

values in the last five columns of Table 1 can be used to judge which of the other methods is most appropriate in this particular case. To accomplish this, the deviations from the values obtained by the fundamental method have been tabulated for each of the other methods in Table 2. The summary statistics for each column are printed at the foot of the table. For a method to be judged both accurate and precise, the average deviation must be close to zero and the standard deviation should be small. On this basis, the five methods have been ranked for accuracy and precision and the overall rank has been determined by weighting these two separate ranks equally.

What emerges from this rather cursory investigation is evidence that the method of multiplying individual pay factors together is equal or superior to any of the other methods that were tested, at least for this particular application. This is encouraging, not only because this approach is widely used, but also because it suggests a method by which additional quality characteristics not included in the AASHTO equation might be incorporated into acceptance procedures for rigid pavement.

SUMMARY AND CONCLUSIONS

A method has been outlined by which the AASHTO design equation can be used to develop acceptance procedures for rigid pavement. By computing the expected load-bearing capacity from the as-built characteristics of the pavement and comparing this with the design loading, a ratio is obtained that forms the basis for a rational pay schedule. Sensitivity tests were performed to confirm the reliability of this approach, and several different acceptance procedures were developed and tested by computer simulation. In all cases, it was possible to make the operating-characteristic curve conform closely to the desired pay function.

It was demonstrated that the limitation of pay factors to a maximum of 100 percent biases the operating-characteristic curve downward, which makes it difficult for contractors to know how to bid or perform under such a specification. This situation

can be alleviated by allowing a bonus provision or by permitting pay factors greater than 100 percent to be used to offset other pay factors less than 100 percent.

Finally, a secondary study was conducted to compare various methods currently in use for combining multiple pay factors. Under the assumption that the method based on the AASHTO equation is fundamentally correct, it was demonstrated that the method of multiplying the individual pay factors together is among the best of the other methods that were tested.

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Interest on Capital Invested in Construction as Delay Damages

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The potential for contractors to recover extended financing costs that result from a construction delay is investigated. Legal case histories arising from the federal courts and boards of contract appeals are reviewed, and recent developments related to federal construction contract procedures are presented. Legal case studies are cited that indicate that delay damages can be recovered under the suspension-of-work clause even though no written directive is issued. Delay damages under the change clause are generally not recoverable, although the general conditions of construction contracts of the General Services Administration and the Department of Defense do permit recovery of cost of delays related to change orders. Legal precedents are reviewed that suggest that interest on borrowed funds that was necessitated by a delay can also be recovered. Regulations that prohibit recovery of interest on borrowed funds governed by most federal construction contracts are reviewed. These have been challenged and upheld in the U.S. Court of Claims. Since 1976, boards of contract appeals have awarded imputed-interest damages. These damages result when a contractor is required by a delay to increase the capital investment in a construction

project. This increased investment represents a loss of profit because these funds could otherwise be invested in short-term securities and treasury notes. Cost Accounting Standard 417, effective December 1980, provides for the recovery of imputed-interest damages resulting from a delay. The calculation procedure presented in CAS 417 is illustrated with a construction example. It is shown that on a project that costs \$2 380 750 and experiences a three-month suspension-of-work delay, the contractor is entitled to \$29 702 in imputed-interest damages in addition to any other damages that may have been incurred.

Acceptable cash flow for a construction contractor is largely dependent on ability to achieve satisfactory progress with regard to the project schedule. Unanticipated delays in the construction process, regardless of the cause or responsible party, will likely result in additional direct and indirect

costs for the contractor. Additional direct costs caused by schedule delays have been cited in numerous damage claims. Whenever these disputes have resulted in litigation, courts have shown a general tendency to award extra compensation. A distinct exception to this trend is the awarding of extended finance charges and interest damages as a result of the delay.

OBJECTIVES AND SCOPE

The objectives of this paper are to define the damages to contractors resulting from financing costs incurred when the work is suspended or when work must be performed that is beyond the scope of the original construction contract. The potential for recovering these damages in litigation proceedings will be assessed by presenting recent legal trends and case studies. New developments in cost accounting standards that describe a procedure for computing financing costs will also be illustrated.

The objectives of this paper were achieved through a study of legal case histories obtained from the legal library of Pennsylvania State University and other unpublished documents and reports. Important aspects of key cases were clarified by interviewing government lawyers involved in construction litigation cases for the U.S. Department of Defense (DOD). The concepts in this paper are limited to interpretations presented in Board of Contract Appeals (BCA) hearings and courts of law. Decisions of contracting officers and out-of-court settlements are not included. Essentially all key decisions, especially recent ones, have been rendered in disputes against the federal government. In the private sector few significant cases involving questions about financing costs have been settled in court. Nevertheless, it would appear logical that federal contracting procedures could easily be extended to state and local governments and to the private sector of the construction industry.

TERMINOLOGY

To understand claims involving government contracts and legal case studies, the following definitions will be used:

1. Contracting officer: An official of the agency awarding a contract who has the power to decide disputes arising during the performance of a construction contract. The contracting officer's decision is conclusive unless appealed to the agency's BCA.

2. Board of Contract Appeals: Any one of 11 different contract appeal boards representing various federal agencies. Appeal of a decision by a contracting officer is heard by BCA. The hearing resembles a courtroom proceeding. The BCA referenced in this paper is the Armed Services Board of Contract Appeals (ASBCA), whose jurisdiction is DOD contracts. Decisions of BCA can be appealed to the U.S. Court of Claims.

3. Court of Claims: A federal court that decides cases involving claims against the United States Government. Decisions of the Court of Claims can be appealed to the United States Supreme Court.

FINANCE COSTS AS DIRECT DAMAGES

A review of federal appeals board cases and Court of Claims decisions involving claims for delay damages indicates that the potential exists for recovering both direct and consequential damages. Direct damages include home and field office overhead, equipment expenses, escalation of material and labor

cost, and loss of efficiency. Consequential damages are not directly related to the delay and include loss of bonding capacity, restrictions on the contractor's ability to perform other jobs due to limited working capital, and loss of profit. Consequential damages can be somewhat vague and often lack "specific rationale," or traceability to the delay. Direct damages are more easily recovered because they can usually be linked to the delay. The fact that contractors must be able to accurately show a cause-effect relationship was demonstrated in the 1975 case of Roanoke Hospital versus Doyle and Russell, Inc. [214 S.E. 2d 155 (1975)]. This requirement is not always easily satisfied where intercorporate and intracorporate financing are involved.

In litigation proceedings, the potential for recovering extended financing costs is largely a function of predictability. Direct damages are predictable because they are a natural outgrowth of construction delays. In essence there is a cause-effect relationship. The case of Roanoke Hospital versus Doyle and Russell is especially significant because the court accepted the concept that extended interest costs constitute direct damages. A second case that establishes a precedent for recovering these costs is Hammermill Paper Company versus Rust Engineering Company [243 A. 2d 389 (1968)]. In this 1968 case, extended financing charges were allowed because they were documented with specific rationale. Therefore, establishing the link between delays and damage is a necessary condition for recovery. Furthermore, the damages must be clearly and accurately documented. When either of these two conditions fails to exist, damages will not likely be awarded [Clark versus Ferro Corporation, 273 F. Supp. 230 (1964)]. Therefore, legal case history indicates that financing costs will not be awarded just because a delay has occurred. It is also important to note that in both the Roanoke Hospital and the Hammermill Paper Company cases, financing costs were treated as damages that were separate from any other damages that may have occurred.

RECOVERY OF DELAY DAMAGES

Contract Provisions Related to Damage Delays

As a general rule, a contractor is entitled to recover damages resulting from a delay caused by an owner, provided the following conditions can be established: (a) a delay initiated by the owner or the owner's agent to the work of the contractor in fact occurred, (b) the contractor was damaged by the delay (cause-effect relationship), (c) the delay was beyond the control of the contractor, and (d) damages are clearly and accurately documented (specific rationale). Should any of these conditions be absent, recovery of damages will likely be denied. However, there are situations where contract provisions may influence the decision of an appeals board or court in a damage claim. It is important, therefore, to understand the contract provisions related to delay damages. Three specific types of provisions will be reviewed. These are clauses related to suspension of work, changed conditions, and provisions prohibiting the recovery of damages.

Suspension-of-Work Clause

Three situations are of interest regarding suspension-of-work clauses. The first condition is when an owner invokes the suspension-of-work clause in writing. For the contractor to recover damages, the following provisions apply:

1. The delay must be for an unreasonable period of time,
2. The delay must not be a result of a concurrent delay caused by the contractor,
3. There will be no cost adjustment if the circumstances require or exclude an equitable adjustment under other provisions of the contract,
4. An allowance for profit is not included in any cost adjustment under this provision,
5. Claims for time extensions must be made in writing no more than 20 days after the commencement of the delay, and
6. Claims for cost adjustments must be submitted in writing as soon as possible after the suspension ends and no later than the date of final payment under the contract.

These conditions are included in most federal construction contracts [10 U.S.C. 2301-2314 (1979)] and in the general conditions of construction contracts of the American Institute of Architects (1), the Associated General Contractors of America (2), and the National Society of Professional Engineers (3).

Although the above contract provisions relate to written suspension-of-work directives, the owner is not necessarily protected from claims when written directives are not provided. This principle was established in the 1972 case of Carl M. Halverson, Inc., versus United States [461 F. 2d 1337 (1972)] where the suspension-of-work order was communicated verbally but not in writing. The trial commissioner ruled that a change order required because of an error in the contract drawings, related to the relocation of a creek, resulted in a suspension of the work of the contractor in a priority work area. Therefore, the contractor was entitled to recover the increased costs resulting from such suspension.

It is unusual for construction contracts to be void of suspension-of-work clauses. Nevertheless, a contractor may still be entitled to recovery of damages under a breach of contract. In fact, in the 1970 case of Chaney and James Construction Company, Inc., versus United States [421 F. 2d 728 (1970)], the court handed down the opinion that there is no difference between the remedies available under a suspension-of-work clause or a breach of contract. The opinion stated in part that "since the suspension of work clause is an administrative substitute for an action at law for a breach of contract...the contractor should be entitled to get the same relief under the suspension of work clause that he could get in the absence of the clause if he sued for breach-of-contract". This opinion is most significant, since it relates to change orders.

Change Orders

The general conditions of most contracts allow the owner to make changes in the scope of the work covered by the contract. Changes may cause delays in the construction process by disrupting the sequence of construction operations, altering previously completed work, or extending the schedule because of an increase in the amount of work to be performed. Although compensation for scope changes may be handled in a straightforward manner, claims for delay damages are not so simple.

In 1943, the U.S. Supreme Court set forth guidelines for recovering damages resulting from changes. The landmark case of United States versus Rice has become known as the Rice Doctrine [United States versus Rice, 317 U.S. 61, 63 S. Ct. 120 (1943)]. The Supreme Court ruled that cost adjustments are the result of altered specifications or changes and are not applicable to consequential

damages. Delay damages are covered by time extensions. In essence, the court said that damages cannot be recovered under the contract provisions related to a change clause. Lower courts have consistently upheld this decision and have allowed damages to be recovered only if a breach of contract could be demonstrated (4). The most likely way to recover damages resulting from change orders is to demonstrate that there was a suspension of work, which is essentially a breach of contract.

No Damages for Delay Clauses

Provisions that preclude the recovery of delay damages may be included in some state, municipal, and private contracts (5). Delay damages are denied in lieu of a time extension for completing the work. Such provisions have been the subject of much litigation. However, courts have ruled that these clauses are not against public policy and therefore are enforceable. There are many exceptions, and enforceability varies from state to state (4).

Developments in Federal Contracting Procedures

In 1968, the General Services Administration and DOD amended the general conditions of their respective construction contract documents to allow for the recovery of costs of delays and disruptions (the ripple effect) caused by change orders (under the change clause) and changed conditions (under the differing-site-conditions clause). This would appear to be contrary to the Rice Doctrine, which precludes the recovery of delay damages under change clauses. However, when delays occur because the change orders are not timely, this constitutes an informal or involuntary suspension of work, and damages can be awarded. It is not necessary that a written suspension-of-work order be issued. Moreover, in 1972, a court decision in Tri-Cor, Inc., versus United States [458 F. 2d 112 (1972)] ruled that a contractor performing government work is entitled to an allowance for profit under these two clauses.

The ASBCA has issued rulings that emphasize the importance that contracting officers render timely decisions and issue change orders that affect work along the critical path of a construction schedule. For example, ASBCA ruled that a contracting officer unreasonably delayed a project by taking eight days to render a decision on certain disputed work. The contractor was subsequently awarded damages under the suspension-of-work clause even though no written order was issued. In another decision, ASBCA ruled that a contractor was entitled to reimbursement for the increased costs incurred when suspension of work was required because of a government delay in issuing required change orders (6).

Interest Damages and Bell Case

Previous court decisions appear to have signaled an opportunity for the recovery of extended financing costs (interest) as delay damages. A landmark Court of Claims case in this area was Joseph Bell versus United States [404 F. 2d 975 (1968)], which was decided in 1968. The court awarded compensation to a contractor for the additional interest he had to pay on a loan over the extended period of time that was caused by a slowdown initiated by the owner. In allowing recovery of the interest, the court held that the increased interest was undoubtedly an increased cost of performance attributable to the change. It is important to note that the court stated that the contractor was not seeking interest on the money owed to him by the owner.

This case was significant in that it established a precedent for recovering interest on borrowed funds as a type of damage. Subsequent BCA and Court of Claims decisions that have awarded interest damages have been based on this precedent. The Bell case set in motion the development in 1970 of regulations prohibiting recovery of interest damages on DOD contracts. However, more recent cases in both BCA and the Court of Claims have permitted recovery of imputed-interest damages. Imputed interest is interest on the capital invested in facilities under construction. These developments have spawned considerable uncertainty in the law.

RECOVERY OF INTEREST ON BORROWED FUNDS

In the private sector of the construction industry where there are no regulations addressing the issue of interest damages, there is some precedent for recovering interest costs. The cases of Hammermill Paper Company versus Rust Engineering Company in 1968 and Roanoke Hospital versus Doyle and Russell in 1975 are examples. In another recent case (1979) interest costs were also awarded. The Atlas Concrete Pipe, Inc., was awarded interest damages because the defendant, Roger J. Au and Sons, Inc., failed to pay an outstanding open account of indebtedness [467 F. Supp. 830 (1979)].

Where regulations exist covering interest damages, such as at the federal and state government levels, the situation prior to 1980 was quite different. Following the Bell decision, which had awarded interest damages, federal regulations were developed to prohibit the payment of interest damages on contracts governed by the Defense Acquisition Regulations (DAR) and the Federal Procurement Regulations (FPR). Defense Procurement Circular (DPC) 79, dated May 15, 1970, mandates the application of DAR 15-106, Section 15 (Cost Principles, Pricing of Equitable Adjustments Under Firm Fixed-Price DOD Contracts) (32 C.F.R. 15.106). Two years later, on March 31, 1972, FPR also made DAR 15 mandatory for other government agency fixed-price contracts (41 C.F.R. 1-15.106). DAR Section 15 specifically states that interest on borrowed funds from external lending institutions is not an allowable adjustment to a contract price.

By using the Bell decision as a precedent, the legality of DAR Section 15 has been challenged in both the courts and BCA. The 1977 case of Framlau Corporation versus United States is of special interest [215 Ct. Cl. 185 (1977)]. The decision by the Court of Claims upheld the concept of administrative regulations that prohibit the awarding of interest on borrowed funds arising from a claim against the government, except where specifically allowed by a contract provision or authorized by statute. The significance of the decision is summarized as follows:

1. Administrative restrictions on recovering interest damages on borrowed funds are lawful, although these regulations can be overruled by statutes or by contract language to the contrary.

2. The decision did not specifically address the legality of interest damages in situations where there are no regulations or contract provisions. However, by stating that regulations can be overruled by contract provisions allowing interest recovery, the court appears to imply that such recoveries are legal.

With the Bell and Framlau cases serving as precedent, it would appear that a contractor can recover interest damages on borrowed funds provided there are no regulations or contract provisions to the contrary.

In the absence of limiting regulations or provisions, recovery of interest damages may be possible. However, a prerequisite is that the contractor must show that the delay or change in work created a clear necessity for borrowing additional funds and that these can be traced to the delay.

The burden of proof and traceability may not be too difficult for small and medium-sized contractors if they secure a loan from a financial lending institution. The situation is quite different for large construction firms, especially those with complex organizational structures. In many instances, such firms are subsidiaries or divisions of larger corporations and are often treated as satellite cost centers with the headquarters level being responsible for all capital investments and corporate financing. In most circumstances, past borrowing practices and the manner in which accounting records are arranged simply do not lend themselves to the degree of traceability that may be necessary. As a result, most large contractors have been unable to recover interest on actual borrowings as a cost of performance. Only in a few instances will there likely be satisfactory evidence to adequately support an interest claim involving a large corporation. Furthermore, the revision of intercorporate and intracorporate financing procedures appears unlikely, particularly those involved with federal contracts, because DAR 15 denies recovery of these damages.

RECOVERY OF IMPUTED-INTEREST DAMAGES

Establishment of Precedence

The Bell case and others dealt only with funds borrowed from an external lending institution. The issue of delay damages to a contractor whose own capital is invested in lieu of borrowing monies was not addressed.

It is important to note that the issue here is over the contingency funds of the contractor that are used as reserve capital when necessary but are otherwise invested in treasury notes and short-term securities. This situation is quite common among larger contractors. Interest on monies borrowed internally from this contingency fund is called imputed interest, and DAR 15 makes no mention of this form of borrowing. Imputed interest represents capital invested in the project by the contractor. Recent trends have been for the larger contractors to try to recover imputed-interest damages. The rationale is that imputed interest represents a loss of profit because the reserve funds could otherwise be invested.

The distinction between interest paid to an external lending institution and imputed interest is, in reality, a distinction between borrowing methods and hence is often related to the size of the contracting firm. An earlier case history that disallowed imputed interest but permitted interest on borrowing from external institutions in essence penalized the larger contractors in favor of the smaller ones.

Since the mid-1970s some contractors have been successful in recovering imputed-interest damages. The first shift in attitude occurred in the 1976 BCA case of New York Shipbuilding Company [ASBCA 16164, 76-2 BCA 11979 (1976)] where the plaintiff was able to recover these damages. Subsequent BCA cases have upheld this philosophy [Bailfield Industries, ASBCA 18057, 77-1 BCA 12348 (1977); Ingalls Shipbuilding Division, Litton Systems, Inc., ASBCA 17579, 78-1 BCA 13038 (1978); Fischbach and Moore International Corporation, ASBCA 18146, 77-1 BCA 12300 (1977)]. When the decisions are reviewed, there appears to be

a trend toward not making a distinction between financing methods. This situation would suggest that the contractor is not required to show that actual borrowing was required but rather that the delay necessitated an increase in the capital invested in the project. Thus the concept of capital invested in a project has been introduced. Since, in these cases, the borrowing method does not seem to be at issue, it appears that the small contractor could also recover interest on borrowings.

Imputed Interest as Element of Profit

When court and BCA decisions are studied, two distinct viewpoints about imputed-interest compensations have emerged. The first viewpoint is that imputed interest is an element of profit, and, as such, the contractor is entitled to fair compensation for the increased investment due to changes in scope of the work. This is not necessarily a dollar-for-dollar recovery. Typically, BCA determines whether the profit associated with the additional work is in itself adequate to provide compensation for the contractor's investment. If so, no additional profit in the form of imputed interest will be allowed.

The 1976 decision in the New York Shipbuilding case marked the first time that imputed-interest damages had been awarded. The element-of-profit concept was established, and the damages were computed by using traditional interest formulas that take into account the principle, type and rate of interest, and the time. A year later, more definitive guidelines were set forth that are a function of progress payments. In the Fischbach and Moore International Corporation dispute, BCA awarded damages as an element of profit. The following considerations were applied: (a) normal progress payments and profit levels in the industry, (b) progress payments actually made on the particular contract, and (c) the amount of profit applied to the changed work.

The question of imputed interest should be placed in proper perspective, because in the 1977 Court of Claims case Framlau versus United States, an element of uncertainty was introduced. It should be recalled that the principal issues in this case were interest on funds borrowed from an external lending institution and the legality of DAR 15. Although recovery of damages was denied, the court stated that it is appropriate to apply different treatment to the recovery of interest on borrowings and imputed interest, because the contractor's cost of borrowing capital is clearly determinable, whereas the value to the contractor for the use of capital equity is not. This viewpoint would tend to make the recovery of imputed interest somewhat doubtful. However, in awarding imputed-interest damages to Fischbach and Moore International Corporation, BCA interpreted the Court of Claims decision as having considered only the question of interest and not profit for the use of capital. No subsequent cases regarding imputed interest have reached the Court of Claims, and whether or not the BCA interpretation would be adopted is quite uncertain.

Imputed Interest as a Cost of Performance

The second viewpoint about imputed interest is that it represents a cost of performance. Therefore, the contractor should be entitled to full recovery of imputed interest plus normal profit should the damage be the result of a change. Although no case history involving the construction industry is available, precedent seems to exist for treating imputed interest as a cost of performance. Cost

Accounting Standard 417 (CAS 417) (Cost of Money as an Element of Capital Assets under Construction), dated December 15, 1980 (45 Fed. Reg. 48573), treats imputed interest as a cost. Also, in certain transactions, the Internal Revenue Code recognizes imputed interest as a cost that can be treated as an expense to a borrower and as an income to a lender. Thus, for tax purposes, imputed-interest charges are sometimes considered a cost of performance. This rule is applicable when loans or extensions of credit are made with no stated interest rate or when the interest is at less than the prevailing rate [IRC 482, Internal Revenue Regulation 1.482-2(a); Aristar, Inc., versus United States, 553 F. 2d 644 (1979); Kahler Corporation versus Commissioner of Internal Revenue, 486 F. 2d 1 (1973)]. Similarly, imputed interest is recognized by the IRS when property is sold or exchanged for deferred payments, and no interest, or an inadequate rate of interest, is quoted [Jeffers versus United States, 556 F. 2d 986 (1977)].

CAS 417

The latest supplement to CAS 417, effective December 15, 1980, sets forth guidelines for computing imputed-interest damages. All contracts to which DAR 15, Cost Principles, is applicable provide for the recovery of imputed interest. This standard is intended to provide a consistent approach in determining imputed-interest damages resulting from construction delays. Damage computations are based on the capital assets that are committed to the project. CAS 417 is applicable to both borrowing from external lending institutions and internal or intra-corporate borrowing situations. Thus, the regulations can be applied to any size contractor with equal fairness. Originally, the Cost Accounting Standards Board required that the contract be at least one year in length. This was based on the philosophy that the administrative costs of the contractor on short-term projects would typically be higher than the imputed-interest damage claim that could be recovered. This restriction has recently been removed since it is now apparent that imputed interest can be quite significant on projects lasting less than one year.

The CAS 417 details two alternative procedures for computing imputed-interest damages. The first method applies to those situations where the cumulative receipts or progress payments are approximated by an S-shaped curve. This situation is, of course, typical of the construction industry. The amount of an award is a function of the average of the cumulative monthly expenses of the contractor. The second method is used when the cumulative receipts or progress payments are approximated by a straight line. The damage amount is a function of the average of the cumulative expenses of the beginning and the end of the accounting period.

To illustrate the computational procedure of CAS 417, an example will be presented. The project to which the calculations are applied is the construction of the Navigation Systems Facility at the Naval Air Development Center, Warminster, Pennsylvania. The construction contract was awarded to G & C Enterprises, Inc., Bordentown, New Jersey, for \$2 380 750.

A hypothetical schedule of receipts and expenditures was developed based on the actual construction schedule of the contractor. It is worthwhile to note that the critical-path method (CPM) of scheduling is very useful in documenting project receipts and expenditures. In this example, an early-start schedule was assumed. In developing the summary of planned project expenditures and receipts given in

Table 1. Planned project billings and receipts.

Date	Monthly Expenses (\$)	Monthly Billings and Profit (\$)	Monthly Receipts Less Retainage (\$)
1979			
June	275 000	294 250	264 825
July	75 000	80 250	72 225
August	180 000	192 600	173 340
September	225 000	240 750	216 675
October	165 000	176 550	158 895
November	225 000	240 750	216 675
December	180 000	192 600	173 360
1980			
January	170 000	181 900	163 690
February	255 000	272 850	245 565
March	170 000	181 900	163 710
April	125 000	133 750	120 375
May	80 000	85 600	77 040
June	40 000	42 800	38 520
July	35 000	37 450	33 705
August	25 000	26 750	24 075
September	-	-	238 075
Total	2 225 000	2 330 750	2 380 750

Table 2. Revised billings and receipts after three-month delay.

Date	Monthly Expenses (\$)	Monthly Billings and Profit (\$)	Monthly Receipts Less Retainage (\$)
1979			
June	275 000	294 250	264 825
July	75 000	80 250	72 225
August	180 000	192 600	173 340
September	225 000	240 750	216 675
October	165 000	176 550	158 895
November	225 000	240 750	216 675
December	180 000	192 600	173 360
1980			
January	170 000	181 900	163 690
February	15 455	-	-
March	15 455	-	-
April	15 455	-	-
May	255 000	272 850	245 565
June	170 000	181 900	163 710
July	125 000	133 750	120 375
August	80 000	85 600	77 040
September	40 000	42 800	38 520
October	35 000	37 450	33 705
November	25 000	26 750	24 075
December	-	-	238 075
Total	2 271 365	2 380 750	2 380 750

Table 1, the following assumptions were made:

1. The overhead and profit are 10 and 7 percent, respectively.
2. Billings are based on the consumption of resources rather than probable pay items.
3. Receipts are actual billings less 10 percent retainage, which is recovered at the time of final acceptance.
4. Billings are made as of the last day of each month; payments are not received until the 15th of the following month.

The following hypothetical situation is presented to demonstrate the effect of a delay on the interest damages due the contractor. Assume that a conflict arises over underground utility work that is in progress in the immediate vicinity of the project. The contracting officer issues a stop-work order effective February 1, 1980. The contractor is not allowed to resume work until May 1, 1980. In computing the revised schedule of expenses, the following assumptions are made:

1. Overhead costs continue during the delay.

2. Extra compensation for overhead is included in a separate damage claim.
3. After the delay, work resumes as previously planned.

The revised billings are summarized in Table 2.

In this example, it is assumed that the cash flow of the contractor is approximated by an S-shaped curve, and imputed interest is calculated for accounting periods that coincide with a calendar year. The cumulative expenses for the seven months in 1979 are as follows:

Month	Expenses (\$000s)
June	275
July	350
August	530
September	755
October	920
November	1145
December	1325
Total	5300

$$\text{Avg} = \$5\,300\,000 \div 7 = \$757\,143.$$

The imputed interest for 1979 is determined by multiplying the seven-month average by the interest rate established by the Secretary of the Treasury. The interest rate (assume 8.6 percent) must be prorated for the number of months (7/12) during the year in which billings were made. Thus,

$$1979 \text{ imputed interest} = \$757\,143 \times 7/12 \times 0.086 = \$37\,983.$$

For the 1980 accounting period, assume that the interest rate quoted by the Secretary of the Treasury is 7.75 percent. The imputed interest for the second accounting period can be determined as shown below:

Month	Expenses (\$000s)
January	1 495
February	1 750
March	1 920
April	2 045
May	2 125
June	2 165
July	2 200
August	2 225
Total	15 925

$$\text{Avg} = \$15\,925\,000 \div 8 = \$1\,990\,625.$$

Next, the imputed interest for 1979 is added to the end-of-month average balance for 1980. This is used to compute the 1980 imputed interest as follows:

$$1980 \text{ imputed interest} = (\$1\,990\,625 + \$37\,983) \times 8/12 \times 0.0775 = \$104\,811.$$

The total imputed interest for the project as originally scheduled is as follows:

$$\text{Total original project imputed interest} = \$37\,983 + \$104\,811 = \$142\,794.$$

Similar calculations are made for the disrupted schedule. Since the delay occurred entirely in the second accounting period, only the 1980 imputed interest will be affected. The revised imputed interest for 1980 is as follows:

Month	Expenses (\$000s)
January	1 495
February (delay)	1 495 (no additional costs)

<u>Month</u>	<u>Expenses (\$000s)</u>
March (delay)	1 495 (no additional costs)
April (delay)	1 495
May	1 750
June	1 920
July	2 045
August	2 125
September	2 165
October	2 200
November	2 225
Total	20 410

Avg = \$20 410 000 ÷ 11 = \$1 855 454.

1980 imputed interest (with delay) = (\$1 855 454 + \$37 983) × 11/12 × 0.0775 = \$134 513.

Delayed project imputed interest = \$37 983 + \$134 513 = \$172 496.

The imputed-interest damage is the difference between the imputed interest determined for the original and that for the disrupted billing schedules:

Imputed-interest damage = \$172 496 - \$142 794 = \$29 702.

The additional costs associated with the overhead expenses that continued during the delay are not included in the \$29 702. These damages must be claimed separately.

CONCLUSIONS

As a result of the research of BCA and court cases related to interest damages, several conclusions can be drawn. These are summarized as follows:

1. Recent case histories in both the federal and the private sectors of the construction industry reveal a distinct trend toward awarding interest damages for the additional capital invested in a project by a contractor.

2. Interest on funds borrowed from an external lending institution have been recovered in certain circumstances where the need for the additional borrowings could be traced to an owner-caused delay. However, in the federal construction contracts, regulations exist that prohibit the recovery of interest on borrowed funds. The legality of these regulations has been challenged and upheld.

3. Imputed interest on funds borrowed from a contractor's in-house contingency fund has been awarded on at least three occasions since 1976. As of December 15, 1980, federal regulations permit the recovery of interest damages on capital invested in construction regardless of the source of the additional required capital. These regulations would appear to establish precedence for recovering imputed interest in the private sector of the construction industry.

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