FORGE
PROJECT FORENSICS

Disruption and Losses of Productivity

Background

Ineffective change management is at the root cause of project distress.

Efficient, productive and economic work performance in conformity with the terms of the agreed contract is mandatory for there to be any opportunity for successful and profitable project delivery. However, such are the challenges of complex project delivery, that the nemesis of certainty; change, which typically compromises all good project intentions, must be managed to maintain the equilibrium between each and every stakeholder.

Change, which may be defined as "*any action, incidence or condition that makes differences to an original plan*"[1] generally serves to divide project 'partners' whilst filling the pockets of lawyers and consultants alike when matters are escalated to formal dispute proceedings. Indeed, irrespective or not of whether change is formalised into dispute proceedings, the losses typically associated with change are extremely high and can ultimately make the difference to project and organisational success. Given then the ironic certainty of change, it is suggested that change must be administered for the benefit of the party, or parties who are wronged by its influence by establishing a framework that relies heavily on common-sense and specific project experience.

Change manifests itself into inefficient and unproductive working, which is typically met by the 'directing minds' of a project by deploying more resources. Unfortunately, this often exacerbates matters by treating the symptom and not the cause. Perhaps this response is a natural reaction to pressure from stakeholders to affect schedule recovery or acceleration, but this high risk strategy is typically embarked upon without a corresponding assessment of available work-faces, congestion, appropriate and effective supervision, and material / equipment logistics, and hence the deployment of more resources may add to further decreases in productivity and performance; just the opposite of what was required.

The result often means that contractors can be faced with exposure to delay liquidated damages, an overrun of their own engineering man-hours and loss of productivity claims from their construction subcontractors which can ultimately lead to an erosion of already slim project margins. It is essential therefore that change is managed in a manner that maximises entitlement to recovery of time and costs.

[1] Change and the Loss of Productivity in Construction: A Field Guide, Ibbs and Vaughan, 2014

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Schedule performance is only a single victim of change, though it is at the heart of most other consequences, such as additional costs or degradation of quality, to the extent that it is exponentially influential. It is ironic then that insufficient attention is typically afforded to the project schedule, either with regard to the contemporary management of change, or indeed as a tool that is really put at the heart of decision making on a project.

The effect of change on a project schedule manifests itself in both delay and disruption, though in reality disruption tends to drip off the tongue by natural association with delay, whereas in reality there is an unfortunate tendency to pay too little effort or analysis to those losses associated with disruption, or loss of productivity. The losses associated with disruption are real, though often left in the shadows of a claim, especially when considering the impact of multiple areas of disruption, or the 'cumulative impact' effect as it is sometimes referred to. Consider for example the analysis of cumulative impact loss researched by Ibbs and McEniry[2]:

> *"Cumulative impact is not just a theoretical concept but a real occurrence on projects suffering numerous changes. At 40% change, a 27% loss of productivity is predicted"*

Unfortunately, the burden associated with demonstrating the impact of disruption is no small feat, for example in Lisbon Contractors Inc. v United States[3] it was noted that

> *"[the Contractor] bears the burden of proving the fact of loss **with certainty**, as well as the burden of proving the amount of loss **with certainty** so that the determination of the amount of damages will be more than speculation" [emphasis added]*

It is small wonder then that the impact of change is narrowly focused on only critical path activities. There are however multitude 'secondary' work packages associated with the 'primary' cause of change. In fact, on the basis that a project critical path is typically representative of only circa 20% of the full scope of work[4], it is essential to examine the remaining 80% for disruption and losses of productivity, especially as many projects are affected by a compound range of changes. The problem becomes even more troublesome during the engineering phase of a project, given that there is an abundance of cyclic and dependant interfaces that may affect planned assumption on an almost daily basis.

Perhaps there is scant evidence of successful disruption claims as a consequence of the significant difficulties involved in reasonably proving that assumed levels of productivity or production have been adversely affected by matters unforeseen, or of realistically associating losses with disrupted areas of work. Such challenges perhaps also go a long way to understanding why disruption often assumes the space at the bottom of a claim, which can more realistically labelled by its other name, global claim. Even the SCL Protocol[5] suggests that a global claim is perhaps the only option available to a Contractor where it is not "*possible or practicable to identify the loss of productivity, and hence loss of expense, relating to individual disruption events.*"

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[2] Evaluating the Cumulative Impact of Changes on Labor Productivity, an Evolving Discussion , Ibbs and McEniry, 2008
[3] Lisbon Contractors Inc. v United States, (1987) 828 F.2d 759, 767
[4] From the author's own experience
[5] Society of Construction Law, Delay and Disruption Protocol, 2nd Edition, February 2017, at paragraph 18.5

Whether a global claim or not, Keating offers the following observation of delay and disruption claims generally[6]:

> *"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."*

The Complexities of Analysing Disruption and Causation

In simple terms, disruption may affect the planned schedule of work without any resultant delay to completion of the project in general, whilst delay will have a critical effect on project completion. In not so simple terms, successful claims for disruption need to take account of the planned intent (if the assumptions underpinning the planned intent are available), evidence of the 'interference' with the planned intent, attribution of that interference with another party, evidence of loss that is directly related to the causes of disruption, and relief for any associated loss under the terms of the contract. All very easy then!

Disruption, especially through engineering phases of a project, has the potential to be influential beyond its immediate impact, and due to its typical cyclical consequences, may result in effects on performance that are exponentially felt beyond its original dimensions. Thus any losses of time or money associated with disruption may be difficult to detect with any degree of confidence when man-hours are being eroded more aggressively than had been anticipated, and the effects of such erosion are potentially so remote from the causes so as to render any investigation too difficult to conduct. It is small wonder that losses associated with disruption get written off.

There is a need then for any successful disruption claim to demonstrate the link between the cause(s) of disruption and the associated losses suffered. Here *"the application of common sense to the logical principles of causation"*[7] is suggested as an acceptable benchmark.

Given the challenges of adequately demonstrating disruption claims, it is small wonder that contractors often resort to 'global claims', or to over-simplistic calculations of loss, with a consequential claim strategy that is beset with inherent challenges from the outset. For example, in Ascon Contracting Ltd v Alfred McAlpine[8], the court dismissed a claim for lost productivity on the grounds of the subcontractor promoting their claim simply on the basis of the full cost of labour employed during a period of schedule delay (extension to time), noting that this was too simplistic and that the subcontractor must seek to demonstrate that any increases in labour costs were attributed to matters such as down-time, loss of productivity, repetition or uneconomic working. In terms of a more global approach, a need to provide evidence of causal relationships was highlighted in Doyle v Laing[9] where it was highlighted that the exact apportionment of culpability, in addition to a complete matrix of causal links between the root causes of disruption and their associated schedule and cost implications was not provided by Doyle, on the basis of being an entirely impractical exercise to conduct. This resulted in the court adopting a 'common-sense approach' to the apportionment of responsibility and costs.

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

[7] John Holland Construction & Engineering Pty Ltd v Kvaerner RJ Brown Pty Ltd, supra, at 82 BLR 84I per Byrne J.; Alexander v Cambridge Credit Corporation Ltd, (1987) 9 NSWLR 310; Leyland Shipping Company Ltd v Norwich Union Fire Insurance Society Ltd, [1918] AC350, at 362 per Lord Dunedin

[8] Ascon Contracting Ltd v Alfred McAlpine Construction Isle of Man Ltd (1999) 66 Con L.R 11; (2000) 16 Const L.J. 316 at para.39

[9] John Doyle Construction Ltd v Laing Management (Scotland) Ltd [2004] BLR 295

An attempt to articulate a causal link to disruption by some practical mechanism is highlighted in the case of ICI v Bovis Construction[10] wherein ICI was directed towards the use of a Scott Schedule. Having used their best endeavours to populate the Scott Schedule, ICI noted that it was simply impossible to make a relationship between all the areas of loss and the actual costs of that loss. In this case, contrary to Doyle v Laing[11] the court scrutinised the detail of the Scott Schedule and deduced that only two items were sufficiently well defined such that Laing was able to consider its associated defence to ICI's assertions. Given that ICI's claim of circa £840,000 was now reduced to only two items (which were minor areas of 'circuits need changing' and 'fire bell repositioning'), their claim failed. It is clear then that a successful disruption claim must be presented in a manner that affords both judicial scrutiny and the opportunity for the defendant to frame their counter-opinions. As will be asserted, even a broad framework of causation will be helpful in this regard.

It seems clear that successful assertions of loss due to disruption will win favour if based on specific contemporary evidence that is directly related to the causes of the losses suffered. The accuracy and nature of 'contemporary evidence' was reinforced in the case of the Attorney General for the Falkland Islands v Gordon Forbes[12]. With reference to the FIDIC form of contract (4th Edition), and more specifically to the terns of clause 53 which refer to a need to keep 'contemporary records' to support a claim, the court made a clear distinction between evidence that was gathered and promoted post the events being claimed (such as witness statements), and those that were factually available at the time of the disruption events. The former was considered to be inadmissible. This is clearly a huge challenge for most contractors, subcontractors and employers alike, given the chaotic and challenging nature of a typical complex project environment. Such data collation challenges do however reinforce that any successful analysis and presentation of disruption must be conducted contemporaneously, hence facilitating a more efficient approach to supporting evidence. A contemporary and proactive approach also presents benefits regarding timely project management interventions and the inherent duty to mitigate delay. There is too a significant benefit with being able to narrow down the focus on important record compilation from the array of records that are generally produced by the bucket-load during the life of a project.

A Need for Clarity

Articulating the complexities of a multi-faceted Primavera schedule into terms that are easily understood by a 'layman' is a difficult task, especially when complicated matters of delay and disruption is intertwined into the mix. Unfortunately, this often results in criticism of expert planning opinion, with comments such as:

> *"…the Reports of the Programming Experts **take me no further** than the findings which I have **already made**…"*[13]

And

> *"…All too often in cases like this, each side relies on a programming expert, but the reports that these experts produce are simply vehicles by which the parties reargue the facts, **rather than reports focussed on programming differences**..."*[14] (emphasis added)

Given that the opinion expressed in both cases related primarily to schedule delay, it is little wonder that the analysis and articulation of schedule disruption becomes almost impossible to express in terms that are compelling and reasonable to understand. Perhaps this is why the 'measured mile' technique of assessing schedule disruption is favoured, given that it is possibly the only method thus far that is reasonably easy to express. A comparison between achieved planned productivity with an area that was impacted by change and hence negatively affected, is, in principle, easy to follow, dissect and attribute relative culpability.

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[10] ICI plc v Bovis Construction Ltd (1992) 32 Con LR 90

[11] John Doyle Construction Ltd v Laing Management (Scotland) Ltd [2004] BLR 295

[12] Attorney General for the Falkland Islands v Gordon Forbes (Falklands) Construction Ltd (2003) 19 Const LJ T1 49

[13] Mirant Asia-Pacific Construction (Hong Kong) Limited v Ove Arup and Partners International Limited, Ove Arup and Partners Hong Kong Limited, [2007] EWHC 918 (TCC)

[14] Van Oord UK Ltd & Anor v Allseas UK Ltd [2015] EWHC 3074 (TCC)

A Framework for Recovery

Keating, as well as a range of other authorities, provide that disruption claims should rely on knowing what you planned to do; provide very clear evidence of losses in terms of time and costs that are associated with matters that are deemed to be the responsibility of others under the terms of the contract and/or at law; and in not over-inflating claims so as to incorporate losses that would otherwise be attributed to your poor assumptions or lack of planned performance.

Further to this, a very simple framework regarding the submission of disruption claims is provided by Mr Justice Akenhead who, in Walter Lilly[15], outlined the 'triangle of proof'. This was predicated as needing to be "proven as a matter of fact", and on the "balance of probabilities", and as is as follows:

- Events must have occurred that entitle the Contractor to recover loss and expense
- That those events actually caused disruption (and/or delay)
- And that the disruption caused a loss

The first side of the triangle, 'entitlement', highlights a key challenge regarding the availability of specific contractual provisions to facilitate recovery of losses associated with productivity / production / disruption. In most standard forms of contract, and even with the array of typical amendments made, it is evident that most make no specific mention of 'productivity' or 'disruption' at all, with a resultant need to adopt those clauses associated with "reasonable losses associated with change orders" type provisions. There are a few exceptions to this, with the CIOB's 'Time and Cost Management Contract'[16] including a provision for "*...the productivity reasonably expected to be achieved in executing each Activity*" and also including "*...to compensate for disruption and/or prolongation...*" whilst in the Australian Standard General Conditions of Contract recovery for disruption is provided as a natural association with delay.[17]

The second side of the triangle relates to causation, and more specifically to those events that represent the root cause(s) of disruption (and/or delay). It is suggested that this is often the greatest area of deficiency with a disruption claim, and with an unhelpful tendency to leave the recipient of a claim to ponder and establish for themselves the relationship between the given cause(s) and the areas of work they directly, or indirectly affect. This of course presupposes that the causes of delay and disruption have been identified, which as noted by Ndekugri[18] is no small matter:

> *"considering the wide range and mutually interactive nature of events that may impact negatively on progress, identification of the event or events that caused the delay and, where they impact concurrently or sequentially, delineating individual causative impacts have been matters of the greatest controversy."*

The resultant gap in being able to clearly articulate cause(s) and effect(s) may once again render a claim submission as being 'global' by its very nature. This kind of deficiency is not unusual, for example, consider the case of John Doyle Construction v Laing Management[19], where Doyle stated that:

> *"despite best efforts, it is not possible to identify positive links between each such cause of delay and disruption and the cost consequences thereof."*

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[15] Walter Lilly & Company Ltd v Mackay and another [2012] EWHC 1773 (TCC)
[16] Chartered Institute of Building, Time and Cost Management Contract, 2nd Edition, 2015 Edition, at 45.2.4 and at 44.3
[17] Australian Standard General Conditions of Contract AS 2124-1992, for example at 12.3(c) "incur extra cost...[due to] delay or disruption" and at 36 "Delay or Disruption Costs", also at 40.5(f) 'Valuation"
[18] Ndekugri, I (2007) 'A legal analysis of some schedule-related disputes in construction contracts' Proceedings of COBRA 2007 (RICS, London
[19] John Doyle Construction Ltd v Laing Management (Scotland) Ltd [2004] BLR 295

The difficulties of demonstrating a causal relationship between work disrupted and loss is all the more challenging if conducted retrospectively, and here additional support is often sought from consulting expertise. Such retrospective support needs to be balanced against its respective added value to a disruption claim, which is well summed by the direction offered by the Court of Appeal in McAlpine Humberoak v McDermott International[20], wherein it was suggested that:

> "*retrospective and dissectional reconstruction by expert evidence of events almost day by day, drawing by drawing, TQ by TQ [technical query] and weld procedure by weld procedure, designed to show that the spate of additional drawings which descended on McAlpine virtually from the start of the work….is just what the case required."*

This of course means that a balance must be struck between the effort afforded through the life of a project to establishing reasonable levels of detail that will be required to compile aligned, relevant and contemporary information to assert losses of productivity, as compared with considered against the challenges and primary focus of the project management team that is more aligned to proactively delivering projects to tight schedule constraints.

This problem is further compounded with respect to cumulative impact, or the 'ripple effect'. Here guidance is provided in Pittman Construction Co[21] where cumulative impact costs were defined as:

> *"[The] costs associated with impact on distant work [that] are not as readily foreseeable or, if foreseeable, not as readily computable as direct impact costs. The source of such costs is the sheer number of and scope of changes to the contract. The result is an unanticipated loss of efficiency and productivity which increases the contractor's performance costs and usually extends his stay on the job."*

It is suggested that 'cumulative impact' losses present specific and significant challenges, both with regard to proximate causation, and also with the losses of productivity specifically associated with a range of instructed and / or constructive changes (in addition of course to the contractor's own losses of productivity). As productivity losses associated with multiple causes are not immediately identified or quantifiable, it is almost certainly necessary to retrospectively examine achieved work performance data, which therefore presents a natural challenge with respect to prospective contract notification and entitlement clauses. Add to this those areas of lost productivity that are associated with the contractor's own performance deficiencies, or even with the reasonableness of the bid documentation as the basis of a credible productivity loss baseline, and it is small wonder that many contractors take a short-cut to the analysis of disruption in their claims, with a consequential 'global claim' label duly assigned.

The final side of the triangle belongs to the assessment of losses as they relate to the given causes of disruption. Again, this is a multi-faceted burden that requires realistic and aligned contemporary records, as well as some practical and tangible demonstration of the connection between those areas of work affected by disruption and the direct / indirect (cumulative impact) losses incurred.

It is clear then that the challenges of assembling a disruption claim are significant. However, it is not unusual for modern day project schedules to be developed without using some form of specialist software, which by its very nature should still be able to demonstrate a reasonable connection between areas of work and resources that are 'influenced' by one another. It is therefore possible for an area of work that is subject to change (and a claim) to be assessed regarding both the effect on delay and of directly associated areas of work that have been re-sequenced, and therefore disrupted. If the array of other matters that may typically

[20] McAlpine Humberoak v McDermott International [1992] 58 BLR 1 at 28
[21] GSBCA Nos. 4897, 4923, 81–1 BCA ¶ 14,847, 73,297 aff'd, Pittman Constr. Co. v. United States, 2 Cl. Ct. 211 (1983)

disrupt planned sequences of work and assumed levels of efficiency, such as drawing approval times, consent periods and other third-party interfaces, can be overlaid on to the project schedule, then variances of productivity and cumulative impact claims may have a relevant foundation upon which losses can be related and quantified. The triangle of responsibility, causation and loss is therefore a step closer in a practical format that may be presented and scrutinised in terms that are more practically aligned to common-sense than to reliance on some kind of sixth-sense!

Measuring a Mile

The SCL Protocol[22] has strengthened its relevance and reference to disruption by expanding Section 18 (Disruption claims) to 29 paragraphs, which represents several more pages than in the original 2002 Edition. The disruption analysis techniques in the second edition of the Protocol however still fall short of any real practical guidance. For example, the 'Measured Mile' technique, which is cited as being "widely accepted" is also correctly noted as being "complex and document-intensive".

His Honour Judge Stephen Davies provided his views regarding the ease of conducting a Measured Mile analysis in Amey LG v Cumbria County Council[23]:

> *"What is referred to as the 'measured mile' approach...ought to have been verified by being able to demonstrate that the planned outputs had actually been achieved in some cases where the disrupting events did not occur....it ought to have been relatively easy, by reference to the contemporaneous records which were produced, to have conducted a cross check on a suitable sample basis."*

Again, judicial guidance appears to set-out a simple enough framework of a competent and compelling disruption claim, but the facts speak for themselves and disruption claims fall short time and again.

The basic premise of the Measured Mile technique is that periods of low productivity are compared against those said to represent unhindered, or baseline productivity. A 'baseline' is said to be a period of achieved productivity, as opposed to the levels of productivity assumed in the contractor's bid submission, in other words, those levels of productivity that the contractor achieved against comparable areas of work on the project. There is a need therefore to present the contractor's baseline assumptions against the measurements of actual productivity losses against those assumptions, together with a clear analysis that expresses what would have happened 'but for' the impact of change events being relied upon.

Given that projects are chaotic environments with a plethora of daily challenges, the analysis of lost productivity typically isn't on top of the Project Manager's task list, and 'measuring a mile' is therefore suggesting as being pretty far down the pecking order. Even if it were to be a priority (as should more often be the case), measuring a 'mile' of un-impacted performance (with regard to compensable change events) in order to compare with periods of impacted performance, is not an easy task. In the first instance this presupposes that change has been identified, that losses of productivity / production are being felt, and that variances from the planned intent is analysed and promoted for contemporary verification.

It is clear then that though the premise of the Measured Mile technique is simple and logical, its translation into practice is far from straightforward. At its heart, the most significant challenge of presenting a competent Measured Mile analysis is concerned with the absence of contemporary records that are aligned directly to the matters being promoted in a claim. There is a natural time lag between work being conducted, productivity being lost (for whatever reason) and the effects being felt on the project cost account. As a result, any call to arms to address and assess losses of productivity will be to a large degree retrospective.

[22] Society of Construction Law, Delay and Disruption Protocol, 2nd Edition, February 2017
[23] Amey LG Ltd v Cumbria County Council, EWHC 2865 [2016] TCC

Perhaps though the biggest challenge of a Measured Mile analysis concerns the absence of any credible baseline (as a matter of fact) or inability to assemble periods of un-impacted performance into a compelling and competent basis for subsequent analysis. This is particularly challenging in complex projects where, unlike linear projects such as roads and tunnels, a Measured Mile looks more like a measured millimetre.

An Evolvement from Measured Mile: The Baseline Productivity Method

In order to try and address these challenges and deficiencies, the 'Baseline Productivity' Method[24] has evolved, which is based on the premise of a baseline period being defined as *"several periods of time when the contractor performs at its best."*[25] There are a few significant differences between this method and the Measured Mile approach, the most obvious being as follows:

1. The use of earned value[26] conversion factors to align more closely the periods of work said to have been disrupted.

2. The use of production data, as opposed to productivity data as an indicator of work affected by losses of productivity. Indeed, a further refinement is to use both production and productivity data together as a more robust means of testing actual performance losses.

3. The use of 'baseline' that adopts high levels of performance, in contrast with one that assumes good (planned) performance.

Significantly, the combination of production and productivity data should yield credible analysis, assuming of course that the data itself has been tested and is proven to be representative of actual performance, this being a significant and important point that can ultimately determine the success, or otherwise, of any claim. Take for example the observations from the Board in L&C Europa Contracting: [27]

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

Assuming therefore that the contemporary records are available and that they have substance in relation to the matters being relied upon, then the Baseline Productivity Method has a natural benefit of triangulating data sources in order to contrast the given areas of disruption with the associated drops in productivity.

[24] Quantification of Delay and Disruption in Construction and Engineering Projects, Gemmel, 2017
[25] When the measured mile is inapplicable why not use the baseline productivity method? Gemmel, 2016
[26] Earned Value Management is a technique recognised by the Association for Project Management (APM), the Project Management Institute (PMI) and similar professional bodies
[27] *L & C Europa Contracting*, ASBCA No 52848 (2004), at para. 12.

The justification for using production over productivity in this technique may be best illustrated by an example. If erection of pipework was curtailed due to the normal working hours being reduced (say as a result of an employer instruction), and that the erection itself was being performed in accordance with the anticipated man-hours per metre, it could be said that the levels of productivity were unaffected, whereas levels of production (achieved metres of pipe erection per day) would be lower than planned each day simply on account of the reduced working hours per day.

Thus, the Baseline Productivity Method is focused on the comparison of actual levels of achieved production / productivity against those periods said to have been disrupted by employer interventions. When added to a representative and amalgamated analysis of earned value, this methodology is given to represent a more practical alternative to the Measured Mile approach.

A Need for Contemporary Management of Change

In Clarke Construction Group[28] it was said that:

> *"[t]he after-the-fact, conclusory assessments of the [Contract Administrator] or the of its experts are not sufficient substitutes for [contractor's] underlying obligation to contemporaneously document the severe adverse impact on labour efficiency it now claims resulted from the changes and RFIs."*

This is to be contrasted to the deficiencies associated with contemporary evidence, which was discussed in Bechtel National Inc[29] where the Judge highlighted the contractor's failings of not maintaining project logs or diaries, stating that they:

> "*did not produce contemporaneous documentation that substantiates the extent of cumulative impac*t"

This is sage advice that aligns very closely to that given time and again about records, records, records. However, this is a more arduous and problematic task than it would first appear. For example, given that the project management team is engaged and focused on building the asset and that the project controls team is typically tasked with more mundane tasks aligned to periodic performance reporting, there is typically nobody in the project team who is given a specific responsibility to monitor and analyse performance variance; to assess the range of work packages affected by delay and disruption; to assemble appropriate contemporary evidence; or to alert the project owner to the probable time and cost implication via appropriate notification obligations.

It is abundantly clear that the only possible way to assemble, analyse and promote a credible disruption claim (which will of course form part of an associated claim for delay), is to do so contemporaneously. It given then that any investment made in the contemporary management of change will have a resultant positive return on that investment.

[28] Clark Construction Group Inc (2000) VABCA No.5674
[29] Bechtel National Inc, NASABCA No 1186-7, 90 BCA (Board of Contracts Appeals Decisions) paragraph 22,549 (1990)]

Summary and Conclusions

No claim for delay should be promoted without an associated claim for disruption. Whether by natural association to the work packages delayed, or by the effects on resources and equipment, delay will impact other work packages with a resultant effect on productivity, production or efficiency, in other words, disruption. It is clear that the proximity of losses to the cause(s) and causation still represents a burden that needs to be addressed, though if administered contemporaneously and based on a methodology similar to the Baseline Productivity Method, will arguably be easier to present in a practical and common-sense manner that should withstand scrutiny.

The 'triangle of proof', though a simple framework, is extremely difficult to administer for the effective presentation and recovery of losses associated with disruption. There exists a particular difficulty with the establishment and presentation of causation, and more specifically still with the assessment of losses that are associated with 'cumulative impact'. With this in mind, the Baseline Productivity Method of analysis is given as being a positive evolvement of the Measured Mile technique as a means to express and investigate the areas of work influenced by a change event, or by several change events. It is therefore promoted as being a more acceptable and practical method of analysing project disruption.

Retrospective analysis of disruption, relying as it often does on impressionistic analysis and misaligned contemporary evidence, is likely to be unconvincing. For disruption claims to be successful it is therefore essential that contemporary evaluation and change management strategies are adopted. But it is recognised and acknowledged that contemporary analysis and management of change represents a significant challenge within the typical pandemonium of complex project environments, or even with many simple projects for that matter. It is also acknowledged that that there are a range of organisational and commercial pressures that lead to an array of associated tensions. As such, an alternative intervention is needed that directs a deliberate and focused effort on the contemporary management of change, records, as-built data and a credible 'model' to proactively assess the impact of delay, disruption and associated costs. For example, the Chartered Institute of Building's 'Guide to Good Practice in the Management of Time in Major Projects: Dynamic Time Modelling'[30], is cited by Keith Pickavance as providing "*a step-by-step illustration of how the parties can work collaboratively to meet this challenge using traditional project procurement routes or the most advanced BIM, from the adoption of a workable time-management strategy through to the day to day detail of risk management, using a predictive time model*."

The associated ability to identify, assess, communicate and manage the impact of change will require a substantial investment during a project, though it is suggested that the effort afforded will significantly improve the chances of recovering of time and costs, and in a manner that is more conducive to both parties. There is therefore a need to afford focus on the contemporary maintenance of contractual risk equilibrium; of entitlement; of the apportionment of losses where they rightfully belong; and on the significance of the project schedule as a means to recover losses associated with both delay and disruption. Ultimately, this represents progress towards a clear common objective - certainty.

[30] 'Guide to Good Practice in the Management of Time in Major Projects: Dynamic Time Modelling', second edition, CIOB, February 2018, Wiley Blackwell

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