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Disruption, Inefficiency & Loss of Productivity On Construction Projects

By W. Stephen Dale and Robert M. D'Onofrio*

Both delay and disruption can coexist on the same construction project, but neither is a prerequisite for the other.¹ Delay occurs when project performance is extended beyond the original completion date. Disruption occurs when disruptive events or scheduling errors disturb the orderly flow of the planned work and interfere with the conditions under which the job was planned and bid. As a result, these circumstances can generate disruption claims and increased costs that can be quantified as damages.² Disruption damages can relate to a project that may be timely completed but nevertheless suffers “a reduction in expected productivity of labor and equipment—a loss of efficiency measured in reduced production of units of work within a given period of time.”³ Disruption can occur irrespective of any changes to the completion date and involves a different set of increased costs from those associated with delays.

This BRIEFING PAPER examines the disruptive impacts of delays and other types of changes on a construction project. Accordingly, it begins by looking at disruption generally and then proceeds with a review of various approaches to quantify or isolate the effects of disruption on construction work.

Construction Productivity Metrics

Quantifying disruption centers on the loss of productivity and measuring the difference between a planned rate of production or completion and the actual, disrupted rate of production. “Productivity” most often refers to the rate of resource input required to achieve a specific performance output; in other words, output for a given input. Construction productivity or efficiency rate may be measured by the number of labor hours required to achieve a specific production metric. Examples of construction labor productivity metrics include:

*W. Stephen Dale is a Senior Vice President and serves as the General Counsel for WSP|Parsons Brinckerhoff for the U.S., Caribbean, and Latin America region. Mr. Dale was formerly a partner with the law firm of Smith Pachter McWhorter, PLC, a construction and public contract boutique located in Tysons Corner, Virginia. Robert M. D'Onofrio, P.E. is a shareholder at Capital Project Management, Inc., specializing in the evaluation and resolution of construction claims. Prior to joining CPMI, Mr. D'Onofrio worked on-site during construction of the World Trade Center in New York City, where his responsibilities included review of schedule delay and disruption claims on behalf of the owner. The authors would like to thank Owen S. Walker, a senior associate at Smith Pachter McWhorter, PLC for his insight and research on cumulative impact.

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- (1) Pounds of duct work per hour;⁴
- (2) Labor hours per electrical circuit installation;⁵
- (3) Cubic meters per crew per day;⁶
- (4) Cubic yards of cut and fill per hour;⁷
- (5) Cubic yards of excavation per shift;⁸
- (6) Cubic yards per hour dredging clay soil;⁹
- (7) Linear feet of pipe installed per hour;¹⁰
- (8) Labor hours per linear foot of pipe installed;¹¹
- (9) Labor hours per square foot to set and strip form-work;¹²
- (10) Square yard per man-hour of subbase;¹³
- (11) Labor hours expended per housing unit;¹⁴ and
- (12) Acres of planting per day.¹⁵

Alternatively, labor is converted to cost, and cost per installation of work is used as a substitute for measurement of labor productivity.¹⁶ Cost metrics for evaluating labor productivity may include other installation costs that are typically proportional to labor hours, such as equipment usage or consumable resources, although the cost metrics may also blend in some fixed material costs.¹⁷ Examples of cost-based productivity metrics include:

- (a) Cost per masonry block;¹⁸
- (b) Cost per square yard of paving material;¹⁹
- (c) Cost per ton of paving material;²⁰
- (d) Installation costs per lineal feet of partitions;²¹ and
- (e) Cost per shoring table assembly.²²

Even when cost metrics are used to measure efficiency, the primary variable being measured is labor productivity. Contractors may bid a project by preparing quantity takeoffs and applying the contractor's historical productivity rates for similar tasks, often using those metrics to derive duration to perform each activity.²³ Productivity metrics normally measure or track average productivity over a period of time, as opposed to peak high or low performance.

Causes Of Disruption, Inefficiency, And Loss Of Productivity

Several factors can impact labor productivity on a project, and a contractor will generally endeavor to accommodate those factors that are foreseeable when preparing its bid or cost estimate. Failure to achieve the planned productivity or efficiency rate on a project is often referred to as a disruption or more simply as a loss of productivity.²⁴ Whether a contractor is entitled to recover the increased costs of disruption depends on the nature of the disruption, the cause of the loss of productivity, and on the terms of its contract as may be interpreted in the light of industry practice. Of equal importance, the actual ability to recover any costs will depend in large part on the contractor's ability to prove the causal connection between the condition and the resultant loss.

Common causes affecting productivity on a project include:

- (1) Labor factors:²⁵
 - (a) Crowding/trade stacking;²⁶
 - (b) Overmanning²⁷ and undermanning;²⁸
 - (c) Manpower changes;²⁹
 - (d) Multiple shifts;

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- (e) Learning curve³⁰
 - (f) Absenteeism;³¹
 - (g) Fatigue;³²
 - (h) Poor morale/lack of motivation;³³
 - (i) Inexperienced personnel;³⁴
 - (j) Inadequate labor pool;
 - (k) Skill dilution;
 - (l) Rework;³⁵ and
 - (m) Labor turnover.³⁶
- (2) Timing factors:
- (a) Acceleration;³⁷
 - (b) Out-of-sequence work;³⁸
 - (c) Suspended work;³⁹
 - (d) Shift work;⁴⁰
 - (e) Extended overtime;⁴¹
 - (f) Schedule compression;⁴²
 - (g) Simultaneous operations;⁴³
 - (h) Beneficial occupancy;⁴⁴ and
 - (i) Joint occupancy.⁴⁵
- (3) Management factors:
- (a) Dilution of supervision;⁴⁶
 - (b) Inadequate supervision;
 - (c) Lack of coordination;
 - (d) Underbidding work;⁴⁷
 - (e) Labor relations;⁴⁸ and
 - (f) Higher quality standard.⁴⁹
- (4) Change factors:
- (a) Numerous changes;⁵⁰
 - (b) Defective plans and specifications;⁵¹
 - (c) Slow response on requests for information (RFIs);⁵² and
 - (d) Over-inspection.⁵³
- (5) Supply factors:
- (a) Fabrication and design defects;⁵⁴
 - (b) Performing field work planned for shop;⁵⁵
 - (c) Late material deliveries;⁵⁶
 - (d) Insufficient equipment;⁵⁷ and
 - (e) Materials, tools, and equipment shortages.⁵⁸
- (6) Site factors:
- (a) Unusually severe weather;⁵⁹
 - (b) Seasonal weather conditions;⁶⁰
 - (c) Lack of protection from elements;⁶¹
 - (d) Limited site access;⁶²
 - (e) Work restrictions;⁶³ and
 - (f) Site conditions.⁶⁴

Disruption vs. Delay

As noted at the outset of this PAPER, delay and disruption can coexist on a construction project but are separate and distinct phenomena. When planned productivity is disrupted and the contractor is prevented from achieving its planned production rates, the disrupting party may be liable for the resultant inefficiency. That inefficiency may or may not be the result of a time-related action (e.g., delay or acceleration) but could arise from any number of influences on the work as outlined above. As a result, delay is not required to recover for disruption.⁶⁵ As the U.S. Court of Appeals for the Federal Circuit explained, a claimant, “need not establish delay to overall contract completion to succeed on its disruption claim.”⁶⁶

Disruption results when a contractor performs the contracted work in a manner different from and less efficiently than originally planned. The disruption may result from a delay event but does not necessarily have to cause any slippage in the period of performance.⁶⁷ Disruption generally focuses on the loss of efficiency on discrete work items but may create a ripple effect through the remaining work that

delays performance and transforms simple disruption into delay.

Proof Of Disruption

Entitlement to disruption damages follows the same requirements as any other claim: a claimant must demonstrate liability, causation, and damages.⁶⁸ The claimant bears the burden of demonstrating these items by a preponderance of the evidence.⁶⁹ As set out in the following sections of this PAPER, a difficult hurdle for disruption claims often comes in proving causation, namely that the alleged act of one party resulted in disruption or lost productivity in another.⁷⁰

In proving loss of productivity and impact, it can be difficult to link cause to effect. Contractors armed for performance with a detailed and precise plan for the work readily assume that changes or other events must disrupt the smooth flow of the planned effort. In a dispute, no such presumption of causation exists. The board of contract appeals highlighted this issue in *Bechtel National, Inc.*:⁷¹

Appellant has made its showing of causation and resultant injury relying on the general proposition that whenever a defective specification is encountered by the contractor in the course of performing its work, there is disruption or impact to the contractor’s planned and orderly performance of the work, and, as a consequence of that disruption, the contractor loses productivity and incurs added costs. Appellant maintains that the sheer volume and continued flow of the RFIs affected [the contractor’s] ability to plan the work and had an impact on performance. . . .It does not follow, however, that any impact actually occurred in the performance of the Contract. There must be evidence of the number, timing, and effect of the changes that were issued.

Proof of the predicate facts regarding disruption, i.e. testimony that the work was in fact disrupted or impacted, is often made using project personnel or another lay witness who can speak to events on the project. When a claimant must convert those lay observations into quantified estimates of the amount of impact or lost productivity, courts and boards have consistently required testimony from a properly qualified expert witness.⁷² As the court in *Luria Brothers & Co. v. United States* stated:⁷³

It is a rare case where loss of productivity can be proven by books and records; almost always it has to be proven by the opinions of expert witnesses. However, the mere expression of an estimate as to the amount of productivity loss by an expert witness with nothing to support it will not establish the fundamental fact of resultant injury nor provide a sufficient basis for making a reasonably correct approximation of damages.

The court in *Flatiron-Lane v. Case Atlantic Co.*⁷⁴ highlighted the opinion-based nature of quantifying impact damages, particularly the need to create a comparison to events that may not have actually occurred when using a technique for proving loss of productivity such as the “measured mile” method,⁷⁵ which is discussed in more detail below.⁷⁶ On that point, the court noted:⁷⁷

Claims for lost productivity damages, based on the measured mile method or any other method, normally require expert opinion testimony under [Federal Rule of Evidence] 702.

* * *

And courts generally require that expert opinion be offered to support the measured mile method specifically.

* * *

Indeed, in every case the court has reviewed involving the measured mile method, an expert was required to apply the method. This court has not found, nor has [the contractor] cited, any case approving lay opinion for a measured mile analysis. This method, like virtually every method of measuring lost productivity, appears to require the opinion of an expert. This is unsurprising. The point of the method is to compare what actually happened to a *hypothetical* universe where the defendant did not disrupt productivity. The construction of hypothetical production rates, using mathematical methods, is the hallmark of expert opinion testimony under [Federal Rule of Evidence] 702.

In addition to meeting the requirements of Federal Rule of Evidence 702, which governs expert testimony,⁷⁸ tribunals have also identified the potential for bias in lay witness analysis of lost productivity.⁷⁹ Failure to use an expert may result in an inability to meet the required burden to prove inefficiency.⁸⁰ However, in limited instances, project personnel have been able to sustain the burden.⁸¹

Disruption Damages

The costs associated with disruption, and therefore the damages for disruption, generally differ from those associated with only delay. Disruption normally leads to increased labor and equipment costs due to the lack of productivity rather than extended time on site. Disruption typically would not include extended performance costs, such as extended project and home office overhead, wage and material escalation, and extended equipment costs. The two issues may join in a claim for acceleration where costs incurred to overcome a delay could include both extended performance costs as well as disruption due to the acceleration effort.⁸²

Discrete Pricing

An initial dilemma in quantifying a disruption event is

segregating those costs that can be quantified discretely from those that must be estimated or priced indirectly. If costs for a loss of productivity can be discretely identified and segregated by using a separate cost code or other method, then for those costs a method for approximating loss of productivity is not required.⁸³ For example, if a differing site condition resulted in additional drilling depth to find bedrock and the additional time required for drilling can be tracked through job tickets and depth measurements, the direct costs resulting from the condition can be determined. As a result, the actual cost of the condition can be clearly separated from other costs and quantified. This approach is sometimes referred to as “discrete pricing” or tracking the direct costs of the inefficiency.

If costs for disruption can be directly tracked, ideally a claimant would do so and would not resort to an approximation of the loss of productivity.⁸⁴ Indeed, the failure to track costs that can be tracked and directly measured may bar recovery in certain circumstances and certainly prejudice recovery in others.⁸⁵ The U.S. Court of Appeals for the Federal Circuit in *Propellex Corp. v. Brownlee*⁸⁶ explored this issue in the context of a contract with the Department of the Army for the manufacture of primers for 5-inch gun shells. The contractor submitted samples of black powder it intended to use in the manufacture of primers. The Government tested them and found the moisture content exceeded that allowed under the contract. The contractor investigated and ultimately discovered that the Government’s testing procedures were defective. The contractor had not tracked the costs of its investigation into the moisture issue, thinking that the results had been generated by the manufacturing process. The board of contract appeals denied the claim for investigation costs on the premise that the total cost calculation offered was inadequate given that the contractor could have tracked its costs discretely.⁸⁷ On appeal, the Federal Circuit made the following observations:⁸⁸

Although [the contractor] does not dispute that it could have set up its accounting system to track the costs of the moisture investigation, it argues that because it “reasonably believed that it was to blame [for the moisture problem], there was no reason [for it] to set up an account to track such costs.” We are not persuaded by this argument. First, [the contractor] did record in detail every aspect of the testing related to the moisture problem, with the exception of costs. Second, assuming [the contractor] believed it was responsible for the moisture problem, it was all the more important for it to segregate costs relating to that problem from costs incurred under the contracts for which it was entitled to be paid by the Army. Where it is impractical for a contractor to prove its

actual costs because it failed to keep accurate records, when such records could have been kept, and where the contractor does not provide a legitimate reason for its failure to keep the records, the total cost method of recovery [under which the measure of damages is the difference between actual expenses and bid or estimated costs] is not available to the contractor.

In sum, substantial evidence supports the Board’s conclusion that [the contractor] did not establish the impracticability of proving its actual losses directly and thus cannot recover under the modified total cost method.

The Federal Circuit’s approach is not limited to claims premised on the total cost method⁸⁹ but can embrace other alternative approaches to damages.⁹⁰

Specificity Of Damages

The same damages principles that apply to delay and other matters apply to claims for disruption, namely that while the plaintiff bears the burden of proving the fact of damage and presenting some evidence of quantum, the claim will not fail if the quantum is not precise.⁹¹ Put differently, courts and boards have expressed a degree of understanding regarding the precision of damages quantification, and in that context are willing to accept estimates.⁹² In short:⁹³

The ascertainment of damages, or of an equitable adjustment, is not an exact science, and where responsibility for damage is clear, it is not essential that the amount thereof be ascertainable with absolute exactness or mathematical precision: “It is enough if the evidence adduced is sufficient to enable a court or jury to make a fair and reasonable approximation.”

Although courts have indicated a willingness to accept approximations, the degree of acceptance is directly proportional to the equities of a particular case. As alluded to in the quote above, tribunals may follow a more loose approach to quantification only when “responsibility for damage is clear.”⁹⁴ Even then, tribunals have been quick to note that “[a] damage award must not be based on ‘mere speculation, guess, or conjecture.’”⁹⁵ The evidence placed before a tribunal to prove the fact of damages and the causation must be clear.

Methods For Proving Loss Of Productivity

Methods for proving loss of productivity generally fall into four major categories: measured mile, comparison to bid, productivity factors, and visual observation or judgment. Each category of essential methods includes multiple subcategories that are generally summarized in the following list:

- (1) Measured mile:
 - (a) Comparison of same work; and
 - (b) Comparison of reasonably alike work.
- (2) Comparison to bid:
 - (a) Earned value;
 - (b) Comparison of similar project;
 - (c) Modified total cost; and
 - (d) Total cost.
- (3) Productivity factors:
 - (a) Academic studies; and
 - (b) Industry studies.
- (4) Visual observation or judgment:
 - (a) By productivity expert; and
 - (b) By project personnel.

The *measured mile* is the generally preferred method for quantifying lost productivity and is based on comparing the contractor’s productivity in one area with achieved productivity of similar work on the same project.⁹⁶ For purposes of this PAPER, the *comparison to bid* category includes all methods that depend upon an accurate bid for the project, a fact not required by the measured mile method.⁹⁷ In the comparison to bid category, earned value and comparison to similar projects are often considered a “type” or “substitute” measured mile that attempts to compare other work on the same project or similar work on a different project.⁹⁸ The *total cost* and *modified total cost* methods compare actual costs to bid and are also reliant on an accurate bid.⁹⁹ The *productivity factors* category consists of application of factors from a published study to the contractor’s labor to estimate inefficient hours resulting from a specific issue.¹⁰⁰ Generally, published studies are broken up into two categories: industry studies and academic studies.¹⁰¹

The last category of methods for proving loss of productivity is *visual observation or judgment*, based broadly on past experience as opposed to a specific analysis or reference.¹⁰² Determination of the lost efficiency percentage is typically based on either visiting the site and observing progress or reviewing the project record and interviewing project personnel.¹⁰³ It has been performed by an indepen-

dent expert based on an expert’s past experience, but has also been supported by project personnel based on their past experience and site observations.¹⁰⁴

Using Multiple Methods

Given that methods for proving loss of productivity approximate the resultant damage, experts offering opinions in adversary proceedings often attempt to reinforce their opinions by using multiple methods of quantification. The approach has advantages in that multiple, consistent, and confirming methods may encourage a factfinder to conclude that the primary method was reasonable. Under this triangulation approach, the multiple methods support an original opinion. Different methods, however, may result in different conclusions, based on either the accuracy of the method or how closely the model matches the underlying facts of the case. As a result, an expert’s use of multiple methods as a “double check” or alternate calculation may actually undermine the expert’s original opinion. Accordingly, using multiple methods as a testimonial approach has seen mixed acceptance.

For example, in *Southern Comfort Builders, Inc. v. United States*,¹⁰⁵ the plaintiff’s expert presented two alternative methods and then averaged the results of the two different methods to reach a third conclusion.¹⁰⁶ Both methods were labeled as being “modified”—a “modified” total cost and a “modified” measured mile.¹⁰⁷ On cross-examination, the expert highlighted that all three methods were estimates, testifying that “these calculations cannot precisely pinpoint exactly what the loss of productivity is. They’re simply methods to develop a range that the loss of productivity be and in both instances, we reduced the amount by ten percent to address any contractor inefficiency.”¹⁰⁸ The court was not persuaded by any of the modifications and even less so by the averaging. In that regard the court observed:¹⁰⁹

Based on the information presented, this court cannot adopt [plaintiff’s expert’s] measured mile analysis or modified total cost analysis to support [the plaintiff’s] calculation of damages for loss of productivity. Nor can the court adopt an average of the two calculations. Plaintiff’s expert attempted three different methodologies without explicitly signing on to any one of those definitively, and his analysis on each of the methodologies presented at trial was flawed.

The court’s rejection to the use of multiple methods supplemented its rejection of the underlying differing site conditions claim.

In *North American Mechanical Inc. v. Walsh Construc-*

tion Co. II, LLC,¹¹⁰ the court took a slightly more favorable approach to multiple analyses and recognized the concept of triangulation. In that case, the court noted that the contractor's expert adopted more than one approach to quantifying the impact damages:¹¹¹

[Contractor's expert] offered two alternative methods for calculating [the contractor's] inefficiency damages. It appears that his purpose in doing so was to bolster his conclusion under the total cost method by demonstrating that they resulted in damage calculations that were in the same general ballpark as the amount arrived at using the total cost method. It does not appear that he intended that these calculations would form an alternative basis for an award of damages to [the contractor] if the court rejected his total cost method of calculating damages.

The court proceeded to evaluate all methods presented, yet concluded that each failed.¹¹² Nevertheless, the court illustrated a scenario under which alternative expert opinions represented by alternative methods of quantifying impacts were considered.

Cumulative Impact Of Changes On Unchanged Work

Changes to specific items of work can create unintended consequences in other parts of a project that were not intentionally or directly modified.¹¹³ Accordingly, an issue related to and often discussed alongside disruption is the idea of cumulative impact or "ripple" impact. The board of contract appeals summarized the concept in *Centex Bateson Construction Co.*, as follows:¹¹⁴

Cumulative impact is the unforeseeable disruption of productivity resulting from the "synergistic" effect of an undifferentiated group of changes. Cumulative impact is referred to as the "ripple effect" of changes on unchanged work that causes a decrease in productivity and is not analyzed in terms of spatial or temporal relationships. This phenomenon arises at the point the ripples caused by an indivisible body on two or more changes on the pond of a construction project sufficiently overlap and disturb the surface such that entitlement to recover additional costs resulting from the turbulence spontaneously erupts. This overlapping of the ripples is also described as the "synergistic effect" of accumulated changes.

The concept has both proponents and detractors,¹¹⁵ but is intended generally to identify and quantify the impacts of one or more changes on unchanged work.¹¹⁶ At least one commentator has asserted that the cumulative impact claim is simply a "total productivity loss" claim akin to a total cost analysis of other damages.¹¹⁷ Those impacts have been deemed recoverable costs by federal and some state tribunals under certain situations.¹¹⁸

Cumulative impact rests on the theory that numerous changes may disrupt original, base contract work and cause a loss of productivity on unchanged work.¹¹⁹ In the federal arena, the concept flows from the language of the "Changes" clause and the ability to recover costs associated with a change "whether or not changed by" a modification.¹²⁰ As a result, work that might be impacted by a change or collection of changes may drive an increase in the cost of performance and thereby create a compensable impact.¹²¹ The cumulative portion of the title derives from the notion that a collection or series of changes may be more substantial and correspondingly more difficult to segregate in terms of costs and causation.¹²²

Conceptually, proving a cumulative impact claim is no different than proof of any other; it requires evidence of liability, causation, and damage.¹²³ Proving causation, as with any other disruption claim, becomes a key hurdle. Cumulative impact claims have been rejected as too speculative,¹²⁴ and many courts consider the cumulative impact argument as little more than an extension of the total cost approach.¹²⁵

Given the preoccupation with causation, the question naturally arises: how can a claimant prove cumulative impact? The answer is not clear, but a board of contract appeals made the following observation on how *not* to prove a claim:¹²⁶

However, impact is not demonstrated solely by showing the number of changes or clarifications to the contract, nor by comparing the cost of the changes to the original contract price. There is no fixed rule setting forth the number of changes or percentage of price of changes to establish a cumulative impact due to many changes.

While the number of changes or the magnitude of changes may not, alone, provide a basis for a cumulative impact claim, those metrics can bear significant weight in presenting a claim.¹²⁷ Moreover, as the number and significance of modifications to the work increase, the circumstances may come close to reflecting a cardinal change (a change beyond the scope of the contract). Accordingly, many decisions that address cumulative impact wrestle with the concept of cardinal change.¹²⁸ While any strict requirement in the federal context that a contractor demonstrate a cardinal change to recover for cumulative impact has been overcome, recent decisions continue to rely on similar language and thus a similar conceptual approach.¹²⁹

An additional issue arising in connection with cumulative impacts is waiver or release. Cumulative impact theoretically arises from the collection or interaction of changes.

As a result, the impact on unchanged work may remain latent until after a formal contract modification has been executed. For example, a forward-priced contract modification to a discrete item of work may not include the productivity impacts on other, unchanged items of work. Any release or waiver language contained in the executed modification can affect later recovery of cumulative impact damages.

*Jackson Construction Co. v. United States*¹³⁰ offers a good discussion of both release and accord and satisfaction in the context of cumulative impact. In this case, the contractor completed its contract with the Corps of Engineers on time and received additional compensation for its work under a signed modification. The contractor sought compensation for cumulative impact resulting from 24 bilateral modifications that increased the contract price by \$618,189. The modifications included the following language:¹³¹

The contract period of performance remains the same. It is further understood and agreed that this adjustment constitutes compensation in full on behalf of the contractor and his subcontractors and suppliers for all costs and markup directly or indirectly, including extended overhead, attributable to the change order, for all delays related thereto, and for performance of the change within the time frame stated.

On the legal issues, the court offered a clear statement of the law:¹³²

An “accord” is a contract under which both parties agree that one party will render additional or alternative performance in order to settle an existing claim made by the other party, and “satisfaction” is the actual performance of the accord. The party asserting an accord and satisfaction defense must establish four elements: (1) proper subject matter; (2) competent parties; (3) a meeting of the minds; and (4) consideration.

An executed bilateral modification with a release provision usually constitutes an accord and satisfaction unless that release is either ambiguous or limited in scope. A contractor may preserve its rights by explicitly reserving its rights to assert additional claims for the work covered by the modification. While the language of the release is a good starting point for this analysis, the Court must look beyond the mere existence or nonexistence of any release language or reservation of rights in a bilateral modification. “[W]hile an accord and satisfaction *may* contain an express release for the immediate discharge of a contractual right or obligation, a release constitutes no condition precedent to discharge by accord and satisfaction.”

The court found against the contractor, but highlighted the kinds of evidence that should be examined for purposes of determining the scope of a release or the validity of an accord and satisfaction:¹³³

Therefore, the Court must focus on whether or not the parties’ objective manifestations of intent demonstrate that they reached a meeting of the minds with respect to the release of additional claims. In such instances, the Court may consider parol evidence in order to construe the release in accordance with the parties’ intent at the time of execution. The Court may also consider evidence to determine if additional negotiations occurred after the execution of the bilateral modification. The rationale in such instances is that “the Government’s consideration of the merits of a claim, following the execution of a release, indicates that the parties did *not* intend the release to extinguish the claim, and hence did not bar the contractor’s earlier claim.”

Furthermore, even if the parties have executed a clear and unambiguous release, this Court can void or reform the release on several grounds, including lack of consideration, lack of performance, lack of authority, unilateral or mutual mistake, misrepresentation, duress, or under other circumstances in which the parties’ conduct evinces an intent to allow additional claims.

The decisions in *Bell BCI Co. v. United States*¹³⁴ also addressed the issue of release but focused on the nature of the language more than parol evidence. In *Bell*, the contractor agreed to build a laboratory at the National Institutes of Health (NIH). As the court noted, “[a]pproximately nine months into construction, NIH decided to add a new floor to the building.”¹³⁵ Addition of the new floor after the work had commenced ultimately resulted in “more than 200 contract modifications,” a \$21 million price increase (34%), and delay to completion of nearly 20 months. At completion, the contractor tendered an “impact claim for the cumulative effect of the changes” in the amount of approximately \$6 million.¹³⁶

At trial, the Government argued that the contractor had waived any impact claims under the doctrine of accord and satisfaction. In support, the Government pointed to the language of the modifications to the work which provided that the modification was—¹³⁷

[F]ull and equitable adjustment for the remaining direct and indirect costs of the Floor 4 Fit-out (EWO 240-R1) and full and equitable adjustment for all delays resulting from any and all Government changes transmitted to the Contractor on or before August 31, 2000.

* * *

The modification agreed to herein is a fair and equitable adjustment for the Contractor’s direct and indirect costs. This modification provides full compensation for the changed work, including both Contract cost and Contract time. The Contractor hereby releases the Government from any and all liability under the Contract for further equitable adjustment attributable to the Modification.

While the trial court noted that the modification did not specifically call out cumulative impact, the Government argued that the language, presumably not least the last sentence, operated to foreclose additional claims related to the same issues.

In its decision, the trial court seems to have weighed the equity of the circumstances in its decision, commenting that:¹³⁸

The record shows that NIH, despite its best intentions, lost control of the project beginning in September 2000, and could not prevent the scientists who would occupy the building from demanding changes. The addition of a new floor after construction had begun proved to be a disastrous idea, particularly in causing many mechanical and electrical changes after the work already had been installed. As changes and delays mounted, NIH and its quality management firm only made matters worse by directing [the contractor] to perform extra work without time extensions, or authorizing [the contractor] to accelerate performance. In issuing 200-plus contract modifications, NIH actually addressed more than 730 Extra Work Orders (“EWOs”).

In that light, the court rejected the accord and satisfaction argument, holding that the modification language did not include any payment for cumulative impact, did not expressly release cumulative impact, and did not even address the concept.¹³⁹ The court noted the lack of language in the modification specifically addressing the cumulative impact and the lack of proof that any “meeting of the minds between the parties ever occurred.”¹⁴⁰

On appeal, the U.S. Court of Appeals for the Federal Circuit disagreed as to the scope of the release and found the language to be unambiguous. On that front, it observed:¹⁴¹

The language plainly states that [the contractor] released the government from *any* and *all* liability for equitable adjustments attributable to Mod 93. At best, there may be ambiguity as to which claims are “attributable to” a given modification, but we cannot glean any ambiguity about which *types* of claims are released—Mod 93 clearly, unambiguously releases the government from “any and all” liability. As the Supreme Court stated. . . , “[i]f parties intend to leave some things open and unsettled, their intent so to do should be made manifest.” Further, the government’s payment of over \$2,000,000 in Mod 93 constitutes adequate consideration for [the contractor’s] release.

As a result, the court outlined the following elements necessary to prove accord and satisfaction: (1) proper subject matter, (2) competent parties, (3) a meeting of the minds of the parties, and (4) consideration.¹⁴² Language of the type at

issue in *Bell* remains a solid basis for denial of cumulative impact claims.¹⁴³

Guidelines

These *Guidelines* are intended to assist you in understanding the quantification and proof of claims related to disruption, inefficiency, and loss of productivity on construction projects. They are not, however, a substitute for professional representation in any specific situation.

1. Recognize that disruption can occur even when a construction project is completed on time and involves a different set of increased costs from those associated with delays. Disruption occurs when a contractor must perform work differently and less efficiently than originally planned and typically leads to increased labor and equipment costs rather than extended time on site.

2. Bear in mind a contractor’s entitlement to disruption damages follows the same requirements as any other claim: the claimant has the burden of proving liability, causation, and damages by a preponderance of the evidence.

3. Be aware that in quantifying estimates of the amount of impact or lost productivity, courts and boards have consistently required testimony from properly qualified expert witnesses.

4. Keep in mind that the failure to track the costs of lost productivity that can be tracked discretely and directly measured without resort to a method for estimating those costs may bar recovery for disruption claims in certain circumstances or prejudice recovery in others.

5. Recognize that the measured mile method, which compares the contractor’s productivity in one area with achieved productivity on similar work on the same project, is the generally preferred method for proving loss of productivity.

6. Bear in mind that the use of multiple methods of quantification—measured mile, comparison to bid, productivity factors, and visual observation and judgment—to estimate damages when proving loss of productivity due to disruption on the same claim has seen mixed acceptance by courts and boards of contract appeals.

7. Be aware that proof of causation for cumulative impact is difficult. The number or magnitude of contract changes may not alone provide a basis for a claim.

8. Keep in mind that release or waiver language contained

in an executed contract modification may result in the denial of a cumulative impact claim under the doctrine of accord and satisfaction.

ENDNOTES:

¹See, e.g., *Bell BCI Co. v. U.S.*, 72 Fed. Cl. 164, 168 (2006) (“There is a distinction in the law between: (1) a ‘delay’ claim; and (2) a ‘disruption’ or ‘cumulative impact’ claim. Although the two claim types often arise together in the same project, a ‘delay’ claim captures the time and cost of not being able to work, while a ‘disruption’ claim captures the cost of working less efficiently than planned.”); see also *U.S. Indus., Inc. v. Blake Constr. Co.*, 671 F.2d 539, 546 (D.C. Cir. 1982) (unlike a delay claim that provides redress from not being able to work, a disruption claim compensates for damages when the work is more difficult and expensive than anticipated); *City of Galveston v. Triple B Servs., LLP*, No. 01-15-00565-CV, 2016 WL 3025261, at *4 (Tex. App. May 26, 2016) (distinguishing delay damages from disruption damages); 5 *Bruner & O’Connor Construction Law* § 15:29.

²See, e.g., *U.S. Indus., Inc. v. Blake Constr. Co.*, 671 F.2d 539, 546–47 (D.C. Cir. 1982) (distinguishing between “delay damages” that compensate nonbreaching party’s inability to work because of breaching party’s delay and “disruption damages” that compensate nonbreaching party for damages suffered because breaching party’s actions made nonbreaching party’s “work more difficult and expensive than [it] anticipated and than it should have been”); see also 5 *Bruner & O’Connor Construction Law* § 15:103.

³5 *Bruner & O’Connor Construction Law* § 15:102. Disruption damages can also be caused by an “event [that] both disrupts and delays a critical path activity.” 5 *Bruner & O’Connor Construction Law* § 15:103.

⁴See, e.g., *Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 635 (2008), *aff’d in part, vacated in part, and remanded*, 570 F.3d 1337 (Fed. Cir. 2009).

⁵See, e.g., *P.J. Dick Inc.*, VABCA No. 5597 et al., 01-2 BCA ¶ 31,647, *aff’d in part, vacated in part, and rev’d in part*, *P.J. Dick Inc. v. Principi*, 324 F.3d 1364 (Fed. Cir. 2003).

⁶See, e.g., *Daewoo Eng’g & Constr. Co. v. U.S.*, 73 Fed. Cl. 547 (2006), *aff’d*, 557 F.3d 1332 (Fed. Cir. 2009).

⁷See, e.g., *Lamb Eng’g & Constr. Co.*, EBCA No. C-9304172, 97-2 BCA ¶ 29,207.

⁸See, e.g., *Clark-Fitzpatrick, Inc. v. Gill*, No. 88-785, 1993 WL 853794, at *21–22 (R.I. Super. Mar. 12, 1993), *aff’d in part, rev’d in part*, 652 A.2d 440 (R.I. 1994).

⁹See, e.g., *Bay W., Inc.*, ASBCA No. 54166, 07-1 BCA ¶ 33,569.

¹⁰See, e.g., *Contract Mgmt., Inc. v. Babcock & Wilson*

Technical Servs. Y-12, LLC, No. 3:10-CV-110, 2013 WL 74619, at *35–36 (E.D. Tenn. Jan. 4, 2013).

¹¹See, e.g., *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *27 (Mass. Super. Jan. 3, 2012).

¹²See, e.g., *Groves-Black*, ENGBCA No. 4557, 85-3 BCA ¶ 18,398.

¹³See, e.g., *Tony DePaul & Son v. City of Philadelphia*, No. 2426, 1992 WL 1071420 (Pa. Com. Pl. Aug. 20, 1992).

¹⁴See, e.g., *Danac, Inc.*, ASBCA No. 33394, 97-2 BCA ¶ 29,184, *aff’d on recons.*, 98-1 BCA ¶ 29,454.

¹⁵See, e.g., *A.W. Burton*, AGBCA No. 431, 77-1 BCA ¶ 12,307.

¹⁶See, e.g., *Safeco Ins. Co. v. Cty. of San Bernardino*, No. EDCV 05-194-VAP(OPX), 2006 WL 5112598 (C.D. Cal. June 12, 2006). The cost of labor metric may more accurately reflect the mix of experience on different crews, for instance if some crews consisted of more apprentices than journeymen, or vice versa.

¹⁷For example, the productivity metric for cost per masonry block installed would likely include the labor cost per block, any associated equipment/lift use cost required by the laborer, and also the fixed cost of the block and mortar. In that example, the labor and equipment cost is proportional to the labor hours required to install the block, but the same block and quantity of mortar would generally be required regardless of the number of labor hours required to install the block.

¹⁸*Kenneth Reed Constr. Corp.*, ENGBCA No. 2748 et al., 72-1 BCA ¶ 9407.

¹⁹*Wayne Knorr, Inc. v. Dep’t of Transp.*, 973 A.2d 1061, 1076–77 (Pa. Commw. Ct. 2009).

²⁰*Wayne Knorr, Inc. v. Dep’t of Transp.*, 973 A.2d 1061, 1076–77 (Pa. Commw. Ct. 2009).

²¹*Flex-Y-Plan Indus., Inc.*, GSBCA No. 4117, 76-1 BCA ¶ 11,713.

²²*Rodman Constr. Co. v. BPG Residential Partners, V, LLC*, No. CIV.A. 07L-08-084JOH, 2013 WL 656176 (Del. Super. Ct. Jan. 8, 2013).

²³See U.S. Army Corps of Engineers Modification Impact Evaluation Guide EP-415-1-3, at 4-4(b) (1979) (rescinded 1996) (“Reduced labor productivity implies a loss from some established normal or anticipated level of productivity. Although construction does not lend itself to definitive measurement of labor productivity, there are methods a contractor can use to quantify anticipated labor costs when preparing a bid. The most common technique draws heavily on data derived from the contractor’s past experiences, including any indicated trends, present labor pay rates, and anticipated labor rate increase during the life of the project.”).

²⁴See, e.g., *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153 (“Impact costs are additional costs occurring as a result of the loss of productivity; loss of productivity is also termed inefficiency. Thus, impact costs are simply increased labor costs that stem from the disrupt-

tion to labor productivity resulting from a change in working conditions caused by a contract change. Productivity is inversely proportional to the man-hours necessary to produce a given unit of product. As is self-evident, if productivity declines, the number of man-hours of labor to produce a given task will increase. If the number of man-hours increases, labor costs obviously increase.”); see also Finke, “Claims for Construction Productivity Losses,” 26 *Pub. Cont. L.J.* 311, 312–13 (Spring 1997).

²⁵See Triple “A” South, ASBCA No. 46866, 94-3 BCA ¶ 27,194 (“Among other things, ‘impact’ includes: ‘inefficiencies due to overcrowding, over or undermanning, skill dilution, extended overtime, shift work and local and cumulative disruption.’”); *Pac. Ship Repair & Fabrication, Inc.*, ASBCA No. 49288, 99-1 BCA ¶ 30,222 (discussing that the “the government believes the design problems have caused significant delay, disruption, standby time, reassignment, loss of efficiency, trade skill dilution, overtime fatigue, etc.”).

²⁶See, e.g., *In re Elec. Mach. Enters, Inc.*, 416 B.R. 801 (M.D. Fla. 2009) (“[The subcontractor] was severely impacted and damaged by the trade stacking that resulted from the lack of coordination of the trade contractors. . . . Trade stacking on the Project resulted because the time sequences for work were compressed without regard to the inability of trade contractors to simultaneously perform necessarily sequential work. [The subcontractor] was often unable to proceed because it was blocked by predecessor trade contractors, such as the mechanical, dry wall, roofing, and painting subcontractors.”); see also *Cent. Ceilings, Inc. v. Suffolk Constr. Co.*, No. SUCV200604129A, 2013 WL 8721044 (Mass. Super. Dec. 19, 2013); *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *50 (Mass. Super. Jan. 3, 2012); *Kinetic Sys., Inc. v. R.I. Indus. Facilities Corp.*, No. KM 02-0616, 2003 WL 22048520, at *7 (R.I. Super. Aug. 4, 2003); *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *23 (Pa. Bd. Claims June 13, 2006).

²⁷See, e.g., *Coastal Dry Dock & Repair Corp.*, ASBCA No. 36754, 91-1 BCA ¶ 23,324 (“Examples of cost not included in hardcore [labor costs] are those caused by impact, by inefficiencies due to overcrowding, over- or undermanning, skill dilution, extended overtime, shift work and by delay of delivery.”); *Pittsburgh-Des Moines Corp.*, EBCA No. 314-3-84, 89-2 BCA ¶ 21,739 (addressing claims related to increased labor or over-manning).

²⁸See, e.g., Triple “A” South, ASBCA No. 46866, 94-3 BCA ¶ 27194 (“Among other things, ‘impact’ includes: ‘inefficiencies due to overcrowding, over or undermanning, skill dilution, extended overtime, shift work and local and cumulative disruption.’”).

²⁹Changes in manpower up and down may cause a loss of productivity. See, e.g., *Ingalls Shipbuilding Div., Litton Sys., Inc.*, ASBCA No. 17579, 78-1 BCA ¶ 13,038 (studies used to support contention that “any upward or downward deviation [in manpower] of more than a small percentage was very bad for cost and productivity”).

³⁰See, e.g., *U.S. Army Corps of Engineers Modification Impact Evaluation Guide EP-415-1-3*, at 4–6 (1979) (re-

scinded 1996) (“Disruption occurs when workers are prematurely moved from one assigned task to another. Regardless of the competency of the workers involved, some loss in productivity is inevitable during a period orientation to a new assignment. This loss is repeated if workers later returned to their original job assignment. Learning curves which graph the relationship between production rate and repeated performance of the same task have been developed for various industrial tasks. The basic principle of all learning curve studies is that efficiency increases as an individual or team repeats an operation over and over; assembly lines are excellent demonstrations of this principle. However, although construction work involves the repetition of similar or related tasks, these tasks are seldom identical. Skilled construction are trained to perform a wide variety of tasks related to their work specific trade. Therefore, in construction it is more appropriate to consider the time required to become oriented to the task rather than acquiring the skill necessary to perform it.”); see also *Groves-Black, ENGBCA No. 4557, 85-3 BCA ¶ 18,398* (“The Appellant attempted to prove that the setting and stripping of forms was essentially repetitive work for the entire spillway structure, that the hours of labor necessary to set and strip a given area of forms should have followed an ever downward curve.”); *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *8 (Mass. Super. Jan. 3, 2012).

³¹See, e.g., *Aleutian Constructors, J.V.*, ASBCA No. 49255, 01-1 BCA ¶ 31,392.

³²See, e.g., *Pac. Ship Repair & Fabrication, Inc.*, ASBCA No. 49288, 99-1 BCA ¶ 30,222.

³³See, e.g., *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *24 (Mass. Super. Jan. 3, 2012) (discussing motivation as a factor).

³⁴See, e.g., *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *24 (Pa. Bd. Claims June 13, 2006) (discussing inexperience as a factor).

³⁵See, e.g., *Kinetic Sys., Inc. v. R.I. Indus. Facilities Corp.*, No. KM 02-0616, 2003 WL 22048520, at *4 (R.I. Super. Aug. 4, 2003) (“[T]his decision would inevitably lead to re-work on the Project that would damage productivity.”); *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153 (“labor inefficiency caused by ‘go-back’ work and other disruptions”).

³⁶See, e.g., *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *24 (Pa. Bd. Claims June 13, 2006) (finding that the contractor “contributed to its own productivity problems through excessive personnel turnover”).

³⁷See, e.g., *George A. Fuller Co.*, ENGBCA No. 1957, 1962 WL 225 (May 23, 1962) (“The speed-up of the work was accomplished by adding workmen to the force and by increasing the hours of work per day and the days of work per week. When men work longer daily hours and weekends, much beyond the normal, their efficiency is impaired resulting in less production for a given number of man hours of work.”); see also *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *23 (Pa. Bd. Claims June 13, 2006) “[The contractor’s] work productivity was adversely affected by

[the contractor's] agreement to accelerate the completion of Phase II which caused the stacking of activities, working areas being over-crowded because multiple tasks were being performed out of sequence and because there was present extra workers and equipment, and the inability to move equipment, manpower and materials efficiently within the work zone."); *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *18 (Pa. Bd. Claims Oct. 28, 1993) ("Acceleration of work, including out of sequence work, start and stop operations, stacking of trades, simultaneous operations, additional manpower and equipment and additional work, causes a loss of efficiency and productivity in a contractor's work efforts. Working in winter weather conditions, including rain, cold and freezing conditions, also causes a loss of efficiency and productivity in work efforts").

³⁸See, e.g., *Danac, Inc.*, ASBCA No. 33394, 97-2 BCA ¶ 29,184, aff'd on recons., 98-1 BCA ¶ 29,454 ("We have long recognized that lost efficiency caused by a disruption of a contractor's planned sequence of work may be compensable."); see also *S. Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 145 (2005) (out of sequence work allegedly caused by waiting for [request for information] caused loss of productivity but was contractor's responsibility for failure to prepare coordination drawings); *Parsons of Cal.*, ASBCA No. 20867, 82-1 BCA ¶ 15,659, at 77,418 (out-of-sequence of work in construction contract caused by drawing defects); *Cent. Ceilings, Inc. v. Suffolk Constr. Co.*, No. SUCV200604129A, 2013 WL 8721044 (Mass. Super. Dec. 19, 2013) (court found loss of productivity where prime contractor required a subcontractor "to constantly demobilize, re-mobilize, and alter the natural sequence of its work under the Subcontract"). But see *Elec. Contractors, Inc. v. Pike Co.*, No. 3:11-CV-01449 JAM, 2015 WL 3453348, at *20 (D. Conn. May 29, 2015) ("[J]ust because work moves to a different area, a different time frame, doesn't mean that it's going to be less productive, [that] the contract was going to be automatically incurring loss of productivity. It means you're doing it at a different time frame.").

³⁹See, e.g., *Groves-Black*, ENGBCA No. 4557, 85-3 BCA ¶ 18,398 (addressing inefficiency caused by suspension of work).

⁴⁰See, e.g., *Grunley Constr. Co.*, GAOCAB No. 2009-1, 2010 WL 2561431 (June 16, 2010) ("The damages [the contractor] seeks to recover here are the night shift differential plus night-time inefficiency costs incurred from October 2005 through December 31, 2006").

⁴¹See, e.g., *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *27 (Mass. Super. Jan. 3, 2012) ("The parties do not dispute that in the construction industry it is accepted that workers' productivity declines when substantial overtime is required. It is referred to as a loss of 'efficiency,' and when . . . a cost submission is developed for a project involving significant overtime, there is customarily an 'efficiency' item included in the forecast. Overtime is one of a number of factors that affects efficiency."); *George A. Fuller Co.*, ENGBCA No. 1957, 1962 WL 225 (May 23, 1962) ("The speed-up of the work was accomplished by adding

workmen to the force and by increasing the hours of work per day and the days of work per week. When men work longer daily hours and weekends, much beyond the normal, their efficiency is impaired resulting in less production for a given number of man hours of work.").

⁴²See, e.g., *Cent. Ceilings, Inc. v. Suffolk Constr. Co.*, No. SUCV200604129A, 2013 WL 8721044 (Mass. Super. Dec. 19, 2013).

⁴³See, e.g., *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *18 (Pa. Bd. Claims Oct. 28, 1993) ("Acceleration of work, including out of sequence work, start and stop operations, stacking of trades, simultaneous operations, additional manpower and equipment and additional work, causes a loss of efficiency and productivity in a contractor's work efforts. Working in winter weather conditions, including rain, cold and freezing conditions, also causes a loss of efficiency and productivity in work efforts").

⁴⁴See, e.g., *N. Am. Mech., Inc. v. Walsh Constr. Co. II, LLC*, 132 F. Supp. 3d 1064, 1081 (E.D. Wis. 2015) (discussing the "beneficial occupancy" factor, which "relates to the difficulties resulting from the fact that [the owner] was still operating during construction" and finding that the subcontractor "was well aware when it bid on the Project that it would have to work around [the owner], which was going to remain open during construction, and it presumably factored that into its bid"); see also *Fire Sec. Sys., Inc.*, VABCA No. 3086, 91-2 BCA ¶ 23,743.

⁴⁵See, e.g., *Cont'l Consol. Corp.*, ASBCA No. 14372, 71-1 BCA ¶ 8742 (finding impacts related to "joint occupancy of the work site with other contractors"); *Kaiser-Raymond-Macco-Puget Sound*, ENGBCA No. 2298 et al., 1964 WL 269 (Sept. 29, 1964) (discussing disruption from "joint occupancy" that impacted "ready ingress and egress to the work areas"); *N. Am. Mech., Inc. v. Walsh Constr. Co. II, LLC*, 132 F. Supp. 3d 1064, 1081 (E.D. Wis. 2015) ("[J]oint occupancy (causing work to be performed while the facility is occupied by other trades not anticipated in the original bid) might result in a 5 to 20 percent loss of productivity.").

⁴⁶See, e.g., *Angelo Iafrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *23 (Pa. Bd. Claims June 13, 2006) (contractor experienced inefficiencies that adversely affected its work productivity on the project not caused by the owner, including "the over-extension of its project management personnel").

⁴⁷See, e.g., *Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 148 (2005) (Government's expert testified that the contractor's "loss of productivity estimate was so high because [it] had undervalued its estimated labor activities in its bid submitted prior to contract award"); *Herman B. Taylor Constr. Co.*, GSBCA No. 15421, 03-2 BCA ¶ 32,320.

⁴⁸See, e.g., *Va. Elec. & Power Co. v. Int'l Bhd. of Boilermakers*, No. 75-212-E, 1980 WL 2062, at *4 (N.D. W. Va. Mar. 3, 1980).

⁴⁹*Kenneth Reed Constr. Corp.*, ENGBCA No. 2748 et al., 72-1 BCA ¶ 9407.

⁵⁰See, e.g., *Bell BCI Co. v. U.S.*, 570 F.3d 1337, 1346 (Fed. Cir. 2009) (noting that "it is not disputed that [the

contractor] was told that no more than 4–6 Extra Work Orders should be expected, and that the 279 Extra Work Orders caused cumulative disruption, delay, and inefficiencies”).

⁵¹See, e.g., *Hardwick Bros. Co., II v. U.S.*, 36 Fed. Cl. 347, 354 (1996); *Hensel Phelps Constr. Co.*, ASBCA No. 49270, 99-2 BCA ¶ 30,531.

⁵²*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 145 (2005) (contractor alleged that many of the disruptions caused by the Government resulted from the Government’s failure to respond to its RFIs in a timely manner, which addressed interferences or obstructions encountered by the contractor); *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153 (discussing disruptions to subcontractor’s productivity “resulting from RFI’s and changes were caused by: moving crews from planned work to unplanned or changed work; the unplanned movement of crews between areas of the building; the hiring of more electricians; and, increasing crew size thereby causing problems in supervision and control and materials distribution”).

⁵³See, e.g., *SIPCO Servs. & Marine, Inc. v. U.S.*, 41 Fed. Cl. 196, 212 (1998); *Two State Constr. Co.*, DOTCAB No. 1006 et al., 81-1 BCA ¶ 15,149.

⁵⁴*Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *51 (Mass. Super. Jan. 3, 2012) (discussing “inefficiencies/impact on productivity in connection with the change orders issued to deal with fabrication and design defects”).

⁵⁵*Pittsburgh-Des Moines Corp.*, EBCA No. 314-3-84, 89-2 BCA ¶ 21,739 (where subcontractor “itself chose to perform penetration work in the field that was originally scheduled for the shop,” Government was “not liable for any reduction in productivity that may have stemmed from this procedural change”).

⁵⁶*Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *33 (Mass. Super. Jan. 3, 2012) (contributing factor to productivity loss was “the issue surrounding the late deliveries and lack of supply of materials and equipment that did not allow the project to move forward in a sequence that was conducive to optimal labor and equipment usage”).

⁵⁷See, e.g., *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *23 (Pa. Bd. Claims June 13, 2006) (“truck shortages”).

⁵⁸See, e.g., *Long Island Lighting Co.—Phase II—Proceeding on Motion of Com’n to Investigate Cost of Constr. of Shoreham Nuclear Generating Facility*, 25 N.Y.P.S.C. 3904, 27563 1985 WL 258217 (plaintiff argued that “poor productivity resulted from late deliveries of equipment and materials (especially piping materials) and prevented the company from achieving better productivity levels”); *Mergentime Corp. v. Wash. Metro. Area Transp. Auth.*, No. CIV. 89-1055 TFH, 2006 WL 416177, at *53 (D.D.C. Feb. 22, 2006) (“Further, while equipment sharing between the two jobs could have resulted in an efficient use of resources, [the contractor] instead suffered further problems and delays due to difficulties coordinating between the jobs with equipment shortages and breakdowns.”).

⁵⁹See, e.g., *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 713–14 (Ct. Cl. 1966) (“That winter weather and adverse water conditions reduce the efficiency of a labor force in the performance of construction work only stands to reason.”); *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *11 (Pa. Bd. Claims Oct. 28, 1993) (“The loss of productivity in this time period resulted from excessive overtime hours, the acceleration effort and adverse job conditions, including weather conditions.”).

⁶⁰See, e.g., *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 713–14 (Ct. Cl. 1966) (“That winter weather and adverse water conditions reduce the efficiency of a labor force in the performance of construction work only stands to reason.”); *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *12 (Pa. Bd. Claims Oct. 28, 1993) (“This loss of efficiency and productivity resulted from excessive overtime hours, adverse weather conditions, and the acceleration effort including labor and intensive winter curing claimed as a separate item.”).

⁶¹*Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *26–27 (Mass. Super. Jan. 3, 2012) (“The lack of siding and roofing continues to impact work due to the weather conditions and there are buildings with live electrical. There is impact to productivity as well as a potential safety impact. . . . [The subcontractor’s] performance of a substantial portion of its work in cold weather months resulted in a substantial loss of productivity and additional costs associated with temporary measures to mitigate the winter conditions.”); *Cent. Ceilings, Inc. v. Suffolk Constr. Co.*, No. SUCV200604129A, 2013 WL 8721044 (Mass. Super. Dec. 19, 2013) (“[T]he failure on [the prime contractor’s] part to reasonably address weather protection and climate problems and to reasonably coordinate the Project also led to loss of productivity. . . .”); *John E. Green Plumbing & Heating Co. v. Turner Constr. Co.*, 742 F.2d 965 (6th Cir. 1984) (“[L]ack of temporary heat and the out-of-sequence work, caused [the subcontractor] to employ more manpower resources to get the job done.”).

⁶²See, e.g., *Angelo Iaftrate Constr. Co.*, No. 3654, 2006 WL 2585021, at *23 (Pa. Bd. Claims June 13, 2006) (contractor experienced inefficiencies that adversely affected its work productivity on the project not caused by the owner, including “problems with moving about the construction zone because of trenching for drain pipe installation and limited access points”); *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *11 (Pa. Bd. Claims Oct. 28, 1993) (“Because [the contractor] was accelerating, the drainage work was performed as areas became available on a piecemeal basis, rather than in a continuous operation, and therefore the efficiency of the operation was impacted by the start and stop process.”).

⁶³See, e.g., *Mergentime Corp. v. Wash. Metro. Area Transp. Auth.*, No. CIV. 89-1055 TFH, 2006 WL 416177, at *13 (D.D.C. Feb. 22, 2006) (contractor contended delays due to rejection of initial traffic plan substantially disrupted and delayed its performance on the project by, “among other things, restricting work space and altering the sequence of work”); *Mergentime Corp. v. Wash. Metro. Area Transp. Auth.*, No. CIV.A. 89-1055 (GHR), 1993 WL 328083, at

*23 (D.D.C. July 30, 1993) (contractor asserted that “change in traffic maintenance requirements and associated delays in the issuance of required permits substantially disrupted its performance of the entire [project] by restricting the work space for [its] crews and causing work operations to be resequenced throughout the project, in turn causing inefficiencies and delays”).

⁶⁴See, e.g., *Certified Power Sys., Inc. v. Dominion Energy Brayton Point, LLC*, No. BRCV2008-01114, 2012 WL 384600, at *8 (Mass. Super. Jan. 3, 2012) (“‘Inefficiency’ is an item in a bid package that reflects an estimate of adverse impacts from site conditions that affect the quality and reliability of the work to be performed.”).

⁶⁵See, e.g., *Bell BCI Co. v. U.S.*, 72 Fed. Cl. 164, 168 (2006) (“There is a distinction in the law between: (1) a ‘delay’ claim; and (2) a ‘disruption’ or ‘cumulative impact’ claim. Although the two claim types often arise together in the same project, a ‘delay’ claim captures the time and cost of not being able to work, while a ‘disruption’ claim captures the cost of working less efficiently than planned.”); see also *U.S. Indus., Inc. v. Blake Constr. Co.*, 671 F.2d 539, 546 (D.C. Cir. 1982).

⁶⁶*Sauer Inc. v. Danzig*, 224 F.3d 1340, 1348 (Fed. Cir. 2000) (citing *Electronic & Missile Facilities, Inc. v. U.S.*, 416 F.2d 1345, 1359–61 (Ct. Cl. 1969)); see also *Bell BCI Co. v. U.S.*, 72 Fed. Cl. 164, 168 (2006).

⁶⁷See, e.g., *Cty. of Galveston v. Triple B Servs., LLP*, No. 01-15-00565-CV, 2016 WL 3025261, at *4 (Tex. App. May 26, 2016) (“Although [the contractor] finished the project on time and was never completely ‘stopped,’ it was ‘hindered’ because of the [owner’s] actions. Thus, any damages from the ‘disruption’ of a construction project that was stopped, hindered, or caused ‘to occur more slowly than normal’ are allowed. . . .”).

⁶⁸See, e.g., *Triple “A” South*, ASBCA No. 46866, 94-3 BCA ¶ 27,194 (claimant “still bears the ‘essential burden of establishing the fundamental facts of liability, causation, and resultant injury’ ”); *Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549 (claimant “has the burden of proving by a preponderance of the evidence liability, causation, and resultant injury”); *Wunderlich Contracting Co. v. U.S.*, 351 F.2d 956, 968 (Ct. Cl. 1965) (“leniency as to the actual mechanics of computation does not relieve the contractor of his essential burden of establishing the fundamental facts of liability, causation, and resultant injury”). See generally *Dale & D’Onofrio, Construction Schedule Delays* § 3:1 et seq.; *Dale & D’Onofrio, “Legal Issues in Schedule Delay Analysis,”* Briefing Papers No. 14-8 (July 2014).

⁶⁹See, e.g., *Centex Bateson Constr. Co.*, VABCA Nos. 4613 et. al., 99-1 BCA ¶ 20,153; *Dawson Constr. Co.*, VABCA No. 3306 et al., 93-3 BCA ¶ 26,177, aff’d, 34 F.3d 1080 (Fed. Cir. 1994); *Triple “A” South*, ASBCA No. 46866, 94-3 BCA ¶ 27,194; *Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549.

⁷⁰See, e.g., *Clark Constr. Grp., Inc.*, VABCA No. 5674, 00-1 BCA ¶ 30,870 (claimant’s “fundamental responsibility to prove by a preponderance of the evidence that a Government action caused its labor to be less efficient than planned

and the extent of that impact”); *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 20,153 (“there must be some proof of a causal connection established showing that the undifferentiated group of contract changes affecting the changed and unchanged contract work resulted in the loss of productivity on that work”); *Southwest Marine, Inc.*, DOT-CAB No. 1663, 94-3 BCA ¶ 27,102 (formula created by expert based on his own judgment and discussions with others related to change orders was not accepted because it presumed causation, did not show that 202 change orders had a cumulative impact, and didn’t factor in underbidding of labor); *Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549 (“General unsupported statements that a contractor suffered impact are not sufficient proof that it did, and the absence of contemporaneous documentary evidence of the disruptive effects to the work may provide reason for rejecting the claim.”).

⁷¹*Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549.

⁷²See, e.g., *Norment Sec. Grp., Inc. v. Ohio Dep’t of Rehab. & Correction*, 2003-Ohio-6572, 2003 WL 22890088 (Ct. Cl. Ohio Dec. 2, 2003) (expert testimony not provided and inefficiency claim failed for lack of proof); *Dawson Constr. Co.*, VABCA No. 3306 et al., 93-3 BCA ¶ 26,177 (project manager’s testimony of inefficiency percentage insufficient to prove inefficiency); *Havens Steel Co. v. Randolph Eng’g Co.*, 613 F. Supp. 514, 540 (W.D. Mo. 1985), aff’d, 813 F.2d 186 (8th Cir. 1987) (court did not accept witness as a loss of productivity expert due to lack of training or expertise); *Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 144 (2005) (“Loss of productivity claims can be difficult to prove. Experts are generally relied on to develop and document such claim.”); *Hensel Phelps Constr. Co.*, GSBACA No. 14744, 01-1 BCA ¶ 31,249 (“Loss of productivity is not an easy matter to prove. The aid of an expert is frequently required.”).

⁷³*Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 713 (Ct. Cl. 1966).

⁷⁴*Flatiron-Lane v. Case Atl. Co.*, 121 F. Supp. 3d 515, 543–44 (M.D.N.C. 2015).

⁷⁵See *Dale & D’Onofrio, Construction Schedule Delays* § 18:1 et seq.

⁷⁶See, e.g., *Daewoo Eng’g & Constr. Co. v. U.S.*, 73 Fed. Cl. 547, 580–81 (2006) (“The measured mile approach to damages is a form of total cost calculations that requires subjective judgment calls by the expert, who estimates damages by comparing periods of production that are unaffected by the contractor’s alleged government-caused delay, with periods during which delays affected its production adversely. . . . We assume that a finder of fact faced with such a method of estimating damages would want to have confidence in the experts’ ability and objectivity. A court would be particularly concerned to know how the experts picked periods of productive and non-productive construction for comparison.”); *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 713, 177 Ct. Cl. 676 (1966); *Clark Constr. Group, Inc.*, GAO CAB No. 2003-1, 2004 WL 5462234 (Nov. 23, 2004) (“Here, [the subcontractor] provided no expert witness testimony or a comparison to some accepted standard for its

claimed labor inefficiencies, and we therefore reject its inefficiency claims because no probative evidence has presented that would support recovery.”); *Sauer, Inc.*, ASBCA No. 39605, 01-2 BCA ¶ 31,525 (productivity factor analysis and estimates prepared by contractor/subcontractors and relied on by expert not accepted due to lack of proof of how and why efficiency was lost); *Havens Steel Co. v. Randolph Eng'g Co.*, 613 F. Supp. 514, 540 (W.D. Mo. 1985), *aff'd*, 813 F.2d 186 (8th Cir. 1987) (labor inefficiency claims by nature require expert testimony); *Danac, Inc.*, ASBCA No. 33394, 97-2 BCA ¶ 29,184, *aff'd on recons.*, 98-1 BCA ¶ 29,454 (accepting expert's "good period vs. bad period" analysis for labor inefficiency claim); *Paccon, Inc.*, ASBCA 7890, 1963 BCA ¶ 3659, at 18,356 (proving labor inefficiency costs necessitates reliance upon estimates by experts).

⁷⁷*Flatiron-Lane v. Case Atl. Co.*, 121 F. Supp. 3d 515, 543–44 (M.D.N.C. 2015).

⁷⁸See Fed. R. Evid. 702, stating: “A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.” See also *Dale & D'Onofrio, Construction Schedule Delays* § 1:5.

⁷⁹See, e.g., *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 713 (Ct. Cl. 1966) (“[W]e cannot ignore the fact that [witness] was plaintiff's former employee and had been over a period of 10 years. While he was not in plaintiff's employment at the time he testified, he quite properly had a certain predilection for his old employer and wanted to ‘help them out’ all he could. His sympathy was naturally with his former employer rather than with the Government. We do not mean the witness was dishonest, but we do think he made his estimates as high as he could to the extent his conscience would permit.”); *States Roofing Corp.*, ASBCA No. 54860 et al., 10-1 BCA ¶ 34,356 (“We similarly reject the [labor productivity factor] analysis here, inasmuch as it was performed not by an expert, but by [the contractor's] president, Mr. DeLauney, making it impossible for us to disregard the inherent subjectivity.”); *AEI Pac., Inc.*, ASBCA No. 53806, 08-1 BCA ¶ 33,792; *Sauer, Inc.*, ASBCA No. 39605 et al., 01-2 BCA ¶ 31,525, at 155,631–33.

⁸⁰See, e.g., *Norment Sec. Grp., Inc. v. Ohio Dep't of Rehab. & Correction*, 2003-Ohio-6572, 2003 WL 22890088 (Ct. Cl. Ohio Dec. 2, 2003) (expert testimony not provided and inefficiency claim failed for lack of proof); *Dawson Constr. Co.*, VABCA No. 3306 et al., 93-3 BCA ¶ 26,177 (project manager's testimony of inefficiency percentage insufficient to prove inefficiency); *Havens Steel Co. v. Randolph Eng'g Co.*, 613 F. Supp. 514, 540 (W.D. Mo. 1985), *aff'd*, 813 F.2d 186 (8th Cir. 1987) (court did not accept witness as a loss of productivity expert due to lack of training or expertise); *Preston-Brady, Co.*, VABCA No. 1892 et al., 87-1 BCA ¶ 19,649, at 99,520, clarified on denial of recons., 87-2 BCA ¶ 19,925 (“A general statement that disruption or impact occurred, absent any showing through

use of updated [critical path method] schedules, [logs or credible and specific data or testimony, will not suffice to meet that burden.”).

⁸¹*Kit-San-Azusa, J.V. v. U.S.*, 32 Fed. Cl. 647, 660 (1995), *aff'd as modified and remanded*, 86 F.3d 1175 (Fed. Cir. 1996) (court accepted project manager's testimony regarding inefficiency percentage, then reduced on jury verdict); *Lee Masonry, Inc. v. City of Franklin*, No. M200802844COAR3CV, 2010 WL 1713137, at *14–16 (Tenn. Ct. App. Apr. 28, 2010) (measured mile presented by subcontractor's president was accepted); *DuBaldo Elec., LLC v. Montagno Constr., Inc.*, 119 Conn. App. 423, 445–46, 988 A.2d 351, 365–66 (2010) (loss of productivity testimony presented by contractor's employees was accepted but reduced by court); *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *10 (Pa. Bd. Claims Oct. 28, 1993) (contractor's construction manager's testimony based on his observations of loss of productivity accepted but reduced by board).

⁸²See, e.g., *Christiansen Bros., Inc. v. State*, 90 Wash. 2d 872, 586 P.2d 840 (1978).

⁸³See, e.g., *Tony DePaul & Son v. Commw. of Pa.*, No. 1452, 1993 WL 764322, at *22 (Pa. Bd. Claims Oct. 28, 1993) (overtime costs resulting from loss of efficiency in a constructive acceleration paid separately from force account tracking in lieu of loss of efficiency calculation).

⁸⁴See, e.g., *John E. Green Plumbing & Heating Co. v. Turner Constr. Co.*, 742 F.2d 965, 968 (6th Cir. 1984) (“In this case, [the contractor] certainly had it within its power to provide the court with an accounting for the number of extra hours caused by change orders for which it was paid. [The contractor] also should have been able to provide a breakdown by job activity for the number of hours that would have been required in the absence of malfeasance by [the construction manager] in the performance of its construction management duties. Because of its failure to do these things, there was ‘no basis for allocation of the lump sum [claimed] between those causes which were actionable and those which were not,’ making ‘it proper to reject the entire claim.’ ”); *Lichter v. Mellon-Stuart Co.*, 305 F.2d 216, 219 (3d Cir. 1962) (because court could not separate claimed subcontractor disruption costs between contractor-responsible costs and not contractor-responsible costs, no recovery was allowed).

⁸⁵See, e.g., *Sauer, Inc.*, ASBCA No. 39605, 01-2 BCA ¶ 31,525 (declining to estimate loss of productivity presented as Mechanical Contractors Association of America productivity factors for lack of proof); *John E. Green Plumbing & Heating Co. v. Turner Constr. Co.*, 742 F.2d 965, 968 (6th Cir. 1984) (rejecting claim for failure to provide accurate hours per activity and failure to track hours incurred performing change order work).

⁸⁶*Propellex Corp. v. Brownlee*, 342 F.3d 1335 (Fed. Cir. 2003).

⁸⁷See also *Propellex Corp.*, ASBCA No. 50203, 02-1 BCA ¶ 31,721.

⁸⁸*Propellex Corp. v. Brownlee*, 342 F.3d 1335, 1342 (Fed. Cir. 2003) (citations omitted). But see *Dawco Constr., Inc. v. U.S.*, 930 F.2d 872, 882 (Fed. Cir. 1991), overruled in

part on other grounds by *Reflectone, Inc. v. Dalton*, 60 F.3d 1572 (Fed. Cir. 1995) (“The issuance of a change order request should signal to the prudent contractor that it must maintain records detailing any additional work. . .”).

⁸⁹See *Dale & D’Onofrio, Construction Schedule Delays* §§ 4:14, 11:2.

⁹⁰See *Raytheon Co. v. White*, 305 F.3d 1354, 1367 (Fed. Cir. 2002) (court refused to even resort to a jury verdict method (under which a factfinder will subjectively evaluate the evidence of damages and try to determine an approximation of the damages suffered by the parties) when a contractor could have tracked loss of productivity costs directly, stating that it agreed with the board that “the jury verdict method was not appropriate, because a more reliable method for calculating damages was available; namely, the discrete events claim”). But see *McKie v. Huntley*, 620 N.W.2d 599 (S.D.2000) (“[There are] disputes where it is difficult or impractical to quantify losses from changed conditions. Sometimes it is impossible to assign a precise monetary loss to each discrete event in a project where continuing problems compound a contractor’s performance difficulties.”).

⁹¹See, e.g., *Specialty Assembling & Packing Co. v. U.S.*, 355 F.2d 554, 572–73 (Ct. Cl. 1966) (“However, this inability to determine the precise amount of the damages attributable to the Government’s breach of contract does not preclude the court from entering a judgment for the plaintiff. The ascertainment of damages is not an exact science. Hence, it is not essential that the amount of damages be ascertainable with absolute exactness or mathematical precision. It is enough if the evidence adduced is sufficient to enable a court or jury to make a fair and reasonable approximation. In estimating damages, the Court of Claims occupies the position of a jury under like circumstances; and all that the litigants have any right to expect is the exercise of the court’s best judgment upon the basis of the evidence provided by the parties.” (citations omitted)); see also *Clark Constr. Grp., Inc., GAO CAB No. 2003-1, 2004 WL 5462234* (Nov. 23, 2004); *Elec. & Missile Facilities, Inc. v. U.S.*, 416 F.2d 1345, 1358 (Ct. Cl. 1969); *WRB Corp. v. U.S.*, 183 Ct. Cl. 409, 425 (1968); *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 712–13 (Ct. Cl. 1966) (“That loss of productivity of labor resulting from improper delays caused by defendant is an item of damage for which plaintiff is entitled to recover admits of no doubt, nor does the impossibility of proving the amount with exactitude bar recovery for the item.”).

⁹²See, e.g., *Bechtel Nat’l, Inc., NASABCA No. 1186-7, 90-3 BCA ¶ 23,105* (reviewing proof of cumulative impact and stating: “A jury verdict only represents a fair and reasonable approximation of what constitutes an equitable adjustment in price. The determination is made in the exercise of judicial discretion on the basis of the entire record after weighing all the evidence. The nature of a jury verdict determination is that it is only an estimate, and it is imprecise. It is necessary when the evidence is insufficient to make detailed and precise computations.”).

⁹³*Elec. & Missile Facilities, Inc. v. U.S.*, 416 F.2d 1345, 1358 (Ct. Cl. 1969) (quoting *Specialty Assembling & Packing Co. v. U.S.*, 355 F.2d 554, 572, 174 Ct. Cl. 153, 184 (1966)).

⁹⁴See *Luria Bros. & Co. v. U.S.*, 369 F.2d 701, 712–13

(Ct. Cl. 1966) (discussing precision and quoting *Story Parchment Co. v. Paterson Parchment Paper Co.*, 282 U.S. 555, 562–63 (1931)).

⁹⁵*John E. Green Plumbing & Heating Co. v. Turner Constr. Co.*, 742 F.2d 965, 968 (6th Cir. 1984); see also *Wunderlich Contracting Co. v. U.S.*, 351 F.2d 956, 968 (Ct. Cl. 1965) (“A claimant need not prove his damages with absolute certainty or mathematical exactitude. It is sufficient if he furnishes the court with a reasonable basis for computation, even though the result is only approximate. Yet this leniency as to the actual mechanics of computation does not relieve the contractor of his essential burden of establishing the fundamental facts of liability, causation, and resultant injury.” (citations omitted)).

⁹⁶See, e.g., *Bell BCI Co. v. United States*, 81 Fed. Cl. 617, 635 (2008) aff’d in part, vacated in part, remanded, 570 F.3d 1337 (Fed. Cir. 2009) (“[The] ‘measured mile’ approach for measuring productivity is an accepted method to prove a cumulative impact claim. See *U.S. Indus., Inc. v. Blake Constr. Co., Inc.*, 671 F.2d 539, 547 (D.C.Cir.1982) (noting that the ‘comparison of the cost of performing work in different periods is a well-established method of proving damages.’); *States Roofing Corp.*, ASBCA No. 54860, 10-1 BCA ¶ 34,356 (“The measured mile approach provides a comparison of a production period that is impacted by disruption with one that is not. See *DANAC, Inc.*, ASBCA No. 33394, 97-2 BCA ¶ 29,184 at 145,152, aff’d on recon., 98-1 BCA ¶ 29,454. We have accepted the measured mile approach as an appropriate method of determining impact to productivity. E.g., *Bay West, Inc.*, ASBCA No. 54166, 07-1 BCA ¶ 33,569 at 166,302–03.”); see *Dale & D’Onofrio, Construction Schedule Delays* § 18:1 et seq.

⁹⁷See *Dale & D’Onofrio, Construction Schedule Delays* § 19:1 et seq.

⁹⁸See, e.g., *Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 635 (2008) aff’d in part, vacated in part, remanded, 570 F.3d 1337 (Fed. Cir. 2009) (earned value); *MCI Constructors, Inc.*, DCCAB No. D-985, 1996 WL 738815 (Oct. 31, 1996) (comparison to similar projects); see *Dale & D’Onofrio, Construction Schedule Delays* § 19:1 et seq.

⁹⁹See, e.g., *Cent. Ceilings, Inc. v. Suffolk Constr. Co.*, No. SUCV200604129A, 2013 WL 8721044 (Mass. Super. Dec. 19, 2013) (total cost); *Servidone Const. Corp. v. U.S.*, 19 Cl. Ct. 346 (1990), aff’d, 931 F.2d 860 (Fed. Cir. 1991) (modified total cost); see *Dale & D’Onofrio, Construction Schedule Delays* §§ 4:14, 19:1 et seq.

¹⁰⁰See, e.g., *Fire Sec. Sys., Inc.*, VABCA No. 5579 et al., 02-2 BCA ¶ 31,977; *Hensel Phelps Constr. Co.*, GSBICA No. 14744, 01-1 BCA ¶ 31,249; see *Dale & D’Onofrio, Construction Schedule Delays* § 20:1 et seq.

¹⁰¹See *Dale & D’Onofrio, Construction Schedule Delays* § 20:1 et seq.

¹⁰²See, e.g., *Kit-San-Azusa, J.V. v. U.S.*, 32 Fed. Cl. 647 (1995), aff’d as modified and remanded, 86 F.3d 1175 (Fed. Cir. 1996); see *Dale & D’Onofrio, Construction Schedule Delays* § 21:1 et seq.

¹⁰³See, e.g., *DuBaldo Elec., LLC v. Montagno Const., Inc.*, 119 Conn. App. 423, 445–46, 988 A.2d 351, 365–66

(2010) (factors of 30 to 50% inefficiency presented by electrical subcontractor employees and subconsultant accepted but reduced to 20% when not opposed with other analysis); see Dale & D’Onofrio, *Construction Schedule Delays* § 22:1 et seq.

¹⁰⁴See, e.g., AEI Pac., Inc., ASBCA No. 53806, 08-1 BCA ¶ 33,792 (board accepted Government’s expert’s estimate); Sauer, Inc., ASBCA No. 39605, 01-2 BCA ¶ 31,525 (board not persuaded by contractor’s on-site employees testimony as to what they thought the loss of productivity was); see Dale & D’Onofrio, *Construction Schedule Delays* § 21:1 et seq.

¹⁰⁵*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124 (2005).

¹⁰⁶*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 146 (2005) (“In assessing plaintiff’s damages for loss of productivity, [plaintiff’s expert], computed plaintiff’s damages using a modified total labor cost method and a modified measured mile analysis. Offering yet a third alternative, without stating which method of calculation was more supportable, plaintiff’s expert averaged the numbers resulting from his modified measured mile analysis and from his modified total cost method, to conclude that plaintiff should be reimbursed in the average amount of \$75,079.00.”).

¹⁰⁷*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 146 (2005).

¹⁰⁸*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 148 (2005).

¹⁰⁹*Southern Comfort Builders, Inc. v. U.S.*, 67 Fed. Cl. 124, 150 (2005).

¹¹⁰*N. Am. Mech., Inc. v. Walsh Constr. Co. II, LLC*, 132 F. Supp. 3d 1064 (E.D. Wis. 2015).

¹¹¹*N. Am. Mech., Inc. v. Walsh Constr. Co. II, LLC*, 132 F. Supp. 3d 1064, 1079 (E.D. Wis. 2015).

¹¹²*N. Am. Mech., Inc. v. Walsh Constr. Co. II, LLC*, 132 F. Supp. 3d 1064, 1078–81 (E.D. Wis. 2015).

¹¹³See, e.g., *Coastal Dry Dock & Repair Corp.*, ASBCA No. 36754, 91-1 BCA ¶ 23,324 (“It is well-established that the increased cost of disrupted unchanged work flowing directly from a change. . . is compensable. . . .”); *Pittman Constr. Co.*, GSBCA No. 4897 et al., 81-1 BCA ¶ 14,847; see also *Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 638 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009); *U.S. Indus., Inc. v. Blake Constr. Co.*, 671 F.2d 539 (D.C. Cir. 1982); *Pittman Constr. Co.*, GSBCA No. 4897 et al., 81-1 BCA ¶ 14,847, aff’d, 2 Cl. Ct. 211 (1983); *Hensel Phelps Constr. Co. v. Gen. Servs. Admin.*, GSBCA No. 14744 et al., 01-1 BCA ¶ 31,249, aff’d, 36 Fed. Appx. 649 (Fed. Cir. 2002); *Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549; *Haas & Haynie Corp.*, GSBCA No. 5530 et al., 84-2 BCA ¶ 17,446.

¹¹⁴*Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153; see also *Triple “A” South*, ASBCA No. 46866, 94-3 BCA ¶ 27,194; *Aetna Cas. & Sur. Co. v. George Hyman Constr. Co.*, No. Civ. A. 93-4750 (E.D. Pa. May 15, 1998) (“The term ‘cumulative impact’ has come to mean in

a generic sense, the impact on unchanged work which is not attributable to any one change but flows from the synergy of the number and scope of changes issued on a project. The underlying theory is that numerous changes cause a cascading ripple-type of impact on performance time and efficiency which is too uncertain or diffuse to be readily discernible at the time of pricing each individual change.”).

¹¹⁵See generally 5 Bruner & O’Connor *Construction Law* § 15:119.

¹¹⁶For an inventory of cumulative impacts decisions, see *Ibbs & Nguyen*, “Cases and Board Decisions on Cumulative Impact Claims,” 31 *Constr. Law* 32 (Fall 2011).

¹¹⁷See *Finke*, “Claims for Construction Productivity Losses,” 26 *Pub. Cont. L.J.* 311, 333–34 (Spring 1997).

¹¹⁸See, e.g., *Freeman-Darling, Inc.*, GSBCA No. 7112, 89-2 BCA ¶ 21,882 (“The result of [cumulative impact] is an unanticipated loss of productivity which increases the contractor’s performance costs and usually extends his stay on the job.”); *Jackson Constr. Co. v. U.S.*, 62 Fed. Cl. 84, 104 (2004) (“An impact claim—often characterized using other names, such as, ‘cumulative impact,’ ‘ripple effect,’ ‘loss of labor efficiency,’ or ‘loss of productivity’—is based upon the theory that individual compensable changes to a Contract, taken as a whole, can have such a disruptive effect on the contractor’s performance that the contractor has a compensable claim for costs in addition to the amounts of its individual change orders.”); see also *Costello Constr. Co. of Md. v. City of Charlottesville*, 97 F. Supp. 3d 819 (W.D. Va. 2015); *Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹¹⁹See, e.g., *Jones*, “Lost Productivity: Claims for the Cumulative Impact of Multiple Change Orders,” 31 *Pub. Cont. L.J.* 1 (Fall 2001); *Keating & Burke*, “Cumulative Impact Claims: Can They Still Succeed,” 20 *Constr. Law* 30 (Apr. 2000); *Backus*, “The Cumulative Impact Claim: Where Do We Stand in 2010?,” 77 *Def. Couns. J.* 206, 212 (2010).

¹²⁰See 48 C.F.R. 52.243-1, “Changes—Fixed-Price (Aug. 1987)” (“If any such change causes an increase or decrease in the cost of, or the time required for, performance of any part of the work under this contract, whether or not changed by the order, the Contracting Officer shall make an equitable adjustment in the contract price, the delivery schedule, or both, and shall modify the contract.”).

¹²¹Accord *Pittman Constr. Co.*, GSBCA No. 4897 et al., 81-1 BCA ¶ 14,847 (“First of all, we have held explicitly that once a contract change has actually occurred, subsequent delays and work disruptions are compensable only under the Changes clause. We would extend this principle equally to (1) changes ordered unilaterally under the Changes clause, (2) changes effected by agreement of the parties, and (3) constructive changes resulting from Government misinterpretation of contract terms or from erroneous Government directions concerning contract performance.”).

¹²²See, e.g., *Bechtel Nat’l, Inc.*, NASABCA No. 1186-7, 90-1 BCA ¶ 22,549 (“Cumulative impacts need not be traced to specific causes of increased performance costs, but can arise from changes which, when viewed retrospectively,

were so many and had such effect on performance that there is a separately compensable impact claim.”).

¹²³See, e.g., *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153 (“In looking at Dynalectric’s cumulative impact claim, we must keep in mind the fundamental triad of proof necessary to sustain a contractor’s recovery for a constructive change giving rise to cumulative impact costs: liability, causation, and resultant injury.”); see also *Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009) (“The contractor must prove for either [a delay or disruption] claim the elements of liability, causation, and resultant injury.”). But see *Southwest Marine, Inc.*, DOT-CAB No. 1663, 94-3 BCA ¶ 27,102 (“Although the specificity otherwise necessary to prove direct or local disruption resulting from the implementation of individual change requests is not required to prove entitlement to cumulative disruption (because it is more difficult to foresee), appellant, nevertheless, shoulders the burden of proving by a preponderance of the evidence that the 202 change orders collectively disrupted its work as alleged.”).

¹²⁴In *re Venetian Lien Litig.*, No. A397391, 2004 WL 3265025 (Nev. Dist. Ct., Sept. 23, 2004) (“Cumulative impact claims are presented when contractors cannot allocate damages to specific breaches and therefore cannot establish actual and proximate cause. Cumulative impact claims are too speculative to meet the requirements for possible recovery in Nevada and are not recognized under Nevada law.”); see also *Phillips Nat’l, Inc.*, ASBCA No. 53241, 04-1 BCA ¶ 32,567 (refusing to apply cumulative impact theory in breach of contract action where contractor was responsible for certain delays at the project in addition to delays resulting from change orders).

¹²⁵See, e.g., *AMEC Civil, LLC v. DMJM Harris, Inc.*, No. Civ. A. 06-64 (FLW), 2009 WL 1883985 (D.N.J. June 30, 2009).

¹²⁶*Montgomery-Ross-Fisher, Inc.*, PSBCA No. 1033, 84-2 BCA ¶ 17,492 (citations omitted); see also *Pittman Constr. Co.*, GSBICA No. 4897 et al., 81-1 BCA ¶ 14,847 (“But even if we accept all figures on behalf of [the contractor] itself and take them at their largest, we do not think a cumulative impact claim arises out of the 206 change orders.”); *Coley Props. Corp.*, PSBCA No. 291, 75-2 BCA ¶ 11,514, aff’d in part and rev’d on another claim, 219 Ct. Cl. 227, 593 F.2d 380 (1979); *Pathman Constr. Co.*, PSBCA No. 444, 79-2 BCA ¶ 14,027.

¹²⁷See, e.g., *Ingalls Shipbldg. Div., Litton Sys., Inc.*, ASBCA No. 17579, 78-1 BCA ¶ 13,038 (in contract for four submarines, more than 2,000 change orders, price increase of more than 50%, and delay of 40 months key factors).

¹²⁸See, e.g., *Aragona Constr. Co. v. U.S.*, 165 Ct. Cl. 382, 390 (1964) (“The sole question remaining before us, therefore, is whether the cumulative effect of the changes in materials necessitated by the priority orders caused a cardinal change beyond the permissible limits of the contracting officer’s discretion.”). For post-Contract Disputes Act similar analysis, see *Saudi Tarmac Co.*, ENGBICA No. 4841, 89-3 BCA ¶ 22,132 (board noted that cumulative impact “approach creates a ‘never-never land’ between the

cardinal change theory and change orders early in a job having no cumulative impact”); *Triple “A” South*, ASBCA No. 46866, 94-3 BCA ¶ 27,194 (relying on pre-Contract Disputes Act analysis, board held that “the contracting officer must have exceeded the permissible limits of his discretion under the Changes clause and ordered changes that ‘materially alter the nature of the bargain’ originally agreed upon”); cf. *Centex Bateson Constr. Co.*, VABCA No. 4613 et al., 99-1 BCA ¶ 30,153 (providing the distinction that “[a]lthough there is no need to engage in a pre-Contract Disputes Act analysis of whether cumulative impact is a separate constructive change or a cardinal change in order to preserve our jurisdiction, it seems to us that cumulative impact must be viewed as a separate constructive change compensable under the CHANGES clause. This constructive change, although resulting from them, is independent of other contract changes and can survive an accord and satisfaction on a change, or a general release.”).

¹²⁹See, e.g., *Coates Indus. Piping, Inc.*, VABCA No. 5412, 99-2 BCA ¶ 30,479 (“For the Government to be liable for cumulative impact, a contractor must show that the Government exceeded the permissible limits of its discretion under the Contract changes provisions serving to ‘materially alter the nature of the bargain’ originally agreed upon.”); *Freeman-Darling, Inc.*, GSBICA No. 7112, 89-2 BCA ¶ 21,882 (in the context of 40 changes, stating: “We were unpersuaded that the magnitude and cumulation of changes so significantly altered the contract as to create a claim for impact costs in addition to direct impact costs.”). For a related yet distinct approach, see *Amelco Elec. v. City of Thousand Oaks*, 27 Cal. 4th 228, 38 P.3d 1120 (2002), where the contractor argued that a multitude of changes to the contract amounted to abandonment of the agreement by the owner. Although denying the claim against the public owner, the court acknowledged that such an approach would be viable in the private setting.

¹³⁰*Jackson Constr. Co. v. U.S.*, 62 Fed. Cl. 84 (2004).

¹³¹*Jackson Constr. Co. v. U.S.*, 62 Fed. Cl. 84, 90 (2004).

¹³²*Jackson Constr. Co. v. U.S.*, 62 Fed. Cl. 84, 93 (2004) (citations omitted).

¹³³*Jackson Constr. Co. v. U.S.*, 62 Fed. Cl. 84, 93 (2004) (citations omitted).

¹³⁴*Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹³⁵*Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 618–19 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹³⁶*Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 618–19 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹³⁷*Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 623 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹³⁸*Bell BCI Co. v. U.S.*, 81 Fed. Cl. 617, 619 (2008), aff’d in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009). In its decision, the court also expressed satisfaction at the proofs provided of the impact itself. *Bell*

BCI Co. v. U.S., 81 Fed. Cl. 617, 637–38 (2008), aff'd in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹³⁹Bell BCI Co. v. U.S., 81 Fed. Cl. 617, 619 (2008), aff'd in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009) (“None of the contract modifications included any payment to [the contractor] for cumulative impact or labor inefficiency. [The contractor] did not expressly release its cumulative impact claim in any modification. Defendant relies on release language in Modification 093, dated October 2, 2000, to support its position, but the release language does not address cumulative impact claims.”). The court also noted that the modification language was “not a model of clarity.” Bell BCI Co. v. U.S., 81 Fed. Cl. 617, 619 (2008), aff'd in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹⁴⁰Bell BCI Co. v. U.S., 81 Fed. Cl. 617, 639 (2008), aff'd in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009) (further finding “no evidence that NIH ever

provided any consideration to [the contractor] to settle a cumulative impact claim”). The court also noted the absence of any testimony from the Government Contracting Officer, and based on her absence, elected to draw a negative presumption in favor of the contractor. See Bell BCI Co. v. U.S., 81 Fed. Cl. 617, 639 (2008), aff'd in part, vacated in part, and remanded, 570 F.3d 1337 (Fed. Cir. 2009).

¹⁴¹Bell BCI Co. v. U.S., 570 F.3d 1337, 1341–42 (Fed. Cir. 2009) (quoting U.S. v. William Cramp & Sons Ship & Engine Bldg. Co., 206 U.S. 118, 128 (1907)).

¹⁴²Bell BCI Co. v. U.S., 570 F.3d 1337, 1341 (Fed. Cir. 2009).

¹⁴³See, e.g., Whiting-Turner Contracting Co., ASBCA No. 56319, 10-1 BCA ¶ 34,436. But see Korte-Fusco Joint Venture, ASBCA No. 59767, 15-1 BCA ¶ 36,158 (finding modification was ambiguous and there were disputed facts as to whether there was a meeting of the minds).

BRIEFING PAPERS