation reports. These may be prepared monthly, quarterly or (in one recent case in my experience) not at all, leaving it to senior management to wonder why a major hole in commercial financing had appeared.

Having identified that such losses are occurring on a project, the next challenge is to identify which element is overrunning, then which trade, and finally, in the absence of records which explain why those losses have occurred (which is all too often the case), it may only be by interviewing relevant personnel that management will find out enough about what happened to be able to assess whether there is any prospect of a successful claim.

Disruption effects may be masked by other project issues, some of which may be recoverable and others not. Acceleration, unrecorded variations, mistakes, inefficient working, even corruption, and so on may all be happening at the same time as the identified disruption. The term 'uneconomic working' covers many adverse financial effects, including recoverable disruption losses. It is therefore important to be able to identify disruption properly, and to separate it from other, non-culpable causes – the principles involved in avoiding global claims apply here.

Disruption can consist of delay costs that are not, strictly, prolongation costs: if a non-critical trade or element is delayed, there may be losses due to engagement of resource on that part of the work for longer than should have been necessary, but since the work is non-critical, there will be no effect on the completion date.[5] These sorts of delays are typically ignored by project managers and, later, by forensic time analysts – whose nomenclature in the USA, 'schedule impact analysts', explains why analysis of these sorts of effects are often ignored: because they have no impact on the schedule.

Indeed, in order to maintain schedule, non-critical work may often be delayed, truncated, carried out in other more difficult ways and generally subjected to uneconomic effects. Thus, maintaining schedule can give rise to disruption losses of a kind that may look like the uneconomic working caused by taking what are sometimes known as 'accelerative measures', but which may be the unexpected consequence of the acceleration instituted, and even possibly agreed to, by the employer.

5 See *Hudson*, note 2, top of page 1076 and quotation from *Keating*, note 1.

Some of that disruptive working may need to have been catered for originally, because it was part of the planned sequence of work to allow critical path activities to proceed more efficiently. The questions that will arise are: what did the tender warn of? what should the contractor have known already and planned for? and just how much disruption occurred after subtracting the originally planned uneconomic working?

It is usual for the contractor's estimator to price for levels of plant and labour resource that will carry out the job in the most efficient manner, consistent with the tender information. The claims analyst needs to identify any tender or other restraints that would anyway have governed the contractor's ability to approach the works in that optimum way. Examples of such assumptions would be the size and capacity of plant, the location of material deliveries, restrictions on sequencing, permitting access for work by others, and ease of access to working areas.

The impact of disruption

Looking at a particular example, disruption of works on a civil engineering project exhibiting the 'linear progress' characteristic identified by *Keating*, such as a rail or road scheme, might arise through late and/or changed sequence of release of working areas, disrupting the normally-envisaged linear progress. Disruption would be manifested in fragmentation of the works into smaller sections, with work in those sections carried out in a different order to that planned, for example leading to the need to move plant and other resource to different parts of the project by road rather than through the site. This would lead, typically, to the kinds of adverse financial effect in Table 1 below:

RESOURCE EFFECT	FINANCIAL EFFECT
Increased numbers of particular types of plant, to service different locations at the same time	Increased overall costs of plant hire
Where efforts are made to avoid simply increasing the volume of plant, transport of same plant between different locations to serve different working fronts	Disproportionate plant transport costs, idle (non-working) time
Increased haul distances for excavated material	Higher plant costs relative to volumes of material shifted
Reduction in size of plant to service smaller working areas	Loss of economies of scale; higher plant costs relative to volume of excavation, haul or fill, or in finishing layers
Need for increased numbers and locations for intermediate stockpiles of material or spoil	Double-handling

RESOURCE EFFECT	FINANCIAL EFFECT
Increased time in transporting labour from small location to small location	Loss of efficiency through time spent travelling rather than at the workface
Use or public roads rather than site haul routes for access to working areas	Higher cost of highway maintenance, road cleaning gangs and road sweepers, temporary traffic controls, site access security at multiple locations
Smaller stockpiles of materials for permanent works	Loss through increased deterioration and wastage
Need to wait for truncated sections to be completed and joined before commencing elements of road surface construction	Need for increased protection of formation levels, and/or further excavation where formation is damaged by weather
Adverse weather encountered through attempting earthworks at wrong time of year as a result of delays	Deterioration of excavated material, rendering it unusable, leading to the need for disposal off-site and importing replacement acceptable fill material
	Slower earthworks operations as a result of waterlogged working areas and more difficult handing characteristics of excavated material itself
All of the above	Cumulative disruption and further loss of productivity/efficiency (see further commentary below)
Damage to finished work through needing to traffic plant over or adjacent to sections already completed	Remedial work

Keating suggests that the effect of disruption on plant is comparatively easy to measure, but labour less so; *Hudson* suggests that any effect on materials is rare.[6] The US commentators generally refer to 'increased labor costs' as the problem in hand. There is therefore, I think, something of a consensus that increased plant costs due to disruption are comparatively easy to measure compared with disrupted labour costs, and that losses on material costs are unlikely to arise. Effects on management costs receive little attention in any of the texts cited here.[7] These propositions seem to me to be over-simplistic; the examples in the table above indicate a number of problems potentially touching all three categories.

6 See quotations in the main text to notes 3 and 4.

7 Apart from references to the attempted percentage addition for unrecorded management time in the claim that was the subject of *Tate & Lyle Industries Ltd v GLC* [1982] 1 WLR 149 (QB): see footnote in *Keating*, note 1, page 298.

Indeed it is tempting for a claimant, when a project suffers major disruption of the sort discussed above, to assert that it is, quite simply, impossible properly to measure the disruption costs that have arisen, and to approach recovery of loss from a different angle altogether.[8]

Keating suggests the following approach:

> 'A better starting point is to *compare actual labour costs with those contemplated*. Thus *a particular activity or part of the works is taken* and, where the contract price can be ascertained, as by reference to the priced bills, the labour element is extracted. This is a matter for experienced surveyors and is done by taking the unit price and applying *constants which are generally accepted in the trade*. From the contractor's records the actual labour content for the activity or part is extracted. From the difference must be deducted any expenditure upon labour which was not caused by the breach, eg delay or disturbance caused by bad weather, strikes, nominated sub-contractors or the contractor's own inefficiency. *If the original contract price was arrived at in a properly organised competition or as the result of negotiation with a skilled surveyor acting on behalf of the employer, the adjusted figure for the difference is some evidence of loss of productivity.*'[9] [*emphasis added*]

These are useful principles, succinctly expressed, and whilst the method described addresses labour costs only, it might perhaps equally be applied to plant resources. However, as we shall see later it does not address some of the objections raised by other commentators; and it relies on a number of assumptions and generalities to arrive only at 'some evidence of loss of productivity'.

How *not* to measure disruption

The most obvious alternative is to assert that disruption has turned the project into a completely different animal from that tendered for: you will of course be familiar with this sort of opening gambit in a *quantum meruit* claim. Us barrack-room lawyers will usually approach evaluation of such claims (if valid in law) from the point of view of actual cost of work, plus allowances for overheads and profit, although there are potential alternative formulations.

A variant on this might be to aver that disruption of a particular element of the project has been so severe, and has changed the element so completely, that it is impossible to stick to contract prices; instead, so the claim will assert, the correct remedy is that the actual cost of that element must be the basis for reimbursement, deducting the relevant original contract allowance. A sort of mini-*quantum meruit* for that element alone, perhaps: whether that is at all valid in law is not for me to judge, but I have seen this approach adopted in

8 As seems to have been asserted by the pursuer in the claims for delay and disruption which featured in the Scottish case of *John Doyle Construction Ltd v Laing Management (Scotland) Ltd* [2002] ScotCS 110, [2002] BLR 393 (Ct of Sess, Outer House) and [2004] ScotCS141, [2004] BLR 295 (Ct of Sess, Inner House).

9 *Keating*, note 1, para 8-054.

some claims. As I discuss below, this may indeed be the only available means of attempting evaluation in circumstances where disruption of a particular element can be shown genuinely to have occurred, and where there are no complicating factors capable of exonerating the respondent responsible for the disruption.

This sort of approach may, however, be adopted for more than one element. Over-deployment of the technique will rapidly acquire the look and feel of a global claim by gradually converting the financial basis of reimbursement for the contract into what UK commentators have colourfully termed the 'Clandestine Cost-Plus'.[10] That is because any claim which computes loss by simply comparing resources consumed with resources planned, however detailed the focus on any single particular resource, pleads major concessions which pre-judge in the claimant's favour issues such as these:

1. Whether the claimant's original estimate, whether for the whole project or the sub-element that is the subject of the disruption claim, was adequate;
2. Whether the claimant's actual costs were reasonably incurred;
3. Whether the claimant is responsible for any of the difference between estimated and actual costs; and
4. Whether the respondent is responsible for all of that difference.

Quite obviously, the lower or more inadequate the tender estimate, and the greater the degree of incompetence in performance, the greater the apparent disruption loss if the tender allowance is simply compared with total out-turn cost. Thus, the greater the error or inefficiency, the more unfair any such presumptions in favour of the claimant would be.

At the other extreme, I have seen a number of claims which, having asserted that disruption occurred, simply add an unexplained 15% or 20% to the originally estimated cost of the work said to have been disrupted. In the absence of any analysis of productivity or actual cost, this kind of approach pre-supposes the fact of loss as self-evident, with the percentage applied, in effect, no more than a guess. This is a formula that is unlikely to be attractive to the tribunal being asked to make an award:

> 'Some contractors add an arbitrary percentage to the contemplated labour costs. It is difficult to see how this can be sustained. There can be no custom or general rule because the loss will vary in each case. A better starting point is to compare actual labour costs with those contemplated.'[11]

10 See Geoffrey Trickey and Mark Hackett, *The Presentation and Settlement of Contractors' Claims* (London, Spon, 2nd ed 2001) page 206, although the authors use this term in the context of total cost claims relating to the project as a whole which go through spurious conversion of contract prices and actual costs into productivity factors.

11 *Hudson*, note 2, para 8-196 and *Keating*, note 1, para 8-054, from which this quotation is taken.

How *should* disruption be measured?

Preliminary observations

In some instances where the method of construction has changed completely due to the matters complained of, the contractor should price the work involved from first principles: this is to be distinguished from the 'cost-plus' and *quantum meruit* approaches described above, because instead of asserting entitlement to the *actual* cost of the work, the contractor asserts entitlement to its *reasonable* cost.

By 'first principles', I mean measurement of the work actually carried out, and then pricing this at either contract rates, where available, or if not, by reference to industry-standard constants and norms for productivity, and/or rates from standard pricing books, taking into account regional variations and appropriate indexation.

Where this method is not appropriate – because the work is the same but it is simply the circumstances in which execution took place that have changed – there may be no alternative but to examine and compare actual and planned productivity and/or costs. In these circumstances the contractor will be advised to deploy one of the methods described in more detail below.

A number of different methods are considered appropriate in different circumstances by academic commentators on the subject of ascertainment of contractors' claims. There is a fair amount of academic literature from the USA which addresses the topic of evaluation of disruption costs, and in particular evaluation methodology. Much of the commentary I refer to here focuses on the disruptive effect of Change Orders (ie client-ordered variation of the works), but the same applies where change that is not the subject of formal Change Order (such as changed conditions, or one of the other causes listed in Table 1 above) is the cause of disruption, and if such change is the responsibility of the respondent.

Schwartzkopf and McNamara summarise the difficulties facing the claims analyst in measuring disruption:

> 'Labor productivity is difficult to quantify and calculate with precision. Moreover, it may be difficult if not impossible to segregate the events that have impacted labor productivity. Numerous methods exist to calculate the loss of labor productivity, and although no method is generally accepted, some methods are preferred over others.'[12]

They then go on to discuss various possible methods of analysis that might be available, each of which I discuss in turn below.[13] There seem to me to be two main groups of methods – the first involves actual or theoretical measurements of productivity, and the second is based on examination of actual costs.

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12 William Schwartzkopf and John J McNamara, *Calculating Construction Damages* (New York NY, Aspen Publishers, 2nd ed 2010), pages 63-64.

13 I have changed the authors' original order slightly to suit the structure of my discussion.

Group 1 methods include what the authors describe as:

1. ‘Measured Mile’ calculations;
2. ‘Industry Standards’;
3. ‘Comparison with Similar Projects’; and
4. ‘Productivity Analysis’.

Group 2 includes:

5. ‘Total Labor [*sic*] Method’; and
6. ‘Modified Total Cost Calculations’.

There is a final rogue in Schwartzkopf and McNamara’s list of methods: ‘Experts and Consultants’, which involves reliance upon expert evidence. This raises the question of what the nature of that evidence should be; I discuss the implications in the section below on ‘How disruption can be measured’.

Group 1 methods: productivity-based analysis

1. ‘Measured Mile’

The essence of this approach is to compare the actual cost for carrying out particular operations in undisrupted periods or other sections of the work with the cost of carrying out the same, or similar, work affected by the alleged disruption. Schwartzkopf and McNamara describe this as follows:

> ‘The most widely accepted method of calculating lost labor productivity is known throughout the industry as the ‘measured mile’ calculation. This calculation compares identical activities on impacted and nonimpacted sections of the project in order to ascertain the loss of productivity resulting from the impact. The measured mile calculation is favored because it considers only the actual effect of the alleged impact and thereby eliminates disputes over the validity of cost estimates, or factors that may have impacted productivity due to no fault of the owner.
>
> Measured mile calculations first require the labor productivity ratios to be calculated for a nonimpacted performance period. As discussed previously, labor productivity ratios are determined by dividing the actual amount of hours by the actual quantities of work performed. The productivity ratio during the nonimpacted period is the standard, or the performance mile, by which productivity is measured.
>
> Next, the contractor must isolate the period of performance that was allegedly impacted [due to one or more reasons the responsibility of the defendant]… The productivity ratio for the impacted period is calculated in the same manner as the nonimpacted period. The lost productivity is the difference in the productivity ratios between the impacted and nonimpacted periods.
>
> On highly troubled projects, however, it may be impossible to segregate one period of performance that was not impacted. Even if a

> nonimpacted period is available for comparison with the impacted period, it may be that wholly different types of work were performed during the two periods, making a measured mile calculation impractical or inaccurate. Therefore, on such projects an alternative method may be more appropriate to calculate labor inefficiency.'[14]

It is indeed rare, in my experience of the kinds of project that reach the stage of requiring my involvement, to be able to segregate an unimpacted period of performance. Instead, an alternative, modified, approach (not referred to by Schwartzkopf and McNamara) is often deployed. The contractor may choose as the benchmark, or measured mile, a period where it is possible to identify and discount the disruptive effects of one particular and easily identified factor – for example, a short period of adverse weather in the middle of the benchmark period that led to no work at all for a complete week. Assuming (on this example) that there was no adverse weather and instead only the alleged culpable causes affecting productivity during the alleged disrupted period, the two periods are then compared using the adjusted productivity statistics from the benchmark period.

It must be emphasised, of course, that for this sort of approach to be valid and credible, all disruptive influences during the alleged disrupted period need to be identified. If not all of these are the responsibility of the respondent, then either a similar adjustment will need to be made to the productivity statistics during the disrupted period – which starts to strain credibility – or some other method will need to be used.

2. The 'Industry Standards' method

This involves comparison of productivity rates accepted and recognised in the construction industry as possible to achieve, assuming given resources, with productivity actually achieved during the alleged disrupted period. In effect, this uses the identified industry standard as the 'measured mile'. As an example, here is how the degree of disruption in the brickwork element of a project might be evaluated:

1. Assess, from industry-standard pricing books such as *Laxton's*, the number of square metres of brickwork that a brickwork team consisting of a pair of bricklayers and a labourer should be capable of laying in a given number of working hours;
2. Calculate the quantity of brickwork actually achieved during that period;
3. Divide that quantity by the total number of team-hours deployed;
4. Compare the results to derive a loss of productivity factor; and finally
5. Apply that factor to the costs incurred during the alleged disrupted period.

14 Schwartzkopf & McNamara, note 12, page 64 onwards.

In common with the 'Measured Mile' method, this does not really assist any further where there are multiple disruptive causes that are not all the responsibility of the respondent.

3. The 'Comparison with Similar Projects' method

As Schwartzkopf and McNamara describe this:

> 'In certain cases, contractors may be required to calculate lost productivity by comparing the anticipated productivity ratio with the actual productivity ratio. The anticipated productivity rate must be supported by reference to the productivity rates on the same or a similar project.'[15]

Thus, in this method, 'anticipated' productivity – ie the output expected at tender, and thus the basis of the contract prices – is used as the benchmark against which to assess the degree of disrupted productivity. This clearly runs the risk of conceding to the claimant the potential issue of adequacy of tender allowances, but invocation of what might have been achieved on another project will, under this method, be the means by which the contractor seeks to demonstrate that this is a valid concession for the tribunal to make.

This is essentially yet another way of deriving a benchmark productivity factor to compare with output achieved in the disrupted work. There is an added disadvantage in this approach: whereas protagonists in a disrupted project, or their experts, will usually be able to examine disclosed project records together under the discipline of a tribunal (or with that eventuality looming in the event that negotiations fail), ascertainment of what may or may not have been achieved on a similar project will not be based upon the same equality of information. There may be many, complex, reasons why the other project went well and cost less than the disputed project. The two may in fact not be comparable, for various reasons. Further, the records of resources and costs may not have been disclosed fully: so the party to whom the other project is cited as a benchmark may have many reasons to treat the statistics adduced with scepticism.

4. 'Productivity Analysis'

This method consists of analysing collected cost or other production data into time periods, work function and work area, and then (again) comparing it with estimated costs adjusted as necessary for scope change, to determine in what time periods and in what areas, and to what extent, overruns were incurred.

The efficacy of this method obviously depends to a great extent on the quality of records, discussed separately below. Schwartzkopf and McNamara again:

> 'An after-the-fact analysis that is entirely based on academic studies, without validation of by the actual labor costs and productivities in the field, and that is not related to actual project events is of little value.

15 Schwartzkopf & McNamara, note 12, page 66.

However, absolute precision in a productivity analysis is not necessary.'[16]

Applying the disruption factor

With all of these methods, once a disruption factor has been determined, the question arises whether it should be applied to the contract price, or to the actual cost of the work, to ascertain the financial effects of disruption:

(a) If applied to *contract prices*, this seems to make the kinds of concessions to the contractor that I disparaged above; but

(b) If applied to *actual costs*, then it is necessary to ascertain whether there are any other causes of disruption that need to be discounted, but valuing different causes separately in order to do so is likely to present further difficulty.

However, it does seem to be a potentially useful sanity check to compare both; if there is marked disparity, then it may suggest either that the tender assumptions were wrong, or that there is some other disrupting factor at work that has not been identified, and these are useful concepts for the claims analyst to identify in order to take the enquiry further, if necessary.

Group 2 methods

5. 'Total Labor' method: examining actual costs

Schwartzkopf and McNamara describe the 'Total Labor' approach, which analyses total costs and subtracting planned costs, as one which may have a role to play, but only as a last resort:

> '[This] is the least widely accepted method to calculate decreased labor productivity. Under the total labor method, decreased labor productivity is calculated by subtracting the estimated cost of performing the work from the actual cost of performance.
>
> Total labor calculations are disfavored because no attempt is made to segregate the factors that may have impacted productivity. Under the total labor method, the difference between the actual and estimated labor costs is presumed to be the result of a combination of factors, all attributable to the owner. Accordingly, the total labor cost method is viewed as a calculation of last resort.'[17]

They go on to say:

> 'Total cost calculations are used in limited circumstances. Total cost calculations may be used only when each of the following are proven: (1) it impossible or impractical to calculate damages with a reasonable degree of accuracy; (2) the contractor's bid or original estimate for the work was reasonable; (3) the contractor's actual costs were reasonable;' and (4) the contractor was not responsible for the added

16 Schwartzkopf & McNamara, note 12, page 72.
17 Schwartzkopf & McNamara, note 12, page 69.

expenses. Each of the four elements above must be present before a total cost calculation is justified.

Total cost calculations are not wholly rejected by courts and boards, however. Recently, the total cost method appears to be gaining acceptance by courts and boards, especially at the state level, and by arbitrators and juries.'[18]

This echoes what I said above about the various concessions to a claimant that acceptance of such an approach would entail:

1. It is rare in my experience for contractors to be able to show conclusively that their original estimate was reasonable other than to demonstrate tender ranking, where they will usually have been the lowest tenderer. Provided that there is no great margin between its own tender and the next few lowest, that may show no more than that other tenderers made similarly over-optimistic assumptions: it could well be the case that the highest tenderer, or group of tenderers, made the correct assessment of possible productivity or risk.
2. Whether or not the contractor's actual costs were reasonable is of course likely to be central to the issue: if they were reasonable for the work actually achieved, then there would be no complaint about disruption losses. The point is likely instead to be that they were unreasonable because of the disruption alleged, but the degree to which they were unreasonable may justify separate enquiry as to any self-inflicted contribution to losses.
3. It is difficult for the contractor to show conclusively that it was not itself responsible for the added expenses. What is usually proffered is an assertion to this effect, inviting a positive case from the respondent as to reasons which do not involve culpable causes. This seems to me to reverse the burden of proof: such an assertion should not automatically oblige the respondent to identify and prove any such alternative reasons, given the likelihood of unequal knowledge, and lack of visibility, about the contractor's domestic issues. On one very large matter with which I was involved, it emerged that the claimant contractor had actively suppressed disclosure of documents evidencing domestic causes of disruption losses, on the grounds that they were not relevant to evaluation of the claims actually made against the respondent. That proved to be incorrect, but only after a battle over adequacy of disclosure.
4. Furthermore, in my experience, whilst it is often impossible or impractical to calculate damages with a guarantee of accuracy, a reasonable stab at it can usually be made using one of the other methods, especially if only particular elements or trades are affected.

18 Schwartzkopf & McNamara, note 12, page 70.

6. ‘Modified Total Cost Calculations’

For the reasons described in 5 above, Schwartzkopf and McNamara recommend an alternative in circumstances where such stipulations cannot be satisfied:

> ‘Total cost calculations are often modified to eliminate some of the inherent inaccuracies found in the standard total cost calculation. In modified total cost calculations, the contractor’s original bid and the actual performance costs are often adjusted to ensure that the owner is not held responsible for bid inaccuracies or other increased costs over which it had no control. Modified total cost calculations are accepted more often than straight total cost calculations, but all types of total cost calculations are generally disfavored.
>
> Modified total cost calculations segregate impacted from nonimpacted work activities. By eliminating the nonimpacted periods, excess costs can be established with more accuracy. The credibility of a modified total cost calculation can be bolstered by expert opinion as to the validity of the contractor’s original estimate for the cost of performing the impacted work. Further credibility may be accorded a modified total cost calculation if costs attributable to the contractor’s own inefficiency are subtracted from the equation. If possible, modified total cost calculations should be chosen over the standard total cost calculation because courts and boards appear to accept the modified method more readily.’ [19]

Whilst this can be seen as potentially addressing some of the shortcomings of the ‘Total Labor’ method, there seem to me again to be the same issues likely to arise from inequality of knowledge as between the parties.

Where cost calculations are able to segregate impacted from non-impacted work activities, as suggested in the last quotation, this is likely to be more successful. By restricting calculations to specific and finite heads or elements only, making appropriate adjustments for matters that are not the respondent’s liability, costs may be examined more minutely. A combination of analysis techniques can be applied, as appropriate, to ascertain against suitable benchmarking whether and to what extent original allowances for those finite heads or elements were reasonable, whether and to what extent actual costs have been unreasonable, and what the proximate causes of disparity between the two may have been. Another US commentator describes this as the ‘cost method [*ie the ‘Total Labor’ method*] applied on a work item basis’.[20]

19 Schwartzkopf & McNamara, note 12, page 70.

20 James J Adrian, *Construction Claims – A Quantitative Approach* (Champaign IL, Stipes Publishing LLC, 2nd ed 1993), pages 80-82. Much of this supports Schwartzkopf & McNamara, note 12, including Professor Adrian describing what is termed the ‘Cost Method’ approach to calculating/presenting lost productivity damages as a ‘last resort’.

However, as noted earlier, application of this sort of approach too widely can quickly turn into a form of 'Clandestine Cost-Plus' claim,[21] so caution is needed in advocating this course.

How disruption can be measured: practical issues

Quality and comprehensiveness of evidence

All of the methods above presuppose the existence of adequate data permitting the claims analyst to be able to establish the fact of disruption, the reasons for it, and the costs arising.

Quite apart from the 'Clandestine Cost-Plus',[22] there are other variants of the techniques described in the previous section which dress up the underlying quality of the claim, including:

(a) 'Cost modelling', which involves estimating in detail what some minute part of an activity or trade said to have been affected by disruption should have cost, comparing it with an assessment of what it actually did cost by looking at detailed records relating to that minute item, and then multiplying the effect by the number of items in the whole activity or trade. Whilst appearing to be a variant on 'Productivity Analysis' combined with 'cost method applied on a work item basis', this is really no more than an attempt to persuade a tribunal to accept extrapolation from too small a sample to be conclusive; and

(b) 'Sampling', which might entail particularising one instance of disruption and analysing its cost effect in minute detail, but wrapping up and purportedly evaluating trickier instances separately and generically by reference to the item analysed in detail.

These variants have in common what Trickey and Hackett call 'The Veneer of Precision'.[23] Because these approaches assemble so much detail in support of a small part of the project, they hint at the existence of a wealth of useful data that has not been disclosed, ostensibly on the grounds of proportionality. All too often – when pressed to disclosure – such data may turn out to be rather patchy, or instead to have been suppressed simply because it is inconvenient to the analysis being promoted.

To be reliable, any method of disruption evaluation must inevitably involve identifying, analysing and costing additional resources said, or – where contemporaneous records are not comprehensive – estimated, to have been necessary. Otherwise, the result will be to permit a cost-plus evaluation that jettisons contract prices completely.

21 See note 10.
22 See note 10.
23 Trickey & Hackett, note 10, page 206.

Schwartzkopf and McNamara's reference to 'Experts and Consultants' appears in connection with the 'Modified Total Cost Calculation' as capable of bolstering results obtained; they also refer to this as a method in its own right. What they seem to have in mind is an expert who will support what the contractor's claim avers.

I referred in the section above on 'How not to measure disruption' to claims where the claimant asserts simply a percentage to be applied to contract prices or actual costs. The intention seems to have been to find an expert who will agree, or advance some alternative factor, essentially on an *ex cathedra* basis. That may have been acceptable and persuasive in times when the qualifications of expert witnesses were more often founded on past presidency of an august professional institution than any outstanding analytical ability. There may still be occasions where a tribunal will have no more to rely on beyond the gut feel, cogently expressed, of an experienced independent expert, but it is certainly more usual for such assertions to be treated with caution where they are not supported by analysis.

Records

Whilst it may be possible for an expert quantity surveyor to give an opinion on the methodology employed by the claimant in calculating disruption losses, advancing a positive and supportive opinion as to value without reference to any analysis at all should rightly be greeted with scorn. Expert evidence asserting a particular factor or value to be placed upon disruption in these circumstances is likely to be particularly unpersuasive if the reason for its absence is that the contractor, for no adequate reason, does not have the data collection or records to support a better method of quantifying alleged lost productivity.[24] As *Hudson* quotes from a US judgment,

> 'Nor does the mere fact that the plaintiff's books and records do not, in segregated form, show the amounts of the increased costs attributable to the breaches give it automatic license to use the 'total cost' method. Contractors rarely keep their books in such fashion. Such failure, however, normally does not prevent the submission of a reasonably satisfactory proof of increased costs incurred during certain contract periods or flowing from certain events based, for instance, on acceptable cost allocation principles or on expert testimony.'[25]

The aim should be for reasonable certainty to be capable of being established for all but the most minor causes of disruption. The sorts of records needed are broadly the same as would be needed for delay analysis. My initial shopping list would be as follows – all obvious, but so often missing when needed by the claims analyst:

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24 Adrian, note 20, page 77. See also the discussion in *Hudson*, note 2, para 8-196, about the short shrift traditionally given to such a plea in the US courts.

25 *Hudson*, note 2, para 8-196; the case is *Boyajian v US* 423 F(2d) 1231 (1970) (US Ct of Claims).

1. Start and finish dates for each sub-contract programme activity, preferably further sub-divided by location; this may be in narrative or chart form.
2. Details of any intermittent working and reasons for it.
3. A well-kept and comprehensive Site Diary recording all factors having any bearing on work progress such as weather, deliveries, dates of commencement of activities, reasons for delay in starting and general comments on progress for each activity.
4. The Site Diary should also record sub-contractors' names, numbers of operatives on site, and the tasks being undertaken. Names of operatives and their trades may be seen as overkill, and requiring site staff to keep these details also risks rebellion, but sub-contractors should reasonably be expected to produce their own daily registers showing these details for filing with the day's Site Diary. They need checking and validation, of course. A word about swipe-card entry systems often advanced as a substitute record: use of these (because they seem so simple and saving of bureaucracy) may have led to the demise of old-fashioned daily registers for larger projects, but in my experience these prove surprisingly prone to challenge as to reliability, accuracy and comprehensiveness.
5. Separate notes of instances of lack of access to working areas, orders to stop work in any area, design or specification changes and similar matters, identifying the person/organisation involved, location, and precisely how progress is affected, describing progress at time of obstruction or suspension and when the obstruction/suspension was removed. This may best be effected by means of a pre-printed pro-forma to be filled in by hand on site by construction supervisors and, ideally, signed by a representative of the employer or, for subcontractors, someone higher up the contractual chain.
6. Dated progress photographs, particularly where a well-taken photograph can illustrate problems.

Analysis

The analyst should then examine the records for relevance, and those that appear to be relevant might usefully be databased to allow automated assembly of all records relating to particular areas, or trades, or periods, or a combination of all of these. There is bound to be some cumulative effect that cannot be disentangled (about which I say more below), but the aim should be to break down the issues discovered into the smallest possible components. This is a typical 'QS-eye view': it is much easier to understand, test and price such things in microcosm. Identification of causation, liability and recoverability in slices will assist not only in defeating attacks on particularity, but also in permitting identification of non-culpable causes.

Proof of costs will require provision and analysis of contemporaneous records such as invoices and payment details for the items claimed. Where comparison with contract allowances is part of the analysis considered necessary, details of how the tender was originally made up must be retained for analysis and comparison with what actually occurred. It is surprising how often contractors seem to mislay these important documents, although where delays and losses result from inadequate tender prices and over-optimistic programming, the absence of tender documentation may make such unfavourable conclusions more difficult to reach.

Access to computer databases of invoices, wages, salaries and other items paid and allocated to the project is unlikely to be sufficient without examination, at least via spot-checking, of the invoices, wages sheets and similar inputting material itself.

The claimant's analyst must be able to demonstrate that it has excluded matters for which the respondent is not responsible, or for which the claimant cannot recover in any event – for example, because of particular restrictions in the contract conditions as to effects of adverse weather, or self-inflicted progress problems.

Witness statements from relevant staff may support gaps in paperwork, but deficiencies in contemporaneous documents that allow a different interpretation of events or attribution of costs than is alleged will weaken the claimant's position and may present the tribunal with a choice between speculation or denying the remedy sought.

My shopping list here is perhaps idealistic, however, because – despite indications to the contrary – contractors tend not to embark on a project with claims as a priority: the primary aim of those responsible for managing the project will be to observe the client's need for completion on time and to the specified quality, in the genuine expectation that the price submitted and agreed by the commercial department will be sufficient to do so. In the circumstances record-keeping often takes a lower priority and falls short of the perfection expected retrospectively by the claims analyst. This is relevant to the notion of 'Cumulative Disruption', which I discuss next.

'Cumulative disruption'

Various US academic studies attest to the concept of 'cumulative disruption' on major construction projects. The proposition is that the sum of individual disruption causes can lead to far greater effects than apparently accounted for by those individual causes that are capable of measurement. Wickwire et al give this succinct definition:

> 'Cumulative impact is basically defined as the unforeseeable and indirect disruption caused by multiple changes and delays, and that such disruption and impacts may not have been apparent on an

individual change basis. The claimed result is a further cumulative disrupting effect on anticipated performance and labor productivity.' [26]

Elsewhere, Bramble and Callaghan have observed:

> 'It is assumed that cumulative disruption is caused by an unreasonable or unforeseeable number of changes. Conversely, a reasonable or foreseeable number of changes does not cause cumulative disruption. Whether contractors recognize it or not, when they bid a project they plan for only a reasonable number of changes. Too many change orders are simply more change orders than reasonably expected. One can establish, therefore, what constituted an unreasonable number of changes or change order labor-hours on a particular project and identify when the project began to experience cumulative disruption. It is clear that labor productivity prior to the onset of cumulative disruption was unaffected because such work was performed under working conditions that existed prior to the onset of the cumulative disruption.'[27]

They continue, a few paragraphs later:

> 'Too many change orders present subtle and profit-eroding problems to contractors, problems that increase performance costs with no increase in change order amounts. Too many change orders may increase overhead, such as clean-up and layout, cause disruptions that result in reduced productivity, and hinder the ability to value the change order. The result: Contractors may lose money when the contract has too many change orders.
>
> Multiple changes may cause at least three problems for contractors. First, they increase a contractor's record keeping burden. Second, they disrupt the work and reduce productivity. Third, multiple change orders are difficult (some say impossible) to cost.
>
> Keeping track of multiple change orders is difficult. Contractors cost control and reporting systems are designed to collect cost data that relate to the contract work. Although a certain number of change orders may be anticipated, standard cost control systems available on package software are usually designed to collect and report the work bid, not extra work added by change order.
>
> Contractors plan for the least amount of project overhead necessary to track only the bid work, not for change orders. Changes tracked separately are expensive, so contractors often use the simplest and least expensive methods to do so. Standard practice in the construction industry is to keep change order costs in one of two ways. Change orders may be lumped together at the end of the cost report. Change orders may also be included in the estimated costs of the bid work by adjusting the budget for each line or cost item included in the cost

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26 Jon M Wickwire, Thomas J Driscoll, Stephen B Hurlbut and Scott B Hillman, *Construction Scheduling: Preparation, Liability, and Claims* (New York NY, Aspen Publishers, 2nd ed 2003), page 243.

27 Barry B Bramble and Michael T Callahan, *Construction Delay Claims* (New York NY, Aspen Publishers, 3rd ed 2000), page 5-30.

report. Change order payments are included with contract revenue and not separated from progress payments.

To keep track of changes separately, time for field labor, materials, and equipment must be separated from contract work, collected and coded with new and different cost codes, then entered independently into the cost report. The income from the change order must also be distinguished from original contract work progress payments.

Most contractors won't increase the overhead in their bid to provide for more cost control detail to track multiple change orders separately for fear the increased cost will prevent them from being competitive. After too many change orders, however, a contractor may have to bite the bullet and expand its cost reporting system to include separate tracking of change order costs and revenue.'[28]

These authors cite other research by William Ibbs, Professor in the Department of Civil and Environmental Engineering at the University of California, Berkeley. He found that, generally, a tendering contractor would anticipate changed work that would amount to no more than 6% of the contract amount. In an email exchange last year with Professor Ibbs, he told me that his later research indicates that '4% may be a better number'. To put this research in context, here is the abstract of his paper:

'Change has a tremendous effect on the performance of a construction project. Research that focuses on the quantitative impact is limited, incomplete, and in some cases questionable. The goals of this study were to quantify the nature and impacts of project change and develop recommended practices so that owners and contractors can manage change better. The focus was on project change during detailed design and construction, in particular the size of change and its impact on the project. These results show that the amount of change is negatively correlated with productivity and total installed project cost, whether within the design phase or construction phase, or between them. The greater the amount of change the more productivity and costs are degraded. Recommendations are also offered here on how to mitigate the impact of project change.'[29]

The nature of change addressed by the paper is explained as follows:

'The type of change investigated was scope change, as opposed to design development change. Changes evaluated in this study did not have to be approved as authorized change orders or claims that the owner paid after the project was completed; in many cases, the contractor absorbed the impact of the change. They were not always design-related changes; rather, some were owner-directed. Our study did not permit us to classify changes according to specific types, such as differing site conditions, material delays, or acceleration, etc. This

28 Bramble & Callahan, note 27, pages 5-30 and 5-31.

29 Professor DC William Ibbs, 'Quantitative Impacts of Project Changes: Size Issues', 123 Journal of Construction Engineering and Management (No 3, September 1997) 308.

study concentrated on large, process-oriented projects that differ from ones in many other sectors of the industry.'[30]

Thus, the paper focuses on change from an originally anticipated workload to a changed – and increased – workload.

Cumulative disruption is an area where particular care has to be taken to avoid the appearance of a global claim, but if all causes of disruption can genuinely be said to be the respondent's responsibility, and disentangling the effects really is impractical or impossible, then there would seem to be no reason why such an approach should not succeed. However, it will readily be seen that this is an extreme application of the Total Cost method, and the cautions as to undue concessions described above in the section 'How not to measure disruption' seem to be all the more relevant.

The conclusions that I draw from this body of research may be expressed in the following propositions:

1. Increases and changes in workload caused by material changes in the manner in which the works were carried out, when compared with that promulgated at contract stage, are likely to lead to disruption and uneconomic working.
2. The threshold of increase at which disruption occurs is likely to be surprisingly small – perhaps as little as 4% to 6%.
3. Disruption is hard to measure and quantify with any degree of precision on any disrupted project.
4. The greater the number of causes of disruption, the harder it is to keep comprehensive records, and the harder it is to quantify losses with precision because of the record-keeping challenges imposed through no fault of the contractor, who would not have expected to have to meet these challenges when the contract was entered into.
5. The greater the number of causes, the more there are likely to be unmeasured and unquantifiable effects in other areas of the project costs, including supervision, and on other operations where specific disruption caused by identifiable employer-responsible events has not been observed and reported to management by those at site level, and which will not feature as discrete heads of claim.
6. Given the onus of proof upon the contractor claimant, any attempts to measure losses arising based on contemporaneous records alone are likely to fall short of true actual losses, and this is a common reason for resort to total cost methods that are generally eschewed by an informed tribunal unless some modified approach is adopted, but which might be argued to be the only possible and practical method of evaluating so-called cumulative disruption.

30 Ibbs: note 29.

Particular contractual issues

Amusing reversal of roles in 'cost-plus' contracts

On contracts where the contractor's entitlement to payment in normal circumstances is based on costs incurred, ie the various types of cost reimbursement contract, then to some extent the issue of evaluation of disruption costs does not arise because they are paid anyway. This sort of contractual arrangement will tend to expose the difference between the accountant analyst and the quantity surveyor: the former will focus on whether the costs claimed have been incurred; the latter will focus on value achieved.

The employer may seek to disallow costs said to have been incurred because of breach of the contractor's obligation to charge only costs that have been incurred reasonably, and where disruption for which the contractor is responsible is alleged. In effect, complaints about uneconomic working will come from the employer side rather than the contractor, and if the latter seeks to deny it, a curious reversal of roles occurs.

In a target cost arrangement the contractor may instead contend that the pain/gain share mechanism is sufficient to capture any inefficiency on its part, but where the excess in cost over target is excessive the employer's complaint may be valid. In such circumstances use of one of the cost-based methods of evaluation of the excessive cost due to disruption is likely to be inevitable, but the issue of what level of cost would have been reasonable arises again, and recourse to productivity analysis will be necessary.

Requirements for notice and particulars within strict timescales

Many engineering contracts have strict requirements for notice of claims and provision of particulars within stipulated timescales. A recent (bespoke) example runs as follows:

> 'Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed.'

This was coupled with sanctions arising if the contractor failed to comply with this provision based upon '… the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim'.

These kinds of provision need to take into account:

1. What it is, in fact, possible to submit, when such circumstances arise;
2. What, in my experience, is generally issued in response to this sort of provision; and

3. Whether that sort of response makes any difference in assisting (or, at least, not preventing or prejudicing) proper investigation of the claim(s).

Provisions such as these require the contractor to commit itself to finite identification, as the project unfolds and within challenging time limits, of the grounds, extent and financial effect to be attributed to any and each potential ground for claim occurring, and at the same time providing all necessary records and documentation necessary for ascertainment.

Stating it in these terms perhaps exposes a degree of ambition inherent in such provisions which may be impractical to achieve for these reasons (I address here only disruption, but similar issues arise in respect of delay events):

1. Evaluation of a single alleged cause of disruption in isolation may produce incorrect results, for example where there are different causes operating at the same time. It may be necessary to wait until the full effect of any particular cause becomes clear.
2. The effect may change during the permitted evaluation period: for example, where a delay occurs but it is not recognised by the contract administrator as an event giving rise to entitlement to an extension of time, and the contractor has to institute accelerative measures to mitigate the delay instead, causing disruption elsewhere.[31]
3. Similarly, another event may supervene – for example, a new disruption event, or a change in design, may complicate the effects of the event that the contractor is still in the process of trying to evaluate.
4. Events that are known about at the time may in fact have an effect that is only discernible in retrospective analysis. A reliable analysis of disruption can only take place when final costs for the relevant activities are known.
5. Attempts to assemble details of costs within the stipulated timescale will often be thwarted by other more basic practical problems, such as the normal time lag for receipt of invoices by suppliers and possible delays, together with any time needed for claims to be submitted by subcontractors arising out of the relevant event(s).

In these circumstances, application of any of the techniques discussed in the section above ‘How should disruption be measured?’ is likely to be impossible, and at best unreliable. What is required by these sorts of provisions is likely, in effect, to be a prospective evaluation of disruption claims. Conventionally what is usually carried out is a retrospective evaluation. Prospective evaluation requires estimation; retrospective evaluation permits ascertainment.

31 See my comments on maintaining schedule in the section ‘What is disruption?’.

Adoption of the *SCL Delay and Disruption Protocol* in a contract, if it leads to contemporaneous firm evaluation of disruption events, may produce similar effects, although clearly this is another topic.

Evaluation of the prospective effect of a single event may be impossible if, for example, the effect includes postponement of work into periods where weather *might* exacerbate problems arising. Since it is not possible accurately to predict weather and its likely effects on work output, there will always be an inherent uncertainty in any attempt to sum up, definitively, and within a short and arbitrary period after the relevant event occurs, what the overall effect of that event will actually be.

Prediction of the effects of 'cumulative disruption' will not be possible until the project nears completion, for the reasons described at length in that section above. It will usually not be possible until then anyway to draw a line after particular events and to conclude that there will be no further effect.

Turning to what happens in practice, my experience is that contractors are rarely able to treat any significant delaying or disrupting event as complete, and even if the effects of it are not obviously continuing they are unable to know reliably whether all effects truly have worked through and are measurable. In these circumstances, the contractor's staff will usually resort to issuing a standard letter of the type which says, 'We record the occurrence of x. We are unable to ascertain the effects of this at the present time and will revert when we are able to do so'. Subsequently, a standard letter will emerge at intervals saying 'With reference to our letter reference (the previous letter), we write to record that the effects of x are either continuing or we are unable at present to ascertain precisely what those effects are'.

There may, or may not, be an attempt to estimate – on an approximate basis – the time and/or financial effects of 'x'. Where complex effects are likely to ensue, these kinds of provisions give rise to unreliable estimates that include substantial contingencies for possible losses that are not yet measurable. These are unlikely to be acceptable to the employer and its analysts: claims analysis tends to proceed on the basis of ascertainment of actual costs incurred, rather than estimates of possible future loss.

Such provisions may therefore lead not to certainty, but to a rushed, provisional submission that relies too much on estimation rather than analysis based on ascertainment. If so, that will arguably thwart 'proper investigation of the claim'; at best it may simply be a misdirection of effort when the evaluation is later superseded, if that is permitted by the contract, and at worst it will lead to incorrect results ending in formal dispute.

Conclusions

Disruption is hard to measure and quantify with any degree of precision on any disrupted project. The greater the number of causes of disruption, the harder it is to keep comprehensive records, and the harder it is to quantify losses with precision because of the record-keeping challenges that arise.

Where there is a multiplicity of causes, the contractor claimant will often resort to rolled-up or global methodology in efforts to measure loss arising from disruption, and such claims are likely to suffer from criticism (by the respondent) as to method and the assumptions underlying such an approach.

The greater the number of causes, the more there are likely to be unmeasured and unquantifiable effects in other areas of the project costs, including supervision, and on other operations where specific disruption caused by identifiable employer-responsible events has not been observed by those at site level, and which will not feature as discrete heads of claim. In the circumstances, arguments based on 'cumulative disruption' are attractive to a claimant.

None of the various alternative methods identified by commentators offers a complete answer to these problems, and the wise analyst will be obliged to attempt a number of approaches in an effort to identify likely losses, combining one of the forms of productivity analysis with planned and actual cost analysis. Applying any resulting factors derived to both planned and actual costs may assist in disclosing alternative causes of loss not attributable to the disruption claimed, such as inadequate tender allowances or inefficient working for other reasons.

Attempts to measure losses arising at the time the disruption occurs, based only upon records then available, are likely to result in an incorrect measure of true actual losses. Where strict notice provisions exist, these are therefore likely to encourage claims that are all the more speculative and unreliable because none of the accepted methods of evaluation are likely to be possible at the time the claim is prepared. Instead a prospective estimate of likely effect containing large contingent provisions for losses not yet ascertained may be presented, and probably rejected by the respondent on what appear to be valid grounds, increasing the propensity for formal dispute.

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'The object of the Society
is to promote the study and understanding of
construction law amongst all those involved
in the construction industry'

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