Update on Proving and Pricing Inefficiency Claims

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Lost productivity is a primary contributor to cost overruns that affect many construction projects. In simple terms, loss of productivity (also referred to as inefficiency, disruption, or impact) can be defined as the increased cost of performance caused by a change in the contractor's anticipated or planned resources, working conditions, or method of performance. Contractors can incur additional costs when they are not able to work as efficiently as planned in the original bid. Achieving less than the contractor's planned or anticipated productivity can increase labor, equipment, and material costs and potentially cause work on a project to be accelerated or delayed. In turn, accelerated, delayed, and disrupted progress can drive up variable costs such as labor, equipment, and material costs as well as field and home office overhead.[1] The purpose of this article is to put some order to the technical and legal issues associated with proving and pricing inefficiency claims.

When and how lost productivity translates into a claim can be a difficult question. Productivity can be affected by many factors that disrupt the efficient performance of the work, not all of which are the owner's responsibility. The contractor anticipates that it will perform the work in a logical sequence with a reasonable number of workers and under normal working conditions.[2] The contractor should, and likely does, recognize that it will not achieve perfect productivity from its workforce and plan accordingly. When external events interrupt that flow of work, the contractor often must shift workers back and forth between tasks or increase the total number of workers on the project while continuing to operate under a rigid schedule. When the contractor's expected productivity falls, project costs rise and the project's success can be jeopardized.

Among the most common factors that cause, or at least contribute to, inefficiency are (1) adverse or unusually severe weather, (2) out-of-sequence work, (3) crowding or stacking of trades, (4) excessive overtime resulting from an accelerated schedule, (5) restricted site access, (6) craft or manpower shortages, and (7) the cumulative effect of numerous change orders, requests for information, or design changes.[3] In response to these types of claims, owners often contend that the inefficiency was caused by the contractor's failure to properly schedule and coordinate the work. In addition, owners often raise defenses of lack of notice, lack of timely claim submittal, waiver, release, or accord and satisfaction.

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Elements of an Inefficiency Claim

Lost productivity is only a measure of the damages experienced by the contractor. Simply experiencing labor or equipment inefficiency does not mean that the contractor is entitled to recover from the owner. In order for these damages to be recoverable, the contractor must prove three elements: (1) liability, (2) causation, and (3) resultant injury.[4]

Liability

The first element, liability, is typically considered together with the second element, causation. Collectively, they are referred to as entitlement. Liability has two components: (1) a legal right to recover based on either a remedy-granting provision in the contract or the owner's breach of the contract and (2) evidence that the owner did something to hinder the contractor's performance, such as denying access to the site for a direct impact claim or initiating a substantial number of contract changes, modifications, or design clarifications for a cumulative impact claim.[5]

Causation

The second element, causation, requires the contractor to prove that the loss of productivity was caused by the owner's conduct or actions, rather than by the contractor's failure to estimate the job properly, inability to properly schedule the work, or failure to coordinate the work. Causation is often the most difficult element to prove. Without proof of a causal link between the claim events and the ensuing loss of efficiency, there is no entitlement to recovery. The contractor seeking recovery for cumulative disruption must submit evidence that "the number, timing, and effect of the changes that were issued" impacted its ability to plan and perform its work.[6] Making this connection is not easy. As one board noted, causation "can be an elusive commodity."[7]

For example, in *Sauer, Inc.*,[8] the Armed Services Board of Contract Appeals (A.S.B.C.A.) denied the contractor's inefficiency claim based on the grounds that the contractor did not adequately prove that the change in another contractor's schedule caused inefficiency. The contractor argued that the government failed to follow a crane installation schedule, thereby forcing the crane contractor's work to be performed concurrently with the contractor's work. According to the contractor's claim, the interferences arising from the change in the crane contractor's schedule made the contractor's work less efficient.

The A.S.B.C.A. began by stating that it was the contrac-

tor's burden to prove that the change in the crane contractor's schedule caused a loss of productivity. In finding that the contractor was unable to meet that burden, the board explained:

> It is a rare case where loss of productivity can be proven by books and records; almost always has to be proven by the opinions of expert witnesses. However, the mere expression of an estimate as to the amount of the 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.[9]

In *J.A. Jones Construction Co.*,[10] the Corps of Engineers Board (E.N.G.B.C.A.) rejected a contractor's attempt to use a modified measured mile where the board found the expert's methodology to be flawed. After a $27 million flood protection project was complete, the contractor sought compensation for labor inefficiencies that the contractor claimed resulted from forty-nine changes that caused a 28 percent increase in its total labor costs to perform unchanged work. The board rejected the expert's analysis because he failed to isolate specific impacts caused by individual changes and eliminate other potential causes of loss of productivity on the unchanged work. According to the board, the absence of a cause-and-effect analysis, together with the expert's lack of knowledge about the project, undermined the credibility of the analysis.

The most accepted method of proving lost productivity claims is the measured mile approach.

In *Clark Construction Group, Inc.*,[11] the Veterans Affairs Board (V.A.B.C.A.) determined that the contractor was able to show through documentary evidence that the government required the contractor to perform out-of-sequence work as a result of a stop work order on the project. The board found, however, that the contractor was not entitled to all of its labor and inefficiencies because it could not prove that the owner was the sole and exclusive cause of all these inefficiencies. In denying part of the claim involving late responses to requests for information (RFIs), the board found that in addressing an efficiency claim, it would expect to see daily logs, CPM fragments, correspondence, and other contract documentation to support the contention that certain events changed the expected working conditions and disrupted contractor's labor productivity.[12] Without these documents, causation is difficult, if not impossible, to prove.

Quantum (Pricing the Loss of Efficiency Claim)

The third and final element, resultant injury, also referred to as "quantum," requires the contractor, typically through an expert witness,[13] to quantify the lost productivity and capture the costs associated with that inability to achieve production. Because of the increasing number and complexity of claims, courts, boards, and arbitration panels now require more sophisticated and detailed evidence to support these claims than they may have in the past.

A wide variety of methods exist to price the loss of efficiency. Certainly, to the degree that it is possible, actual costs derived from the job cost records and other contemporaneous accounting records are ideal.[14] Although such discrete pricing provides the best evidence, it is often not feasible as a result of the very problems that caused the inefficiency.[15] Consequently, courts and boards look to other approaches such as the total cost method, modified total cost method, measured mile analysis, expert estimates, and industry studies. When presenting a claim, contractors, lawyers, or experts should, and often do, rely on more than one approach.

No matter what methodology or combination of methodologies the party chooses, there are three components that must be addressed to successfully recover inefficiency damages today: (1) contemporaneous project documentation (including daily reports, RFIs, updated CPM schedules, accurate costing data, and correspondence identifying delays and impacts as they occur); (2) productivity and schedule analyses by qualified experts who have thoroughly reviewed the project documentation, interviewed witnesses, and utilized accurate and updated data to support its analysis; and (3) contract terms that have been followed by the claimant and allow for the types of claims that are being asserted. Simple as-planned versus as-built bar charts, after-the-fact productivity or scheduling analyses, and witness testimony without supporting documentation are generally insufficient.[16]

Total Cost Method

In calculating inefficiency, contractors often begin by introducing evidence based on a total cost method.[17] Under this method, the estimated labor costs for the project are subtracted from the costs actually incurred to arrive at the amount of the equitable adjustment.[18] Although courts and boards are reluctant to allow contractors to rely on the total cost method, they have allowed the method in the disruption cases on the theory that "the very factors that produce loss of productivity can also serve to preclude precise and accurate record-keeping."[19] With respect to cumulative impact claims specifically, the V.A.B.C.A. reasoned in *Centex Bateson Construction Co.*[20] that "[t]he current case law recognizes that using the 'synergy' analysis of cumulative impacts necessarily leads to a total cost damages analysis."

The total cost approach is disfavored because it does not provide proof that the sole cause of the overrun was the owner's actions. As the Energy Board (E.B.C.A.) stated: "The Total Cost Method is disfavored, in part, because it is extremely difficult to assure that the contract is not transformed into a *de facto* cost reimbursement contract and that cost which should be borne by the [contractor] excluded."[21] A simple comparison of the estimated cost and the actual cost to complete the project does not differentiate between owner and contractor-caused problems or errors in the original bid estimate.

In government contracts, courts and boards have required the contractor utilizing the total cost approach to satisfy four prerequisites.[22] In *Centex Bateson*, the V.A.B.C.A. stated that the total cost method was a method of last resort and could be used only if the contractor showed

- The impracticality of proving actual losses directly;
- The reasonableness of its bid [or estimate for the project];
- The reasonableness of its actual costs; and
- Lack of responsibility for the added costs.[23]

In *Centex-Bateson*, the board found that the contractor failed to prove that its bid was reasonable. No one who worked on the bid preparation testified. From this, the board drew the negative inference that their testimony would not support the contractor's assertions.[24] Internal reports made at the time the bid was submitted, which showed that the contractor underbid the project, were even more damaging to the contractor's cause.

While some state courts permit contractors to use some form of the total cost approach based on a state law standard for proving contract damages, other state courts require contractors to satisfy the four prerequisites outlined above. Two cases illustrate the dichotomy.

In *MARTA v. Green Int'l, Inc.*,[25] the Georgia Court of Appeals affirmed a trial court ruling awarding a contractor $2.8 million for increased performance costs caused by inadequate plans and specifications and the owner's failure to correct or properly administer the contract. At issue in the appeal was whether the contractor failed to prove damages proximately caused by the owner's failure to timely correct the design deficiencies. The owner relied on federal case law to discredit the contractor's use of the total cost approach and argued that the contractor failed to meet the four-part test discussed above. The court determined that the four-part test was not relevant to Georgia's standard for proving damages.

The court explained that the trial court's ruling was supported by lay and expert testimony that the poor quality of the plans required the contractor to submit over 350 RFIs and resulted in over 1,000 revised drawings. Specifically, the court found that the contractor supported its claim with an expert "who conducted a detailed evaluation of the claim, including review of all construction documents, interviews with . . . [project] personnel and scheduling and cost analysis."[26] As a result, the court reaffirmed that under the applicable state law, "if a plaintiff can show with reasonable certainty the total amount of damages and the degree to which those damages are attributable to defendant, that is sufficient to support an award."[27]

In contrast, in *Biemann and Rowell v. Donohoe Companies*,[28] the North Carolina Court of Appeals affirmed the trial court's rejection of a contractor's use of the total cost method where it failed to satisfy the four-part federal test for recovery stated above. In that case, an HVAC subcontractor sued the prime contractor for breach of contract arising out of the construction of a hospital. Citing federal case law, the court stated:

> Plaintiff must satisfy the conjunctive four-part test for recovery under the total cost method: (i) the impracticability of proving actual losses directly; (ii) the reasonableness of the bid; (iii) the reasonableness of its actual costs; and (iv) the lack of responsiveness for the added costs.[29]

The court of appeals affirmed the trial court's finding that the contractor failed to establish impracticability where the contractor maintained a daily logbook of labor overruns but did not attempt to tie the costs to any of the specific delays that caused the inefficiency. Further, the court affirmed the finding that the contractor failed to prove that its bid was reasonable because the contractor's employees had testified that the bid was "aggressive." Consequently, the court rejected the contractor's appeal because the contractor failed to prove that it sustained damages that could be ascertained and measured with reasonable certainty.

Modified Total Cost

The modified total cost approach eliminates the dependence on the original estimate and accounts for nonowner-related inefficiencies by requiring the contractor to back out internal contractor-caused factors from the claim. In order to calculate the inefficiency cost, the (1) costs incurred due to contractor error during construction and (2) errors in the bid price are subtracted from the total cost to determine the owner-caused damages.[30] This approach overcomes many of the objections to the total cost approach and has been accepted by many courts under the appropriate circumstances.[31]

Measured Mile Approach

The most accepted method of proving lost productivity claims is the measured mile approach in which the productivity for similar work from an unimpacted or minimally impacted period of the job is compared with productivity during the impacted period. In *DANAC, Inc.*, the A.S.B.C.A. emphasized that "[f]or labor inefficiency claims, a 'good period' vs. 'bad period' analysis, comparing the cost of performing work during periods both affected and unaffected by disruptive events 'is a well-established method of proving damages.'"[32] Often, however, there is no period of unimpacted or minimally impacted performance from which a measured mile can be determined, and another approach must be used.

In *P.J. Dick*,[33] the V.A.B.C.A. found that "the use of the 'measured mile'" analysis developed by a qualified expert is recognized as the most reliable, though not exact, method to quantify labor inefficiency. The V.A.B.C.A. determined that the government caused the electrical subcontractor to accelerate its work, which resulted in each crew having to perform all aspects of installing branch circuits, rather than using separate crews for rough-in, wire pulling, and installation of switches and devices. Being forced to multitask, rather than divide tasks among crews, caused the subcontractor to use labor inefficiently.

The V.A.B.C.A. recognized "that quantifying the loss of labor productivity is difficult and that measuring labor inefficiency with exactitude is essentially impossible."[34] In this case, there was no period during contract performance in which the subcontractor's installation of branch circuits was not impacted by the acceleration or electrical design deficiencies. Consequently, the expert developed a baseline productivity

from similar work on the project. Specifically, the expert developed a productivity standard from unimpacted branch work by analyzing the subcontractor's productivity on feeder circuit work. The board found that there was "no basis to conclude that either the productivity of the same crew or that exactly the same work is a prerequisite for a valid measured mile analysis to establish the amount of the loss of productivity."[35]

In *Clark Concrete Contractors, Inc.*,[36] the contractor agreed to construct a multistory concrete building for the Federal Bureau of Investigation. During construction, the government elected to implement significant design changes to make the building more capable of withstanding a bomb blast. Because the changes occurred after construction began, the impact from the changes was significant. Specifically, the changes resulted in resequencing and rescheduling work, site congestion, overtime, and delays. The impact from the changes was compounded by the government's failure to respond timely to contractor questions relating to the changed work. Despite the government's attempt to shift blame for the inefficiencies to the contractor, the board easily found that the government was responsible for the inefficiencies and the resulting cost arising from the changes. The board then focused on calculating the inefficiency costs.

The General Services Board of Contract Appeals (G.S.B.C.A.) accepted the contractor's measured mile analysis as the appropriate method for determining the additional costs. In this case, the contractor's expert was able to isolate a period of work prior to the design changes and compare that work with work during both severely and moderately impacted periods. The government objected to the use of the measured mile on the basis that the work during the unimpacted period was not the same as the work during the impacted period, and therefore a comparison between the two did not yield an accurate lost productivity rate. The board recognized that the work performed during an unimpacted period might not always be identical to the work performed during the impacted period. But it is generally accepted that labor inefficiency costs are not susceptible to "absolute exactness." [37] The board explained: "We will accept a comparison if it is between kinds of work which are reasonably alike, such that the approximation it involves will be meaningful."[38]

Industry Studies

For over twenty years, contractors have relied upon a variety of industry studies to assist in forward pricing changes and to determine whether and to what extent productivity on a project has been impacted. Examples of the studies that seek to quantify inefficiency include the Mechanical Contractors Association of America, Inc.'s *Factors Affecting Labor Productivity* (MCAA manual); the U.S. Army Corps of Engineers' *Modification Evaluation Impact Guide*; Charles A. Leonard's 1988 master's thesis; the National Electrical Contractors Association, Inc.'s (NECA) *Guide to Electrical Contractors' Claims Management*, Volume III; and the Construction Industry Institute's studies.[39]

Critical to the successful application of any of these studies in a claim situation is for an expert, experienced in assembling productivity claims, to corroborate the productivity rates contained in the studies with the contemporaneous documentation and interviews of the key project personnel. To the extent that these studies have come under fire, it is because contractors, often without the assistance of an expert, have attempted to base their claims entirely on the productivity rates contained in these studies without corroborating the study with the actual conditions experienced on the project.

MCAA Manual

Several recent decisions have permitted contractors to rely on expert testimony based on the sixteen factors listed in the MCAA manual.[40] The MCAA manual lists several types of impacts that may occur on a project and assigns a percentage for each that represents loss of labor productivity for minor, average, and severe impacts.[41] The sixteen factors include (1) stacking of trades, (2) morale and attitude, (3) reassignment of manpower, (4) crew size efficiency, (5) concurrent operations, (6) dilution of supervision, (7) learning curve, (8) errors and omissions, (9) beneficial occupancy, (10) joint occupancy, (11) site access, (12) logistics, (13) fatigue, (14) ripple, (15) overtime, and (16) season and weather change.[42] The MCAA manual provides the following disclaimer:

> The factors listed are intended to serve as a reference only. Individual cases could prove to be too high or too low. The factors should be tested by your own experience and modified accordingly in your own use of them, since percentages of increased costs due to the factors listed may vary from contractor to contractor, crew to crew, and job to job.[43]

The V.A.B.C.A. in *Clark Construction Group*[44] calculated the mechanical subcontractor's recovery for lost productivity applying the MCAA percentages to the subcontractor's bid hours. In this case, the prime contractor brought a claim on behalf of its mechanical subcontractor, Poole and Kent Company (PKC), for labor inefficiency. The contract called for the construction of a hospital for the Department of Veterans Affairs (VA). PKC planned to perform the work based on a horizontal construction sequence. The area upon which the project was to be constructed was several feet below the water table and, thus, the site required extensive dewatering. During the construction phase, the local water management authorities issued two stop pump orders to halt the dewatering activities because the VA failed to obtain the necessary permits, which required PKC to change from a horizontal construction sequence to a vertical construction sequence.

PKC presented two MCAA analyses to prove its lost productivity, one prepared by its project manager and the other prepared by its expert. PKC's project manager selected three factors—"morale and attitude," "reassignment of manpower," and "dilution of supervision"—that he believed impacted the project. In his assessment, wet conditions at the site, constant crew relocations, material availability problems, late responses to RFIs, and the change in the construction sequence caused the inefficiency. Based on his experience and involvement in the project, he assigned an "average" effect (15 percent) due to morale and attitude, an "average" effect (10 percent) due to "reassignment of manpower," and a minor effect (10 percent) due to "dilution of supervision" for

a total of 35 percent for the first year and lower percentages for the second and third years of the project. He applied these percentages to the actual hours worked to determine the lost productivity.

PKC's expert identified two of the factors—"reassignment of manpower" and "dilution of supervision"—and determined that these two factors adversely affected the project for the entire three-year period. He based his analysis on a review of the project files and discussions with PKC's project manager. He, however, applied the factors to the bid hours, as opposed to the actual hours, explaining as follows:

> What I have found in looking at a lot of cases that have been submitted . . . is the contractor also, in my opinion, incorrectly multiplies the MCAA factors times the actual hours expended. Well, those actual hours already include the loss of productivity. In my opinion, that's double dipping. I explain in the new draft manual of why that's wrong and how to correctly apply the percentages to account for productive hours and subtracting those productive hours from the total actually, you come up with a much more reasonable, and frankly, conservative estimate of loss.[45]

The V.A.B.C.A. conducted its own analysis using the MCAA factors. The board identified the applicable factors to be "dilution of supervision" and "site access" because these two factors were descriptive of the conditions resulting from the change in construction sequence. Because the board found that the change occurred early in the project, it attributed a 10 percent or "minor" loss of efficiency for the "dilution of supervision" condition and a 5 percent or "minor" loss of efficiency due to restricted "site access." The V.A.B.C.A. further concluded that "concurrent with the inefficiencies resulting from the construction sequence, were other causes affecting labor productivity not attributable to the VA."[46] Consequently, the board adjusted the factors from 15 percent down to 7.5 percent to account for problems attributable to the contractor and applied that percentage to the bid hours after determining that PKC's bid was reasonable. The V.A.B.C.A. then looked at the effect of wet and "mucky" conditions and concluded that the "morale and attitude" factor best described the impact. From the evidence in the record, the board classified the condition as "minor" and assigned a 5 percent inefficiency factor to the time period during which PKC planned to perform installation work. The V.A.B.C.A. then used the jury verdict method to award PKC 15 percent of its additional coordination drawing costs. In the end, the V.A.B.C.A. found that PKC was entitled to an equitable adjustment in the amount of $853,355 where PKC sought $1,935,092.[47]

Expanding on its decision in *Clark Construction Group, Inc.*,[48] the V.A.B.C.A. in *Fire Security Systems, Inc.*, multiplied the factors from the MCAA manual by the bid hours to quantify the loss of efficiency, but ultimately reduced the recovery because the estimated hours in the contractor's bid exceeded the actual hours that the contractor expended on the project.

The project involved renovation of the fire protection and sprinkler system in a veterans' hospital. The contractor claimed loss of labor productivity due to the effects of the presence of asbestos on the contractor's pipefitters. The contractor introduced testimony from its president, who had prepared an analysis based on the MCAA factors. The president focused on three factors: "morale and attitude," "reassignment of manpower," and "dilution of supervision." According to his analysis, these three factors had a "severe" impact on the project and assigned percentages of 30, 15, and 25 percent, respectively. The contractor also introduced the testimony of its expert, who discretely priced the impacts based on information contained in the daily logs in order to validate the contractor's damages calculations.

The V.A.B.C.A. found that the loss of efficiency factors calculated by both the contractor and its expert were not supported by the daily logs, but nonetheless concluded the contractor experienced some disruption. The contract required the contractor to notify the contracting officer immediately when the contractor believed it had encountered asbestos. The board determined that "such discoveries were disruptive in and of themselves."[49] The board rejected the government's argument that "because the contractor expended less labor hours than it had estimated in its bid, it has not proven that it was in any way impacted by the presence of asbestos."[50] The board noted that "a contractor in a fixed price contract is entitled to any labor cost savings that it may experience."[51]

In turning to the MCAA manual for assistance in determining quantum, the V.A.B.C.A. stated:

> Our Board has recognized that it is somewhere between impractical and impossible to maintain cost records identifying and separating inefficiency costs. For this reason, we have utilized the productivity factors from the MCAA manual . . . to estimate the extent of impact on labor productivity in the absence of better evidence, such as a "measured mile" analysis.[52]

The V.A.B.C.A. determined that there was no unimpacted area to establish a measured mile, and, as a result, the board looked to the MCAA manual. Further, the board concluded that the only factor that was applicable was "morale and attitude," and its effect was "minor" or 5 percent. Applying the methodology from *Clark Construction Group, Inc.*,[53] the board took the contractor's estimated hours for pipefitters from its bid and multiplied it by 5 percent to arrive at the unproductive hours.[54] Because the contractor's bid hours exceeded the actual hours by 30 percent, the board reduced the unproductive hours by 30 percent to arrive at its award.

Projects with less than 6 percent changes, on average, were able to achieve better-than-planned productivity.

In *Hensel Phelps*,[55] the G.S.B.C.A. granted a mechanical subcontractor's appeal and awarded $1,518,382 for the costs of lost labor productivity caused by the cumulative effect of multiple contract changes, scope revisions, and the government's failure to provide information timely. Specifically, the subcontractor's losses arose out of three separate factors, which the G.S.B.C.A. determined were the government's responsibility: (1) the lack of a complete coordinated design at the time the project was awarded, which resulted in extensive changes to the various piping systems; (2) the govern-

ment's direction to install vibration isolation on the HVAC and plumbing piping, which was not part of the original contract scope; and (3) the government's direction to add manpower to mitigate the potential schedule impact caused by the government-directed changes.

When calculating its claim for damages, the subcontractor's expert evaluated the impact of six of the sixteen MCAA factors and applied the percentages to assess their impact on the contractor's as-planned hours for each building and time period. The G.S.B.C.A. found this method highly credible because the expert derived his conclusions from a thorough review of the project records, extensive interviews with project personnel, multiple visits to the project site, a review of the subcontractor's original plan for performing the work, and his analysis of the as-built schedule. The board also pointed to the expert's extensive experience in the construction industry as well as his expertise in assessing labor productivity losses.

In addition to endorsing the measured mile method as discussed above, the G.S.B.C.A. in *Clarke Concrete Contractors, Inc.*[56] allowed recovery by the mechanical subcontractor based on MCAA factors. Based on the MCAA manual, the subcontractor's president concluded that his company sustained a 60 percent loss of productivity in its work. The impacts considered included stacking of trades (20 percent), concurrent operations (15 percent), dilution of supervision (5 percent), site access (5 percent), out-of-sequence work (10 percent), and competition for labor (not in the MCAA manual but recognized by the board as an impact—5 percent). The subcontractor then multiplied the lost productivity percentage (60 percent) by the man-hours it estimated to perform the work at issue in order to determine the lost productivity. The G.S.B.C.A. accepted this approach but reduced the subcontractor's claim based on its finding that some of the additional lost productivity costs were a result of contractor delays rather than agency disruptions.

Over the last several years, the Construction Industry Institute (CII) has chartered a number of excellent studies that have examined the phenomenon of cumulative impact claims.

Corps of Engineers' Modification Impact Evaluation Guide

In 1979, the United States Army Corps of Engineers published the *Modification Impact Evaluation Guide*.[57] Chapter 4 of this manual discusses the effect that contract modifications have on material, equipment, and labor.[58] With respect to labor, the guide evaluates (1) disruption, (2) crowding, (3) acceleration, and (4) morale.[59] Although the Corps of Engineers officially recognized this guide as a valid means to assess inefficiency claims for over twenty years, the Corps officially rescinded the guide on June 14, 1996.[60] Despite the guide having been relied upon and accepted by various boards of contract appeals, the Corps claimed that the guide "has been updated and is incorporated in other publications to include higher level regulations, training course materials and other command guidance."[61] There is, however, no evidence that the guide has been incorporated into any other publication or manual.

Because of its rescission, contractors as well as public and private owners should be reluctant to use or accept claims based on the guide. Like any industry study, it is necessary to independently establish, based on the specific facts of the case, that the project at issue was qualitatively affected by the factors listed in the guide.[62]

The Leonard Study

Charles A. Leonard's 1988 master's thesis, *The Effects of Change Orders on Productivity,*[63] represents one of the few comprehensive studies to attempt to quantify cumulative impacts. In that early thesis, Leonard examined ninety cases from fifty-seven different projects to determine the disruptive effect of change orders on unchanged base contract work. His statistical analysis examined the percentage of the total number of hours performed on change order work compared with the total number of hours. Leonard concluded that loss of labor productivity was greatest where the hours spent on change order work exceeded 10 to 15 percent of the normal base contract hours. Accordingly, Leonard began by calculating the percent of change orders to base contract work by dividing "change order hours" by "actual contract hours." He concluded that the accumulation of change orders results in the following causes of loss of productivity: "stop-and-go operations; out-of-sequence work; loss of productive rhythm; demotivation of work force; loss in learning curve; unbalanced crews; excessive manpower fluctuations; unbalancing of successive operations; lack of engineering support; and acceleration when equitable time extensions are not granted."[64]

Leonard's conclusions, however, have been subject to criticism.[65] For example, in *J.A. Jones Construction Co.*,[66] the E.N.G.B.C.A. declined to accept the study, stating that the government's expert had discredited the study and concluding that "[n]o court has adopted the Leonard study approach in measuring productivity loss/inefficiency." The E.N.G.B.C.A. explained that the study was based upon "relatively small building and facility projects, consisting of ninety-four contracts totaling $220 million."[67] Thus, the board reasoned that the study was inapplicable to heavy civil engineering projects such as the massive flood protection project at issue in *J.A. Jones Construction*. Similarly, in *Aetna Casualty & Surety Co. v. George Hyman Construction Co.*,[68] the Special Master appointed by the U.S. District Court for the Eastern District of Pennsylvania dismissed the study as "wholly unreliable because it is based on unfounded assumptions, biased and incomplete data, and speculative determinations."

Construction Industry Institute Studies

Over the last several years, the Construction Industry Institute (CII) has chartered a number of excellent studies that have examined the phenomenon of cumulative impact claims. Those studies include *The Quantitative Effects of Project Change* and *Quantifying the Cumulative Impact of Change Orders for Electrical and Mechanical Contractors*.[69] These studies provide a positive contribution to understanding and successfully resolving cumulative impact claims. Unfortunately, at this point, none of the models appear to have been tested by a court or board. Therefore, the issue of whether these models can be used to prove or disprove cumulative impact claims remains to be seen.

In 1995, the CII chartered a research team to study the quantitative effects of project changes.[70] The research effort was led by C. William Ibbs, a professor of civil engineering at the University of California at Berkeley. The first hypothesis to be tested was the idea that the more changes that a contractor experiences on a project, the greater the negative impact on productivity. The second hypothesis was that changes that occur late in the project are implemented less efficiently than changes that occur early in the project. Unlike the earlier Leonard study, the research team studied 104 large commercial and heavy industrial private projects from thirty-five CII member companies with a median-size project of $44 million. Fifteen contractors volunteered sixty projects, and twenty owners volunteered the remaining forty-four projects.

With respect to the first hypothesis, the researchers concluded that there was a definite downward trend in construction productivity as the percent of changes increases.[71] Interestingly, projects with less than 6 percent changes, on average, were able to achieve better-than-planned productivity, and no project with more than 25 percent changes exhibited a better-than-planned productivity.[72] The researchers also examined the effect of changes on engineering productivity and determined that a similar loss of efficiency occurs with certain differences. First, even with projects experiencing no changes, there was an average overrun of 7 percent. Looking at the relationship between engineering and construction changes, the research indicated that construction productivity declines significantly with increasing engineering changes.[73] Conversely, "the research show[ed] that projects that start well and that are executed with little engineering change tend to run well in the field."[74]

The research team was unable to prove the second hypothesis that contractors are not able to implement changes that occur late in the project as well as the changes that occur early in the project with the information that it obtained from the questionnaires submitted by the CII members.[75]

Most recently in 2000, the CII organized a research team composed of representatives from the construction industry and from the University of Wisconsin–Madison to study the cumulative effect of change orders on labor productivity and to develop a method to quantify cumulative impact.[76] The research team set out to develop two models: (1) an impact model to determine whether a cumulative impact occurred on a project and (2) a quantification model to measure the extent of the impact on the projects. The team limited its analysis to electrical and mechanical contractors.

The researchers used data obtained through questionnaires from sixty-eight separate electrical and mechanical contractors on 116 different projects, varying in size and scope from industrial to institutional and commercial construction projects as well as a small sample of residential projects. Unlike the earlier Leonard study, the CII analysis sampled both impacted and unimpacted jobs as well as projects with and without claims by contractors. For the first model, the research team assembled a list of seventy-five factors that could potentially impact a project. Using statistical regression analysis to determine the correlation between these factors and loss of productivity, the researchers concluded that their model could determine whether a project has been impacted by the accumulation of change orders with 80 percent certainty.[77] For the second model, the team distilled the seventy-five variables down to six independent variables that "significantly affect productivity loss."[78] These six factors included (1) percent of change in terms of the original budgeted work-hours, (2) percent of time the project manager spent on the jobsite, (3) percent of change orders initiated by the owner, (4) whether the contractor tracked productivity, (5) whether the project was overmanned, and (6) the amount of time it takes the owner to approve change orders.[79] The team subsequently developed a linear regression equation to predict the value of the loss of efficiency resulting from the six factors.[80]

Claims for the Cumulative Impact of Multiple Change Orders.

Cumulative impact claims for the effect of multiple changes have been the subject of many recent court and board decisions.[81] The magnitude and accumulation of owner-directed changes under a construction contract may significantly disrupt the unchanged work on a construction project. As a consequence, the parties to a contract are frequently confronted with the issue of whether a contractor may recover for the impact or "ripple effect" caused by either the size or large number of changes.

The U.S. Court of Federal Claims and the various boards of contract appeals have recognized a general right to recover for the cumulative effect of a multitude of owner-directed changes.[82] According to this theory of recovery, "the issuance of an unreasonable number [or unusual quality] of change orders creates a synergistic disruptive impact such that the total disruption caused by the changes exceeds the sum of the disruptive impacts caused by the individual change orders when looked at independently."[83]

Cumulative impact can be defined as the disruption that occurs between multiple change orders and the base contract work. It does not include the local or direct disruption that is directly attributable to one specific change order. In *Bechtel National, Inc.*, the NASA Board of Contract Appeals explained that cumulative impact arises from changes that had such an effect on performance that there is a separately compensable impact claim that does not involve the direct

cost of the changes.[84] Unlike claims for the direct costs of the changes (direct impact claims), which can be recognized when a change order is issued, the cumulative impact claim represents a claim for lost productivity on unchanged work that contractors claim is not foreseeable at the time the change order is issued.

Cumulative Impact Claims under State Law

In *Amelco Electric v. City of Thousand Oaks*,[85] the California Supreme Court held that a public entity cannot be found liable to a contractor under an abandonment theory[86] of recovery when the public entity makes numerous changes to the contract work, and these changes make it difficult and more costly to perform the contract because of delay, interference with the work of other trades, and other problems not captured in the price of the executed change orders. The contractor in this case attempted to extend California law, which currently allows contractors to recover from private owners on the theory that the owner has abandoned the contract when the owner failed to follow the change order procedures and when the final product differs substantially from the original.[87] The court rejected the contractor's argument on the grounds that it is inconsistent with the purpose of California's competitive bidding statutes and that California courts have not previously allowed this type of recovery for extra work performed beyond the contract requirements.

Reserving the Right to Claim Cumulative Impact

Often the initial obstacle to recovering for a cumulative impact claim is avoiding release or waiver of the claim before the contractor is even aware that disruption has occurred.[88] The government contracts trend appears to require contractors to expressly reserve the right to request an equitable adjustment for the cumulative disruption even before any impact becomes known. Failure to make an express reservation of right in change orders or modifications may prevent a contractor from seeking recovery under the affirmative defense of accord and satisfaction. The issue is generally a question of fact (whether rights were reserved) and not a question of law.

Courts and boards look to the language contained in the contract modifications or the general conditions of the contract to determine whether a contractor has waived or released its rights. An example of the reservation language that contractors include in change orders is as follows:

> This change represents full and complete compensation for all direct costs and time required to perform the work set forth herein, plus the overhead and profit as provided for in the Changes clause in this contract. The contractor hereby reserves the right to submit a request for equitable adjustment for all costs resulting from the impact of this change on unchanged contract work.[89]

In *Hensel Phelps Constr. Co.*,[90] the government argued that the mechanical subcontractor was barred from recovering additional compensation for the impact of certain piping system changes because the subcontractor signed bilateral change orders and that the impact of the changes on the unchanged work was readily foreseeable at the time the parties agreed to the piping changes.

The G.S.B.C.A. stated that the signed modifications neither expressly nor implicitly barred the contractor from recovering additional impact costs from the changes. The board then held that the inefficiency claims were not barred because the prime and subcontractors had advised the government at a meeting about the cumulative impacts, which they followed up with a letter from the subcontractor that distinguished between direct impacts on the changed work and the cumulative effect on the unchanged work.

In *Linda Newman Constr. Co. v. United States*,[91] the U.S. Court of Federal Claims entered summary judgment against a contractor that relied upon the cumulative impact reservation of right language contained in the change orders to recover overhead costs otherwise barred by the changes clause found in Department of Veterans Affairs contracts. The contractor executed nineteen change orders that contained a clause reserving "the right to submit a request for equitable adjustment for all costs resulting from the impact of this change on the unchanged work."[92] The contractor argued that this reservation permitted the contractor to recover all costs including extended overhead. The court held that the reservation clause did not override the limitations provision in the VA changes clause and that the term "impact on unchanged work" referred to the additional direct costs of performance.

Endnotes

1. William Schwartzkopf, Calculating Lost Labor Productivity in Construction Claims, *Labor Productivity Defined*, § 1.1 (1995).
2. Thomas E. Shea, *Proving Productivity Losses in Government Contracts*, 18 Pub. Cont. L.J. 414, 415 (1989).
3. *See* MCI Constructors, Inc., D.C.C.A.B. No. D-924 (June 6, 1996).
4. Centex Bateson Constr. Co., V.A.B.C.A. Nos. 4613, 5162–65, 99–1 B.C.A. ¶ 30,153 at 149,258; Bechtel Nat'l, Inc., NASA B.C.A. No. 1186-7, 90–3 B.C.A. ¶ 22,549 at 113,177; Acme Missiles & Constr. Corp., A.S.B.C.A. Nos. 11256, 11716, 68–1 B.C.A. ¶ 6873 at 31,770.
5. *But see* Hensel Phelps Constr., A.S.B.C.A. No. 49270, 99–2 B.C.A. ¶ 30,531 ("the number of RFIs and changes alone is insufficient to establish the Government's liability for a contractor's inefficiency").
6. *Bechtel Nat'l.*, 90–3 B.C.A. at 113,177.
7. *Centex Bateson Constr. Co.*, 99–1 B.C.A. at 149,258, *aff'd*, Centex Bateson Constr. Co. v. West, Fed. Cir. No. 99-1309, 44 CCF ¶ 77,646 (July 6, 2000).
8. A.S.B.C.A. No. 39605, 01–2 B.C.A. ¶ 31,525.
9. *Id*. quoting Luria Bros. & Co. v. United States, 369 F.2d 701, 713 (Ct. Cl. 1966).
10. E.N.G.B.C.A. Nos. 6348, 6386–91, 00–2 B.C.A. ¶ 31,000.
11. V.A.B.C.A. No. 564, 00–1 B.C.A. ¶ 30,870.
12. *Id*. at 152,417.
13. *See* Luria Brothers & Co. v. United States, 369 F.2d 701, 713 (Ct. Cl. 1966) ("It is a rare case where loss of productivity can be proven by books and records; almost always has to be proven by the opinions of expert witnesses."); *see also* P.J. Dick, Inc., V.A.B.C.A. Nos. 5597 et al., 01–2 B.C.A. ¶ 31,647 at 156,354; aff'd in part, rev'd in part, vacated in part, and remanded in P.J. Dick, Inc., v. Principi, 324 F.3d 1364 (Fed. Cir. 2003) (exclusively addressing the contractor's claim for unabsorbed home office overhead); Hensel Phelps Constr. Co., G.S.B.C.A. Nos. 14744 et al., 01–1 B.C.A. ¶ 31,249 at 154,321.
14. *See, e.g.*, Dawco Constr., Inc. v. United States, 930 F.2d 872, 882 (Fed. Cir. 1991) ("Clearly, the 'actual cost method' is preferred because it provides the court . . . with documented underlying expenses, ensuring that the final amount will be just that—equitable—and not a windfall for either the government or the contractor."), overruled on other grounds in Reflectone, Inc. v. Dalton, 60 F.3d 1572, 1583 (Fed. Cir. 1995).
15. Shea, *supra* note 2, at 419–21.
16. *See, e.g.,* Clark Constr. Group, Inc., V.A.B.C.A. No. 564, 00–1 B.C.A. ¶ 30,870 at 152,413 ("The after-the-fact conclusory assessments of the project managers or the opinion of its experts are not sufficient substitutes for [the contractor's] underlying obligation to contemporaneously document the severe adverse impact on labor inefficiency it now claims

resulted from the changes and RFIs.").

17. *See, e.g.*, Servidone Constr. Corp. v. United States, 931 F.2d 860, 862 (Fed. Cir. 1991); J.D. Hedin Constr. Co. v. United States, 171 Ct. Cl. 70, 347 F.2d 235 (1965); WRB Corp. v. United States, 193 Ct. Cl. 409, 426 (1968); Thalle Constr. Co., Inc. v. Whiting-Turner Contracting Co., 945 F. Supp. 652, 654 (S.D.N.Y. 1996); Atlas Constr. Co., G.S.B.C.A. Nos. 7903 et al., 90–2 B.C.A. ¶ 22,812 (applying the total cost method to a cumulative impact claim); State v. Guy F. Atkinson, 187 Cal. App. 3d 25, 231 Cal. Rptr. 382 (1986).

18. Shea, *supra* note 2, at 419.

19. *Id*. at 416 & 419–21.

20. V.A.B.C.A. Nos. 4613, 5162–65, 99–1 B.C.A. ¶ 30,153 at 149,261.

21. McMillin Bros. Constructors, Inc., E.B.C.A. No. 328-10-84, 91–1 B.C.A. ¶ 23,351 at 117,102.

22. *See* Youngdale & Sons Constr. Co., Inc. v. United States, 27 Fed. Cl. 516, 540 (1993); Skip Kirschdorfer, Inc. v. United States, 14 Ct. Cl. 594 (1988); S.W. Electronics & Mfg. Corp. v. United States, 228 Ct. Cl. 333, 655 F.2d 1078 (1981); Boyajian v. United States, 191 Ct. Cl. 233, 423 F.2d 1231; WRB Corp. v. United States, 193 Ct. Cl. 409, 426 (1968); J.D. Hedin Constr. Co. v. United States, 171 Ct. Cl. 70, 347 F.2d 235 (1965).

23. *Centex Bateson Constr. Co.*, 99–1 B.C.A. ¶ 30,153 at 149,261.

24. *Id*.

25. MARTA v. Green Int'l, Inc., 235 Ga. App. 419, 509 S.E.2d 674, 676 (1998).

26. *Id*. at 677.

27. *Id*. at 678.

28. 556 S.E.2d 1, 5–6 (N.C. App. 2001); *see also* Amelco Electric v. City of Thousand Oaks, 115 Cal. Rptr. 2d 900, 911, 27 Cal. 4th 228, 243, 38 P.3d 1120 (2002).

29. *Biemann and Rowell v. Donohoe Companies*, 556 S.E.2d at 5.

30. *See* Stuart Sobel, *The Modified Total Cost Method of Determining Damages*, 21:4 THE CONSTR. LAW. 5 (FALL 2001); Shea, *supra* note 2, at 421; Roy S. Cohen, Session 612: Survey of Courts' Reactions to Claims for Loss of Productivity and Inefficiency 5, presented December 10, 1998, at the Construction Superconference (Andrews Conferences, Inc.).

31. *Id.*

32. A.S.B.C.A. No. 33394, 97–2 B.C.A. ¶ 29,184, citing U.S. Industries v. Blake Constr. Co., Inc., 671 F.2d 539, 547 (D.C. Cir. 1982).

33. V.A.B.C.A. Nos. 5597, 5836–37, 5839–50, 5951–65, 6017–24, 6483, 01–1 B.C.A. ¶ 31,647: aff'd in part, rev'd in part, vacated in part, and remanded in P.J. Dick, Inc., v. Principi, 324 F.3d 1364 (Fed. Cir. 2003) (exclusively addressing the contractor's claim for unabsorbed home office overhead).

34. *Id*.

35. *Id*.

36. G.S.B.C.A. No. 14,310, 99–1 B.C.A. ¶ 30,200.

37. *Id*. at 149,746.

38. *Id*. at 149,747.

39. *See* MCAA MANAGEMENT METHODS BULLETIN No. 58 (1976), republished in Bulletin PD-2 (1994) [hereinafter MCAA manual]; NECA, *Rate of Manpower Consumption in Electrical Constr.* (1983); U.S. ARMY CORPS OF ENGINEERS, MODIFICATION IMPACT EVALUATION GUIDE, EP 415-1-3 (July 1979); Charles A. Leonard, *The Effects of Change Orders on Productivity* (1988) (unpublished master's thesis, Concordia University); *see also* SCHWARTZKOPF, *supra* note 1, § 4.4; H. RANDOLPH THOMAS & AMR A. OLOUFA, NEGOTIATING LOSS OF LABOR EFFICIENCY FOR ELECTRICAL CONTRACTORS (2001) (published by The Electrical Contracting Foundation); THE BUSINESS ROUNDTABLE'S MEASURING PRODUCTIVITY IN CONSTRUCTION (September 1992, reprinted October 1991); *Quantitative Effects of Project Change*, CONTSTRUCTION INDUSTTRY INSTITUTE PUBLICATION 43-2 (May 1995); *Quantifying the Cumulative Impact of Change Orders for Electrical and Mechanical Contractors,* CONSTRUCTION INDUSTRY INSTITUTE RESEARCH SUMMARY 158-1 (2000).

40. *See, e.g*., Clark Constr. Group, Inc., V.A.B.C.A. No. 564, 00–1 B.C.A. ¶ 30,870; Fire Security Systems, Inc., V.A.B.C.A. Nos. 5559–63, 2002 WL 1979118 (August 16, 2002); Hensel Phelps Construction Co., G.S.B.C.A. Nos. 14,744, 14,877, 01–1 B.C.A. ¶ 31,249; *Clark Concrete Contractors*, 99–1 B.C.A. ¶ 30,200; Stroh Corp., G.S.B.C.A. No. 11029, 96–1 B.C.A. ¶ 28,265 at 141,132–133; *but see* Hensel Phelps Construction Co., A.S.B.C.A. No. 49270, 99–2 B.C.A. ¶ 30,531, on reconsideration, 00–1 B.C.A. ¶ 30,733, affirmed by 2001 WL 360727 (Fed. Cir. 2001).

41. MCAA manual, *supra* note 39.

42. *Id*.

43. *Id.*; *see also Clark Construction Group,* 00–1 B.C.A. at 152,406–07.

44. *Clark Construction Group,* 00–1 B.C.A. at 152,419–20.

45. *Id*. at 152,407–08.

46. *Id*. at 152,419.

47. *Id*. at 152,421 and 152,411, respectively.

48. V.A.B.C.A. Nos. 5559–63, 02–2 B.C.A. ¶ 31,977.

49. *Id*.

50. *Id*.

51. *Id*.

52. *Id*.

53. V.A.B.C.A. No. 564, 00–1 B.C.A. ¶ 30,870.

54. *Id*.

55. G.S.B.C.A. Nos. 14,744, 14,877, 01–1 B.C.A. ¶ 31,249.

56. G.S.B.C.A. No. 14,310, 99–1 B.C.A. ¶ 30,200.

57. DEPARTMENT OF THE ARMY, OFFICE OF THE CHIEF OF ENGINEERS, MODIFICATION IMPACT EVALUATION GUIDE, EP 415-1-3 (July 1979).

58. *Id*. at 4-1 through 4-17.

59. *Id*. at 4-6 through 4-10.

60. Albert J. Geneni Jr., Department of the Army, U.S. Army Corps of Engineers, Circular No. 25-1-244 (June 14, 1996); *see also* Mark G. Jackson, Carl W. LaFraugh & Robert P. Majerus, *Using Industry Studies to Quantify Lost Productivity*, CONSTR. BRIEFINGS at 3 (December 2001).

61. *Id.*

62. *See, e.g*., DANAC, Inc., A.S.B.C.A. No. 33394, 97–2 B.C.A. ¶ 29,184 at 145,152–53 (rejecting a contractor's claim for constructive acceleration based on the *Modification Impact Evaluation Guide* where the A.S.B.C.A. found no evidentiary link between the phenomenon listed in the guide and the project at issue in the case).

63. Leonard, *supra* note 39; *see also* SCHWARTZKOPF, *supra* note 1, at § 4.4.

64. SCHWARTZKOPF, *supra* note 1, at § 6.1.

65. *See, e.g.*, Aetna Cas. & Surety Co. v. George Hyman Constr. Co., U.S. Dist., LEXIS 22627 (E.D. Pa. 1998); J.A. Jones Constr. Co., E.N.G.B.C.A. Nos. 6348, 6386–91, 00–2 B.C.A. ¶ 31,000.

66. E.N.G.B.C.A. Nos. 6348, 6386–91, 00–2 B.C.A. ¶ 31,000.

67. *Id*.

68. U.S. Dist., LEXIS 22627 (E.D. Pa. 1998).

69. *Quantitative Effects of Project Change, supra* note 39; *Quantifying the Cumulative Impact, supra* note 39.

70. *Quantitative Effects of Project Change*, *supra* note 39.

71. *Id*. at 7.

72. *Id*.

73. *Id*. at 10.

74. *Id*.

75. *Id*. at 17.

76. *Quantifying the Cumulative Impact*, *supra* note 39.

77. *Id*. at 12.

78. *Id*. at 15.

79. *Id*. at 16.

80. *Id*. at 15.

81. *See generally* Geoffrey T. Keating and Thomas F. Burke, *Cumulative Impact Claims: Can They Still Succeed*; 20 CONSTR. LAW. 30 (April 2000); Reginald M. Jones, *Lost Productivity: Claims for the Cumulative Impact of Multiple Change Orders*, 31 PUB. CONT. L.J. 1 (Fall 2001).

82. Pittman Constr. Co., G.S.B.C.A. Nos. 4897, 4923, 81–1 B.C.A. ¶ 14,847, *aff'd*, Pittman Constr. v. United States, 2 Cl. Ct. 211 (1983); Hensel Phelps Constr. Co., G.S.B.C.A. Nos. 14,744, 14,877, 01–1 B.C.A. ¶ 31,249.

83. *Pittman*, 81–1 B.C.A. at 73,297.

84. Bechtel Nat'l, Inc., NASA B.C.A. Nos. 1186–87, 90–1 B.C.A. ¶ 22,105.

85. 115 Cal. Rptr. 2d 900 (Feb. 4, 2002); *see generally* Justin Sweet, *The* Amelco *Case*: *California Bars Abaondonment Claims in Public Contracts*, 32 PUB. CONT. L.J. 285 (Winter 2003).

86. The difference between alleging breach of contract and abandonment involves the measure of damages. Contract damages are limited to those costs that are either generally contemplated by the parties when the contract is signed or the costs that are reasonably foreseeable. In contrast, damages for abandonment can be much greater because they include the reasonable value for all of the contractor's work.

87. *See* C. Norman Peterson Co. v. Container Corp. of America, 218 Cal. Rptr. 592, 601 (Cal. Ct. App. 1985).

88. *See generally The Waiver or Reservation of Impact Costs*, 23 CONSTR. CLAIMS MONTHLY 1 (February 2001).

89. Linda Newman Constr. Co. v. United States, 48 Fed. Cl. 231, 234 (2000).

90. G.S.B.C.A. Nos. 14,744, 14,877, 01–1 B.C.A. ¶ 31,249.

91. 48 Fed. Cl. at 231.

92. *Id*.