BEFORE THE
MARYLAND STATE BOARD OF CONTRACT APPEALS

Appeal of TRAYLOR BROTHERS AND ASSOCIATES	)	
	)	Docket No. MDOT 1028
Under MTA Contract No. NW-02-05	)	

November 1, 1984

Burden of Proof - Where a contractor failed to establish that its design costs were increased as a result of a contract change deleting a support of excavation requirement, it was not permitted to recover the costs actually incurred in preparing certain drawings relating to the support plan. Put another way, the contractor failed to demonstrate that the design costs incurred were increased beyond what it reasonably should have bid for this aspect of its work.

Scheduling - Although shop drawings relating to the reolocation of utilities contractually were required to be submitted at least 60 days prior to the commencement of operations, a CPM schedule allowing for less than the specified approval period necessarily was not unreasonable. The approval of drawings is an administrative function which can be accelerated to meet a given situation. Accordingly, the 60 day period was waivable by the MTA. Here the MTA's actions both at the time the schedule was submitted and continuing to the hearing demonstrated its concurrence in the accelerated schedule. Evidence likewise was not submitted to establish that the approval procedures required by the local utility company necessitated a longer review period than was provided for in Appellant's schedule. Under these facts, the MTA thus impliedly waived the 60 day requirement, and the CPM schedule, therefore, was deemed reasonable.

Scheduling - A contractor's CPM schedule showing the completion of certain work prior to the onset of cold weather was determined to be reasonable. A finding of reasonableness did not turn solely on the schedule approval given by the MTA upon its review, but also upon an analysis of the schedule's logic and durations.

Loss of Efficiency - Although the contractor here was not required to perform work over an additional winter period, its costs nevertheless were increased due to efficiency losses stemming from an MTA change and constructive suspension of work.

Loss of Efficiency - The contractor had a burden to establish the fundamental facts of liability, causation, and resultant injury. By establishing that the MTA's actions caused its pile installation, decking and fabrication work to be performed in winter weather rather than in the fall, and further showing that this work was affected to a greater degree by cold weather than the winter work originally planned would have been, the contractor met its burden of proof.

Loss of Efficiency - When winter weather reduces the efficiency of a contractor's labor force and equipment, and this condition is brought about by an action of the State, a contractor is entitled to recover its additional costs as part of an equitable adjustment.

Equitable Adjustment - A contractor need not prove his increased costs with absolute certainty or mathematical exactitude, but it must furnish a reasonable basis for computation, even though the result is only approximate.

Equitable Adjustment - Loss of productivity always cannot be proven by books and records. Normally, it must be proven by the opinion of experts. Here the testimony of experts was sufficiently credible to permit a reasonable approximation of lost efficiency.

Equitable Adjustment - A contractor's loss of efficiency computation was adjusted to delete delay factors not attributable to the cold weather and which ordinarily would not be encountered in work of the type being performed.

Delay - Delay to the contractor's work ended on the date its shop drawings were approved finally. The earlier return of the shop drawings marked "approved as noted, resubmission required" contractually did not authorize the contractor to commence operations and, accordingly, work was not begun.

Extended Overhead - The contractor was permitted to recover extended overhead for the delay to job completion resulting from the loss of efficiency encountered during winter weather.

Extended Overhead - Where the evidence established that the contractor would have completed its work earlier than shown on its approved CPM schedule, extended overhead properly was measurable from this earlier date.

Labor Escalation - Where the contractor's work was delayed beyond the date of a new wage rate agreement, the increased labor costs resulting from this agreement were recoverable as part of an equitable adjustment.

Standby Costs - Additional holidays and weather days incurred as a result of a change and resulting in standby costs to the contractor properly were to be taken into account as part of an equitable adjustment.

Counterclaims - Affirmative claims may not be raised by the State in pleadings before the MSBCA unless they initially were addressed in the agency final decision. This is true regardless of whether the State seeks an affirmative recovery or otherwise raises the matters in the form of a defense such as recoupment.

Recoupment - Even if the counterclaim properly was before the Board, the MTA was not entitled to recover payments which it contended were made erroneously by contract modification since it did not establish that the MTA Administrator acted outside the scope of his authority in executing the modifications. The evidence submitted by the MTA showed that the modifications simply were bad bargains for the MTA. However, there is a

distinction between the MTA Administrator's authority to act and the judgment displayed by him in performing the act. Bad judgment does not void a modification.

Interest - Predecision and post decision interest were recoverable as part of the contractor's equitable adjustment.

APPEARANCES FOR APPELLANT:

Laurence Schor, Esq.
Richard C. Walters, Esq.
Schnader, Harrison,
Segal & Lewis
Washington, D.C.

APPEARANCES FOR RESPONDENT:

Brian Cohen
Steven G. Hildenbrand
Assistant Attorneys General
Baltimore, Maryland

OPINION BY CHAIRMAN BAKER

This appeal is taken from a decision of the Maryland Mass Transit Administrator dated December 17, 1980 directing that a unilateral contract modification in the amount of $33,909 be processed for payment. This amount was determined by the Administrator to represent the reasonable additional costs incurred by Appellant's subcontractor as a result of the MTA's untimely approval of shop drawings relating to the support of a construction shaft. Appellant refused to sign this modification and here seeks an additional $65,794.33[1] in costs stemming both from its futile attempt to meet defective contract specification requirements and the impact of the MTA's late shop drawing approval on its contract work. The MTA contends that Appellant is not entitled to the full amount claimed and further that it is entitled to a credit of $49,909[2] against any amount found due. The credit represents alleged erroneous payments previously made to Appellant under the contract. The issue of quantum is all that is before the Board.

I. Findings of Fact

A. Introductory

Appellant received a notice to proceed with the captioned contract effective August 25, 1977. Contract work was to include the construction of two circular earth tunnels connecting the Lexington Market and Charles Center Stations on the Baltimore subway system. The station structures were to be constructed by other contractors under separate MTA contracts.

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[1]In its complaint, Appellant originally requested an additional $126,779.17. This request was reduced by Appellant during the litigation process in response to the MTA's audit of labor and equipment rates.

[2]This amount includes $33,909 paid under change order no. 18 and $16,000 in extended overhead costs paid under change order no. 12.

An integral part of the contract work was the construction of an 80 foot long by 60 foot wide shaft extending some 70 feet below the surface. This shaft was essential to permit Appellant to lower its men and equipment to the elevation where the driving of the two tunnels was to begin. Delay to the construction of this shaft furnishes the basis upon which Appellant seeks an equitable adjustment.

On September 12, 1977, Appellant executed a subcontract with the joint venture of Jones & Artis/Bucher (JAB) for the design and construction of the shaft. JAB is the real party in interest here and Appellant has consented to pass the claim of its subcontractor onto the MTA for resolution under the prime contract.

B. Contract Requirements Pertaining to Construction Shaft

Appellant contractually was required to design the construction shaft excavation support system. This design, however, was to incorporate and satisfy certain MTA specified criteria. The design criterion most pertinent to this dispute was stated in the contract as follows:

> Design the construction shaft excavation support system to permit the complete removal by the station structure contractor of the north wall of the support system at the interface with the Lexington Market Station.

Contract Special Provision Section 02410, ¶1.02 A.(1); see also contract drawing sheet no. S-61, note 8 (sheet no. 84).

The contract further required Appellant to submit shop and working drawings detailing its intended method of performing the construction shaft work.[3] These drawings were to be submitted " . . . sufficiently in advance of construction requirements to permit no less than 21 calendar days for review and appropriate action by the Engineer."[4] If submitted shop drawings showed variations from contract requirements, these variations were to be described in the letter of transmittal.[5]

Where the contract specified, or it otherwise was necessary to maintain, support, protect, or relocate existing utilities, shop and working drawings submittals also were required. These drawings were to be submitted " . . . not less than 60 days prior to the intended date to commence operations. . . . "[6]

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[3]Standard Specification Section 01300, ¶1.03 A(4), August 1975.
[4]Standard Specification Section 01300, ¶1.03 B(3), August 1975.
[5]Standard Specification Section 01300, ¶1.03 B(5), August 1975.
[6]Contract Special Provision Section 02550, ¶1.02 A(1).

C. History of Shop Drawing Submittals For Construction Shaft

On September 15, 1977, Appellant submitted its shop drawings for the construction shaft. These drawings depicted an installation procedure for the augering and placement of 42 soldier piles, the decking[7] of the shaft construction area at Eutaw and Lexington Streets, and the support of the excavation to the necessary depth. Four days later, the MTA Resident Engineer wrote Appellant's Project Manager and requested an explanation for certain contract variations which the MTA recognized as existing on the shop drawings relative to shaft configuration. In this regard, the MTA Resident Engineer believed that contract drawing number S59-1 (sheet no. 82) set forth a mandatory configuration of the shaft. However, this drawing, entitled "Construction Shaft Excavation Limits," was construed by Appellant to represent only the minimum size of the shaft. Accordingly, by letter dated September 22, 1977, Appellant replied that its shop drawings were consistent with the requirements of the contract specifications.

In further response to the MTA Resident Engineer, Appellant indicated, by letters dated September 19, 1977 and September 22, 1977, that the west pile line of the shaft was made parallel to the west property line of N. Eutaw Street in order to permit sufficient work area for the mining operation and to allow proper compliance with the contract maintenance of traffic plan. Appellant also stated that a sanitary sewer line was to be rerouted in order to satisfy the proposed configuration. This rerouting of the sewer line was to be performed at no cost to the MTA. Appellant's plan nevertheless was rejected on September 27, 1977. (Tr. 528, Appeal file, Tab IV(4)).

The parties continued to discuss the need to enlarge the shaft access opening to the requested 14 feet by 25 feet. Several letters were exchanged and a subsequent meeting was conducted on October 5, 1977. Ultimately, as a result of this dialogue, the MTA decided to approve the change in shaft configuration including the realignment of the sewer line. (Tr. 532).

The foregoing, however, did not end the controversy over the shop drawings. During an October 19, 1977 meeting with Appellant and JAB, MTA engineers admitted concern over the feasibility of designing the shaft support system to assure stability of the construction shaft upon removal of the north shaft wall by the Lexington Market Station contractor. It was agreed by those present that a letter would be written by JAB suggesting to the Resident Engineer that the contract be modified to remove the support requirement from the captioned contract. (Appeal file, Tab IV(15)). This letter thereafter was written by JAB on October 21, 1977 and forwarded to the MTA Resident Engineer by Appellant on October 24, 1977. The requested deletion was approved on October 28, 1977 and Appellant's shop drawings later were returned on November 14, 1977 marked "approved as noted, resubmittal required." (Appeal file, Tab IV(18); Tr. 533; Board Exh. #1). The MTA Resident Engineer, Mr. Carmichael[8], testified that a resubmittal was

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[7]Decking consists of timber mats which cover the shaft opening and permit traffic to be maintained over the area being excavated.

[8]Mr. Horace H. Carmichael was the Resident Engineer on the captioned project when the shop drawings were submitted and for the period during which they were being reviewed by the MTA. (Tr. 522).

required in order to obtain a clean set of drawings for incorporation into the Lexington Market Station contract. (Tr. 534-35). Pursuant to the foregoing contract change, the future Lexington Market Station contractor was to be made responsible for the stabilization of the shaft when it removed the earth supporting the north shaft wall. The resubmitted construction shaft shop drawings finally were approved on November 22, 1977. (Board Exh. #1).

D. Submission and Resolution of Claim

By letter dated October 3, 1977, Appellant notified the MTA Resident Engineer that the delay in approving its construction shaft shop drawings constituted both a suspension of work and a change to the contract. The Resident Engineer immediately sent written acknowledgement of this letter, but denied that a suspension of work had occurred.

By letter dated December 6, 1977, Appellant again wrote the MTA Resident Engineer alleging a delay of 48 calendar days due to the " . . . late review of our construction shaft drawings." (Appeal file, Tab IV(19)). This claim was denied by the Resident Engineer[9] on April 26, 1978. In late August 1978, Appellant submitted additional information relating to its claim and requested further consideration. Again, however, the MTA Resident Engineer denied the claim.[10]

Appellant next requested administrative consideration of its claim by the MTA Construction Manager. (Appeal file, Tab IV(27)). The claim again was rejected. (Appeal file, Tab IV(28)). Upon submittal of the claim finally to the MTA Administrator, however, entitlement was recognized and, on June 5, 1979, the MTA Administrator advised Appellant that he had requested his Construction Manager to attempt to negotiate a mutually satisfactory settlement of the claim. (Appeal file, Tab IV(31)).

Settlement negotiations began in August 1979 and terminated without success one month later. On April 9, 1980, a unilateral modification (change order 18) in the amount of $33,909 was issued by the MTA Administrator. (Appeal File, Tab II). This unilateral modification was affirmed by final decision of the MTA Administrator on December 17, 1980 and a timely appeal was taken therefrom.

E. Appellant's As-Planned Schedule For Construction of the Shaft

Contract General Provision GP-8.04 and Special Provision Section 01300, paragraph 1.02 required Appellant to submit a progress schedule showing the proposed order of work and indicating the time required for completion of the work. This progress schedule was to be in the form of an activity oriented detailed network diagram, commonly referred to as a critical path method analysis (CPM). The CPM submittal was to include a computer produced diagnostic report, a manpower requirement forecast, and a

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[9]The Acting MTA Resident Engineer at this time was Kenneth A. MacDonald. (Appeal file, Tab IV(23)).

[10]Here the Acting Resident Engineer was Stephen W. Kagay. (Appeal file, Tab IV(26)).

cash flow projection. The project schedule contractually was subject to MTA review and approval and was to be updated monthly to reflect actual progress.

Within 15 days after the effective date of the notice to proceed, the contract required that a preliminary progress schedule be submitted to the MTA Resident Engineer.[11] This preliminary schedule was to depict the first 90 days of work and the general approach thereafter. The initial CPM was not due until 45 days after the effective date of notice to proceed.[12]

Consistent with the foregoing, Appellant's Project Engineer and an outside consultant prepared and submitted a preliminary schedule[13] dated September 7, 1977 (Exh. 2). At the time this schedule was prepared, Appellant had not retained all of its subcontractors and was in the process of mobilizing its field office. (Tr. 21). JAB, although under subcontract to Appellant, was not consulted concerning the preliminary scheduling of the construction shaft work. (Tr. 80).

Appellant's preliminary schedule showed the construction shaft work being preceded by utility relocation work and the construction of steam and sanitary lines. The augering of soldier pile holes, the first step in the construction shaft work, was not scheduled to begin until November 18, 1977. Augering and placement of soldier piles thereafter was to continue through approximately December 18, 1977. Initial excavation, first level bracing, and decking installation was to be performed from December 18, 1977 until January 13, 1978. Excavation beneath the decking to the shaft bottom was to occur continuously thereafter through the end of April 1978.

JAB's Mr. Edward Bucher ultimately met with Appellant's representatives towards the end of September 1977 to discuss the scheduling of the construction shaft work. (Tr. 80). Mr. Bucher took with him a sketch, prepared in late August or early September 1977, showing the activities involved in the shaft construction, their order of performance, and the number of work days required for each. (Exh. 4; Tr. 82). Anticipated dates of performance thereafter were affixed to the activities shown on the sketch and were submitted to Appellant around the beginning of October 1977. (Exh. 6).

Appellant's first detailed CPM and computer generated network analysis was completed on October 31, 1977. (Tr. 51-54; Exh. A). This CPM incorporated JAB's proposed plan of performance, although it extended the durations of a number of activities. The critical elements of Appellant's schedule versus JAB's schedule are compared below:

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[11]Contract Special Provision Section 01300, paragraph 1.02 B(1).
[12]The effective date of the notice to proceed was August 25, 1977. (Board Exh. #1). Hence the preliminary schedule was due around September 9, 1977 and the initial CPM was due around October 9, 1977.
[13]The parties call this the first CPM. However, it was submitted at the time the preliminary schedule was due and the record does not indicate that it was accompanied by a computer generated network analysis.

Activity		Appellant's CPM Begin	Appellant's CPM End	JAB's Schedule[14] Begin	JAB's Schedule[14] End
1.	Prepare shop drawings-construction shaft	25 Aug. 77	16 Sep. 77	25 Aug. 77	15 Sep. 77
2.	Submittal/approval of shop drawings	16 Sep. 77	7 Oct. 77	15 Sep. 77	6 Oct. 77
3.	Place west side soldier piles	7 Oct. 77	25 Oct. 77	6 Oct. 77	20 Oct. 77
4.	Place east side soldier piles	25 Oct. 77	10 Nov. 77	20 Oct. 77	3 Nov. 77
5.	Level 1 bracing and decking-east side	10 Nov. 77	25 Nov. 77	3 Nov. 77	28 Nov. 77
6.	Level 1 bracing and decking-west side	25 Nov. 77	9 Dec. 77	28 Nov. 77	2 Dec. 77
7.	Excavate and support to elev. 70	9 Dec. 77	5 Jan. 78	2 Dec. 77	23 Dec. 77
8.	Excavate and support to elev. 60	5 Jan. 78	27 Jan. 78	23 Dec. 77	17 Jan. 78
9.	Excavate and support to elev. 50	27 Jan. 78	22 Feb. 78	17 Jan. 78	7 Feb. 78
10.	Excavate and support to elev. 40	22 Feb. 78	16 Mar. 78	7 Feb. 78	28 Feb. 78
11.	Excavate and support to elev. 26	16 Mar. 78	13 Apr. 78	Not Shown	
12.	Excavate and support to temp. work slab	13 Apr. 78	11 May 78	Not Shown	

Despite the differences in certain durations, it is apparent from the foregoing comparison that shaft construction work was planned to commence 21 days after submittal of the shop drawings. Further, all decking and first level bracing work to be performed from the street surface was to be complete by early December 1977. This is contrasted with the preliminary schedule under which first level bracing and decking was not to be completed until January 13, 1978.

In further contrast to the preliminary schedule, Appellant's CPM called for the relocation of a 20" gas line and the construction of steam and sanitary lines simultaneous with the placement of soldier piles in the shaft area. The sanitary line construction was scheduled to be performed by JAB forces over a 20 work day period to commence in the time frame from October 7 to October 13, 1977. (Exh. A, activity 130-1110). It was anticipated that this latter work would be performed using a tunneling operation. (Appeal file, Tab IV(2)).

[14]These dates were obtained by converting work days to calendar days and extrapolating from the October 6, 1977 date shown on exhibit 6. Adjustments were made for the Thanksgiving, Christmas and New Years holidays.

At the time JAB prepared its schedule for submittal to Appellant, it had not decided whether to subcontract the soldier pile drilling operation or use its own forces. (Tr. 193-194). Ultimately, it elected to rent equipment and use its own personnel. When renting equipment of this type, JAB's Mr. Bucher testified that it normally requires two to three days to receive the equipment and six to seven days thereafter to assemble it. (Tr. 224-226). Further, JAB anticipated ordering the equipment seven to ten days after submission of the construction shaft shop drawings, provided that it had not received any adverse indications from the MTA as to the propriety of its design.

F. Appellant's As-Built Schedule

There were four prerequisites to the construction of the shaft. First, the soldier piles had to be ordered and delivered to the site. Second, these soldier piles had to be cut and spliced together to permit placement to the appropriate depth.[15] Third, "probe and prep"[16] work had to be completed. Fourth, all tools and equipment had to be mobilized. (Tr. 86).

The parties have stipulated that the soldier piles were delivered to Appellant's jobsite storage yard on September 1, 1977. JAB began splicing these piles on October 19, 1977 and completed this operation on November 10, 1977. (Tr. 231). Probe and prep work commenced on November 9, 1977. Since all of the foregoing work had to be complete prior to the inception of the augering operation, JAB began these operations before receiving final approval of its construction shaft shop drawings. (Tr. 89). Mr. Bucher testified, however, that he had waited until it appeared that all major problems with JAB's shop drawings had been resolved before proceeding with the work. (Tr. 89).

JAB received its approved shop drawings on the morning of November 23, 1977. On this day, it ordered delivery of the drilling equipment essential to its soldier pile operation. (Tr. 98). The drill rig, leased from The George Hyman Construction Co., arrived on the job two to three days later. (Tr. 226). Thereafter, it took approximately ten working days to assemble it. (Tr. 228). Appellant thus was prepared to begin its augering work on December 8, 1977.

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[15]The soldier piles were ordered in 60 foot lengths. Because the effective depth of the shaft was 80 feet, it was necessary to cut and weld pile lengths to form the necessary 80 foot sections. (Tr. 88, Exh. 8).

[16]"Probe and prep" work is performed at each pile location and involves the excavation of approximately four to five feet of earth to make certain that the area is free of utilities, rubble and other obstructions. (Tr. 86).

Augering operations actually began during the night shift on December 8, 1977. (Exh. F).[17] Almost immediately, however, the rented drill rig broke down as a result of a transmission problem. Repairs could not be made at the jobsite. (Tr. 100-101). On December 14, 1977, JAB was notified by its off-site mechanic that repairs would take another week. Accordingly, a replacement drill rig was rented from Western Caissons. This latter rig was truck mounted and did not require assembly. Augering operations, therefore, were able to resume on the night shift of December 15, 1977. (Tr. 101-102).

During the preceding period of equipment breakdown, JAB continued fabricating steel members for eventual use during the support of excavation work. (Tr. 99). These steel members had arrived at the job site on October 29, 1977 and were being welded in an outdoor work area. This operation had begun on November 11, 1977 and continued until March 16, 1978. (Tr. 231-32).

JAB completed installation[18] of 42 construction shaft soldier piles, 20 sanitary soldier piles[19] and two caissons for sanitary manholes by February 21, 1978. Pile cap and decking operations were completed by March 15, 1978. (Tr. 108). Excavation and support work down to the level of the temporary work slab thereafter proceeded to final completion on July 13, 1978. (Tr. 108).

G. Description of Operations Involved In Shaft Construction

1. Augering of Holes and Setting of Soldier Piles

In order to support the vertical earth walls of the construction shaft, it initially was necessary to place steel soldier piles around the perimeter of the shaft opening. These piles were to be placed in holes excavated by

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[17]Mr. Bucher testified that the rig broke down on the night shift of December 9, 1977. (Tr. 98). However, the MTA's review of the daily inspection reports indicates that the breakdown occurred on December 8, 1977. The MTA's position is corroborated by Appellant's exhibit 14, page 4 which shows that no work was even attempted on the night shift of December 9, 1977 due to existing equipment problems.

[18]After a hole is drilled to the required depth, structural concrete is placed in the bottom of the hole to anchor the soldier pile tip. The soldier pile is inserted into the hole and is held vertical by a collar until the concrete hardens. Lean mix concrete is then poured into the remainder of the hole engulfing the soldier pile.

[19]The sanitary sewer line, although originally to be installed by tunneling, was constructed by an open cut excavation method. The piles were necessary to support the sides of the excavation. (Tr. 60-61).

rotary drilling. The rotary drilling operation involved a drill rig, a service crane and various personnel. Both the equipment and personnel all were to be located on the street (surface) level and were to be exposed to whatever weather conditions prevailed.

The work began by locating the pile positions called for in the approved shop drawings. Appellant's field personnel marked these locations by driving a peg into the ground. The drill rig then was successively brought to each of these locations and setup. This latter procedure involved the placement of hydraulically operated "outriggers" (truck supports) to stabilize the drill rig and level it. (Tr. 324). Where stabilization and leveling were difficult to achieve due to uneven and frozen ground conditions, a front end loader was used to flatten the ground beneath the outriggers. If necessary, timber mats were placed beneath the outriggers to further assure stability. (Tr. 325).

Upon completion of the setup procedures, it next was necessary to raise the 70 ton boom to a vertical position. This boom contained a telescoping square pipe (kelly bar) running through a device known as a rotary table. The kelly bar was attached at its bottom end to a cutting tool (auger). This attachment involved the insertion of the square end of the inside kelly bar into a slightly larger square box (auger box) located at the top of the auger. The fit was very tight and necessitated the removal of any excavation debris from the auger box prior to insertion of the kelly bar. These parts were secured together with a pin.

In drilling a hole, the rotary table would turn the kelly bar while allowing it to move vertically downward into the excavation. The telescoping nature of the kelly bar permitted it to extend the auger to a considerable depth.

Temporary casing[20] was utilized in the drilling operation to prevent the augered holes from collapsing. The initial casing installation was installed to a depth of 15 feet with an outside diameter of 48 inches. In order to accomplish this, a 48 inch auger had to be used in the drilling operation. Thereafter, an inner casing having a 42 inch outside diameter was driven down approximately 55 feet below the bottom of the initial casing. This necessitated one tool to turn the 55 feet of casing into the earth and another to fit within the 42 inch casing to remove the earth and muck. (Tr. 327, 396).

Each time the auger tool was changed, the kelly bar had to be raised out of the hole. As this was done, moisture and debris which had accumulated thereon had a tendency to flow downward to the kelly box. The kelly box thus had to be cleaned thoroughly in order to remove this debris and permit later reattachment of the kelly bar. (Tr. 326). Similarly, moisture and debris also had to be cleaned from the inner kelly bar in order to prevent sticking. (Tr. 296).

The augering operation involved a drill rig operator, an oiler and two laborers. The laborers were needed to clean earth spills from around the hole and to clean the inside kelly bar and kelly box. (Tr. 280). The laborers also were responsible for pouring 4000 p.s.i. concrete into the bottom ten feet of

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[20]The casing used here was cylindrical. (Tr. 327).

each hole to anchor the soldier pile vertically. Further, as the temporary casing was being removed, these laborers were to fill the hole with a lean concrete mix to maintain the circumference of the hole. (Tr. 369, 396). Where needed, a front end loader and operator and an air compressor and operator were provided to assist the laborers. (Tr. 279-80).

A service crane was to be used to insert the steel soldier piles into the augered holes. This operation involved a crane operator, oiler and a pile driving crew.[21] (Tr. 280-81). The pile drivers were responsible for setting the pile in the freshly poured concrete base, plumbing it, and tieing it off until the structural concrete hardened. The pile drivers also were used to make welding repairs to the drilling equipment and remove the temporary casing. (Tr. 281).

2. Decking, Excavation and Support of Construction Shaft

After installation of the soldier piles was completed, minor excavation had to be performed to expose the top of each pile. The pile tops then were to be cut to the grade required to receive the decking members which eventually would be supported thereby. (Tr. 108). These members included pile caps, cap beams, deck beams and timber mats.[22]

In order to accomplish the foregoing, it was necessary to close half of North Eutaw Street to traffic during the day and all of it at night. The procedure utilized also required JAB to cut the existing street surface and excavate 10 to 15 feet of earth so that adequate work space would exist beneath the completed decking. (Tr. 108). An initial level of excavation bracing also was to be installed at this time. Like the pile driving operation, this work was fully exposed to whatever weather conditions prevailed. (Tr. 109).

After completion of the decking, equipment was to be lowered into the excavation and work was to proceed under cover. (Tr. 109). Five additional levels of bracing thereafter had to be installed at excavation intervals spaced from 11 to 13 feet vertically. JAB took approximately five days to perform the excavation for each level of support and ten days to install the steel support bracing. (Tr. 107). Fabrication of the bracing members was performed on the surface and substantially was to be complete prior to the excavation process in order to permit an orderly operation. In this regard, JAB anticipated a continuous operation wherein the same personnel who fabricated the bracing members prior to the commencement of excavation would install those members as the excavation proceeded. (Tr. 107). Only some miscellaneous fabrication was planned once the excavation work commenced. (Tr. 110). This miscellaneous fabrication work was to be performed during the five day periods when excavation between bracing levels was taking place.

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[21] A pile driving crew here consisted of a foreman and four pile drivers.

[22] Pile caps are welded to the top of each soldier pile. Cap beams are placed on top of the pile caps running parallel to the sides of the excavation. Deck beams rest on the cap beams and are placed across the excavation. Timber mats finally are placed atop the deck beams to provide a riding surface for automobiles during construction. (Tr. 108-109).

H. Change Order 12

Change order 12 was entered into by the parties in September 1979, in part, to compensate Appellant for those costs incurred as a result of a design change requiring relocation of a 16 inch steam line. This design change resulted in modifications to JAB's scheduling, pile installation, decking installation and support of excavation system. After negotiations, the parties agreed that JAB had incurred additional costs totalling $94,197. Of this total, $16,000 was for extended overhead costs incurred as a result of a 24 work day delay. The change order amount was offset by an $11,930 credit due the MTA for the elimination of the requirement to design the construction shaft support so as to permit removal of the north shaft wall by the Lexington Market Station contractor. The net adjustment to the contract under this change order, therefore, was an increase of $82,267.00.

II. Decision

Appellant seeks to recover the following costs allegedly incurred by JAB as a result of the MTA's defective shaft design:

1.	Direct costs of preparing shop drawings	$ 4,972.00
2.	Loss of efficiency	65,610.89
3.	Escalation	1,688.44
4.	Extended overhead	27,432.00
	Subtotal	$99,703.33
5.	Less funds received under unilateral change order 18	(33,909.00)
	Total	$65,794.33

The MTA, while originally contending that it fully compensated Appellant by issuance of unilateral change order 18, amended its answer to contend that it paid too much, both under this modification and under change order 12, and is entitled to a refund. The amount of the refund is said to be either $33,624, $33,799 or $19,843 depending alternately upon whether JAB suffered a loss of efficiency and how that loss is to be calculated. The various cost elements claimed by Appellant and the legal propriety of the MTA's refund claim shall be discussed hereafter seriatim.

A. Direct Costs

In attempting to comply with the original contract requirement to design the construction shaft to permit the subsequent safe removal of its north wall, JAB's Project Manager and Engineer developed shop drawings which detailed the use of vertical footings. The salary cost associated with this work was $4,972 which JAB charged to an overhead account. Given the agreed impracticability of the foregoing contract requirement and its eventual deletion from the contract, JAB seeks to recover this salary expense as a direct cost of the contract change. The MTA denies responsibility for such

costs on the basis that Appellant already has recovered all overhead chargeable to the contract through receipt of the original contract amount plus payments for extended overhead as made under change orders 18 and 12.

JAB correctly states that an equitable adjustment, under a defective specifications claim, properly should include the costs incurred in attempting to perform in accordance with the defective specifications and drawings. J. W. Hurst & Son Awnings, Inc., 59-1 BCA ¶2095 at p. 8965; Hol-Gar Manufacturing Corp. v. United States, 175 Ct.Cl. 518, 524 (1966). Further, where it is practicable or feasible, it always is more desirable to reimburse a contracting party for its incurred indirect costs exactly in the same manner as for direct costs. Kemmons-Wilson, Inc. (Florida) and South & Patton, Inc., A Joint Venture, ASBCA No. 16167, 72-2 BCA ¶9689 at p. 45, 254; Granite Construction Co., MDOT 1014, Dec. 20, 1983, p. 55. This premise notwithstanding, JAB's claim for the cost of preparing shop drawings must fail.

Appellant's claim is governed by contract General Provision "GP-4.05 Changes" which provides, in pertinent part, as follows:

> D. If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this Contract, whether or not changed by any order, an equitable adjustment shall be made and the Contract modified in writing accordingly.

Here JAB and Appellant contractually obligated themselves to design and build a construction shaft capable of remaining stable when the north shaft wall eventually was removed. In this regard, it was necessary to include a reasonable sum in the bid for the design and construction of vertical footings and related bracing necessary to absorb unbalanced south wall loads. JAB has failed to demonstrate that the $4,972 it actually incurred in design costs was in excess of what it reasonably bid for this purpose. For this reason, there is no factual basis which would permit us to find that JAB's cost of performance was increased.[23]

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[23]Although neither party has discussed the effect of change order number 12 on this aspect of the claim, it may very well have constituted an accord and satisfaction as to the claimed costs. Change order 12 was a bilateral modification which, in part, was intended to recognize the deletion of the two vertical footings and additional bracing required to assure stability when the north shaft wall was removed. The record of negotiations for this change order reflects that JAB would have incurred an agreed $14,730 in construction costs related to the vertical footings and additional bracing. The record of negotiations further shows that JAB had incurred $2,800 in design costs pertaining to this work. The $2,800 amount was then set-off against the $14,730 resulting in an MTA credit of $11,930. In other words, it appears that JAB was paid for its vertical footing design costs under the terms of the contract.

B. Loss of Efficiency

Appellant's loss of efficiency claim relates only to that portion of its work which was performed at surface level and without cover. This work consisted of the augering and setting of piles, the initial ten feet of shaft excavation, and the installation of decking. The remainder of the shaft construction was performed beneath the timber decking which covered the shaft and allegedly was not affected by cold weather. Appellant maintains that it had planned to have all of its surface level work completed prior to the onset of cold weather. The MTA's untimely approval of JAB's shop drawings is said to have resulted in delays to this as-planned schedule with the corresponding result that the surface level work relating to the construction shaft had to be performed at a later time. This, we are told, resulted in additional costs resulting from reduced labor and equipment efficiency.

The MTA initially contends that it has no liability for any loss of efficiency suffered by JAB because the preliminary work schedule prepared by Appellant in September 1977 showed that the surface work relating to the shaft was not to commence until November 18, 1977. Since Appellant's shop drawings were returned "Approved as Noted" on November 14, 1977, it is contended that there was no delay to JAB's operations as a result of the design change and thus no cold weather impact on the efficiency of its laborers and equipment.

First, we must determine what the reasonable as-planned schedule was for the construction of the shaft. In this regard, we shall focus solely on the schedules prepared and submitted by Appellant since it, and not JAB, had the contractual responsibility to plan the work.

Appellant submitted two as-planned schedules as required by the contract. One was a preliminary schedule and the other was the initial CPM. The former showed soldier pile work commencing on November 18, 1977 (Exh. 2, node 1100) and the latter indicated an October 7, 1977 start date (Exhs. 3, A, node 1104). This resequencing of the work resulted from Appellant's realization that certain utility work did not have to be complete in its entirety before pile installation could begin.[24] If this conclusion was reasonable, modification of Appellant's original plan is permissible. Compare Erickhof Construction Co., ASBCA No. 20049, 77-1 BCA ¶12,398.

Although the MTA approved Appellant's first CPM, its Resident Engineer, Mr. Carmichael, testified at the hearing that the CPM nevertheless unreasonably made the performance of the sanitary sewer relocation concurrent with the drilling and placement of soldier piles. (Tr. 524).

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[24]Exhibit 2 shows utilities such as the steam line, electrical lines, gas line, water lines, sanitary lines and storm drains all being relocated from August 25, 1977 to November 18, 1977. Thereafter pile drilling was to commence. Exhibit 3 shows the storm line, 20" gas line and 12" sanitary line being relocated concurrent with the pile operation.

Mr. Carmichael's testimony was based upon the uncontroverted fact that the existing sanitary sewer line ran through the area where the expanded portion of the shaft would be constructed. (Tr. 524; contract drawing U-13-1). He thus concluded that the existing sanitary sewer line would have interfered with shaft construction if not removed prior to the performance of that work. Notwithstanding Mr. Carmichael's testimony, however, there is no evidence to suggest that Appellant's CPM was not reasonable. The approved CPM recognizes that the sanitary sewer line had to be relocated prior to the performance of shaft excavation to elevation 70. Neither Mr. Carmichael nor any other witness has suggested that the sewer line would have interfered with earlier construction activities, namely, the augering and placement of piles and the level one bracing operation.

Mr. Carmichael also testified that there was insufficient work space in the shaft area to permit the simultaneous relocation of the sewer and construction of the shaft. Since we have no factual basis upon which to conclude that the work area would not have permitted Appellant to perform as planned, we find that the resequencing of work, as represented in the approved CPM, was reasonable.

Even if the sequencing of work was reasonable, the MTA further contends that the approved CPM was unreasonable in view of Appellant's failure to provide an adequate period of review for the sanitary sewer line relocation shop drawings. In this regard, contract Special Provision 02550, section 1.02A states that ". . . not less than 60 days prior to the intended date to commence operations, working drawings and shop drawings, if applicable, showing the details, procedure and scheduling for performance of the [utility] work . . ." are to be submitted. Appellant, however, provided only for a 15 working day (21 calendar day) period for review and approval of its utility shop drawings under the approved CPM. (Exh. A, nodes 1001 to 1002).[25]

The contract Special Provisions essentially apprised Appellant that unless it submitted utility shop drawings at least 60 days prior to the planned start of work, the MTA could not guarantee that all drawing approvals could be issued so as not to impact Appellant's utility work schedule. The 60 day lead time apparently was inserted into the contract because of the need to submit these shop drawings to the utility owners for review and approval. (Tr. 525). There is nothing in the record, however, to demonstrate that the 60 day period was rigid and that the review process could not be expedited in order to permit critical items of work to be performed. Further, neither party adduced evidence detailing the period of time actually required to approve the utility shop drawings submitted under the contract. The issue here, therefore, is whether Appellant reasonably assumed that its utility shop drawings could be reviewed and approved within a 21 calendar day period.

We find noteworthy the fact that the MTA is alleging that Appellant's preliminary schedule, and not the approved CPM, is reasonable. The preliminary schedule makes no provision for the submission of any shop drawings. In making this finding, we observe that utility shop drawing approvals are not described in the preliminary schedule, utility work is

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[25]The late start date for submission of these drawings was September 20, 1977. Appellant actually made the submission on September 19, 1977. (Appeal file, Tab 2).

scheduled to commence on the date of notice to proceed, and the durations indicated for performance of the utility work were virtually identical to those set forth in the approved CPM.[26] Accordingly, it is clear to the Board that a 60 day approval period for shop drawings likewise was not built into the preliminary schedule.

The approval of shop drawings is an administrative function. The MTA here was in the best position to determine the reasonableness of Appellant's plan as it pertained to the approval process. In view of the MTA's approval of Appellant's initial CPM, its acceptance of the preliminary schedule as reasonable, and its failure, until the hearing, ever to question the time set forth for drawing approvals, we conclude that the abbreviated shop drawing approval period shown in the initial CPM was feasible and attainable.

Finally, the MTA challenges the reasonableness of the approved CPM because it allegedly shows too high a production rate for the augering and placement of piles. In this regard, the approved CPM shows 24 work days to place the 42 piles necessary to the shaft, or 1.75 piles per day. We note, however, that the preliminary schedule, now accepted by the MTA as reasonable, shows 20 work days to place the 42 piles, or 2.10 piles per day. Obviously, the production rate shown on the approved CPM is less than that represented on the preliminary schedule.

During the hearing, Appellant presented a number of witnesses whose uncontroverted testimony was that production rates of up to 2 piles per drill rig shift were reasonable and attainable given adequate light and normal weather conditions.[27] In view of this testimony and the MTA's acceptance of

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[26]The following is a comparison of the utility work appearing on the preliminary schedule and the first CPM:

Activity	Work Days Prelim. Sched.	CPM
Shop Dwg. Submittals-Water/ Fire hydrant	not shown	15
Water/fire hydrants Reloc.	20	15
Shop Dwg. Submittals- Steam Line	not shown	15
Construct steam line	20	20
BG&E Elect Relocations	50	25
Gas Drawings Submittal	not shown	15
BG&E Gas Relocation	30	15
20" Gas line Relocation	10	10
Sanitary Line Dwgs. Prepared	not shown	10
Sanitary Line Dwgs. Submitted/Approved	not shown	15
Santiary Line Construction	55	62

[27]Mr. Dayton Winham, a 35 year veteran of the drilling business, testified that his company had performed similar drilling work on the MTA Charles Center project. Although they only attained a production rate of 1 pile per drill rig shift, the work was performed at night. (Tr. 263-64). He further testified that drilling production at night was 50% of what is attained during the day. (Tr. 267). This was corroborated by the testimony of Mr. Grady Milner, a drill rig operator with 18 years experience. (Tr. 336). The MTA's own

the higher production rates in the preliminary schedule, we find Appellant's approved CPM to be reasonable as regards the production rates shown therein.[28]

The MTA next contends that loss of efficiency costs should not be recognized because JAB would have had to perform excavation and bracing work during the winter of 1977-78 even if its pile driving operation had been accomplished as contemplated. The excavation and bracing work, we are told, would have been subject to the same cold weather loss of efficiency as was encountered in pile driving. Accordingly, JAB's costs allegedly were not increased.

The evidence of record clearly demonstrates that the pile installation work was affected by cold weather operations. Efficiency loss particularly was significant in subfreezing temperatures where moisture from the earth being augered created mud which then accumulated on the drill rig's kelly bar and gradually flowed to the rotary table and kelly box. This mud had to be cleaned repeatedly and thoroughly to prevent freezing.

These conditions further affected labor in that it was difficult for crewmen to stay warm once their gloves inevitably became wet. Despite the use of several pairs of gloves, a certain amount of time was lost to the crew's need to seek warmth for their hands.

Cold weather also affected equipment usage. Drill rigs were more difficult both to stabilize at a given location and start in the morning. Additionally, repairs to equipment were more time consuming in winter months when mechanics were burdened with heavy clothing and gloves.

The record does not reflect a comparable loss of efficiency in the excavation and bracing work performed below the deck. While it still was very cold beneath the decking in winter months, the problem with moisture and its effect on the laborers and welders was not shown to exist. Further,

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witness, Mr. Duncan, testified that he was able to drill two pile holes per drill rig shift even at night when working to install the Charles Street Station slurry walls. (Tr. 367).

[28]Appellant contends that its as-planned production rate is irrelevant to the resolution of its claim. (App. Reply Brief, pp 9-10). However, the as-planned production rate and schedule do have importance in that it first must be determined that pile driving would have been completed prior to the onset of winter weather but for the contract change. The reasonableness of the as-planned schedule, depicting the completion of pile driving before the onset of winter, is dependent upon the pile driving production rate which would have been achieved by Appellant.

despite the fact that it would have been cold beneath the deck, the record shows that the wind would not have been a factor and that freshly excavated, undisturbed earth would have had a warming effect on a confined area such as the shaft being constructed here.

The MTA recognizes the sheltering effect of the decking but contends that 50% of the excavation and bracing work still would have been accomplished above ground. The record, however, does not support this argument. Although removal of the excavated earth from the shaft was to be accomplished by a service crane located at street level, the operator was to be housed in a cab. Further, while some fabrication was to continue at surface level during the excavation, the bulk of this work was to have been complete prior to the commencement of the excavation.

We find, therefore, that the installation of piles, decking and fabrication work, as performed in exposed areas, was affected to a greater degree by winter weather than the excavation and bracing work would have been under comparable temperatures. Accordingly, we reject the MTA's argument that JAB's loss of efficiency was no greater than otherwise was to be expected under its original performance schedule.

In Wunderlich Contracting Company v. United States, 173 Ct.Cl. 180, 199, 351 F.2d 956 (1965), the U. S. Court of Claims stated as follows:

> A claimant need not prove his damages with absolute certainty or mathematical exactitude. It is sufficient if he furnishes the court with a reasonable basis for computation, even though the result is only approximate. Yet this leniency as to the actual mechanics of computation does not relieve the contractor of his essential burden of establishing the fundamental facts of liability, causation, and resultant injury. (citations omitted).

See also Story Parchment Company v. Patterson Parchment Paper Company, 282 U.S. 555 (1931); Granite Construction Company, MDOT 1014, December 20, 1983, at p. 50; Calvert General Contractors Corp., MDOT 1004, March 4, 1981, at p. 39. With regard to loss of efficiency claims resulting from the performance of work during winter weather, the Court of Claims more precisely has said:

> That winter weather and adverse water conditions reduce the efficiency of a labor force in the performance of construction work only stands to reason. It has been held by this court that when loss of productivity brought about by these conditions results from defendant's breach of contract, the plaintiff is entitled to recover its additional costs occasioned thereby as damages.

Luria Brothers & Co. v. U. S., 177 Ct.Cl. 676, 697-98, 369 F.2d 701, 713-14 (1966).

JAB's efficiency while performing pile placement, decking installation and fabrication during winter weather clearly was reduced from what it otherwise would have been in the October - November 1977 time frame. Since the harsh effects of winter affected these activities only because of an

MTA-caused delay, we are satisfied that the facts relating to liability, causation and injury have been established sufficiently to permit us to focus on the dollar impact.

We now examine Appellant's actual computation of its increased costs due to an alleged loss of efficiency in winter weather. The analysis begins on December 5, 1977, the day upon which JAB contends that the weather began to change significantly. From December 5, 1977 until the completion of the decking on March 15, 1978, JAB states that it worked a total of 59.25 day shifts and 29 night shifts[29] on the augering and placement of soldier piles for the shaft and sanitary sewer line, and on the installation of street decking. (Exh. 14, attch. 2). It is the work performed on these shifts which allegedly was subject to the cold weather efficiency loss.

JAB's loss of efficiency estimate was derived by its President, Mr. Bucher, based upon his personal observation[30] of the work. Mr. Bucher concluded that his firm experienced a labor efficiency loss of 21% on day shift work and 28% on night shift work. (Tr. 131). Mr. Bucher also assumed that equipment efficiency would be reduced by an identical percentage since the equipment operators would be impeded by decreased labor production. (Tr. 131).

In order to quantify his observations of job progress, Mr. Bucher first determined that the mean day shift temperature for October through November 1977 was 60 degrees and the mean night shift temperature during this same period was 45 degrees. Mr. Bucher assumed no efficiency loss at these temperatures on the respective shifts. However, at 30 degrees, Mr. Bucher assumed a loss of two hours of productive work per day shift and two and a half hours per night shift. Plotting these points on a graph with temperature scaled vertically and efficiency loss horizontally, and assuming a straight line relationship between temperature and efficiency, a means of calculating efficiency loss on a daily basis, by temperature reading, was produced. Mr. Bucher then analyzed the daily mean temperatures for each day and night shift worked to obtain JAB's efficiency loss per shift. He then computed an average efficiency loss of 21.12% for all winter day shifts and 28.43% for winter night shifts.

As further support for his analysis, Mr. Bucher examined the inspector's daily reports for the adjacent Lexington Market Station project constructed by the Peter Kiewit Company. Pile driving work on this project was performed in the summer of 1978. Mr. Bucher took the number of shifts during which pile driving equipment was on the Peter Kiewit job site without deduction for delays due to weather, lost casings, or utility interference. By dividing the

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[29]At hearing, Appellant contended that the correct numbers were 59 day shifts and 28 night shifts. This was amended at pp. 30-31 of Appellant's post hearing brief to reflect an additional eight hours of night work and two hours of day work on the sanitary sewer relocation. Both parties now are in agreement as to the number of shifts worked during this period. (Tr. 446).

[30]Mr. Bucher testified that he was on the job site 40 to 50% of the time. Further, he served as superintendent on several shifts including some occurring in winter weather. (Tr. 130).

number of shifts into the number of 80 foot piles placed on that job, a production rate of 0.73 piles per rig per shift was obtained. This compared to a production of 0.46 piles per rig per shift experienced by JAB during winter months on the captioned project. The reduction in efficiency between Peter Kiewit's summer work and JAB's winter work thus computes to 36.7%.

Having satisfied himself that the loss of efficiency factors of 21% for day shift work and 28% for night shift work were reasonable and conservative, Mr. Bucher applied these factors to the actual number of shifts worked on the pile driving and decking operations. Holiday and weather shifts lost due to the projection of the work into the winter months were included at 100% of audited equipment rates per shift. A deduction then was made for those winter efficiency losses already compensated for under change order 12 as well as those relating to the sanitary sewer relocation. The result was a net loss of efficiency cost of $65,610.89.

In response, the MTA first submits that JAB has failed to support its computation of efficiency loss by contemporaneous records of its performance. Instead, JAB has offered only the uncorroborated observations and estimates of its President and experts. Under such circumstances, the MTA concludes that there can be no recovery of lost efficiency costs. Compare Dravo Corporation, ENGBCA No. 3800, 79-1 BCA ¶13,575; Harvey Wells Electronics, Inc., ASBCA No. 6507, 67-2 BCA ¶6603.

"It is a rare case where loss of productivity can be proven by books and records; almost always it has to be proven by the opinion of expert witnesses." Luria Bros. & Co. v. U. S., supra at 177 Ct.Cl. 696. Where such proof is sufficiently credible to permit a reasonable approximation of lost efficiency, recovery may be had. Joseph Pickard's Sons Company v. The United States, 209 Ct.Cl. 643, 532 F.2d 739 (1976); Wunderlich Contracting Company v. United States, supra; Granite Construction Company, supra at p. 50.

Aside from Mr. Bucher's estimate, JAB presented the testimony of Mr. Dayton Winham, the chief of operations for Dominion Caisson Corporation. Mr. Winham, who prepares bids in support of his company's drilling operation, states that a 25% loss of efficiency is expected in winter months. However, Mr. Winham further testified that only an eight to ten percent reduction in efficiency occurs when the temperature is between 33 and 59 degrees.

JAB also presented the testimony of Mr. Grady Milner, a drill rig operator with 18 years of experience. Mr. Milner similarly testified that winter efficiency is half of that achieved in summer. However, most of the equipment problems which reduce efficiency in winter are not a problem at temperatures above 32 degrees.

In rebuttal, the MTA offered two experts. Mr. Harry Duncan, a pile driver with thirty-five years experience, testified that cold weather requires close supervision of the work force in order to maintain efficiency. Even so, however, he admitted that equipment setup and repairs were more difficult and time consuming in winter. Mr. G. Theodore Brayman, the Deputy Construction Engineer for the MTA, testified that cold weather down to 35

degrees had no effect on production and temperature levels between 20 and 35 degrees had only a negligible effect. Below 20 degrees, labor is affected more than equipment.

Obviously, there is no precise formula for application here. It is clear that efficiency will be reduced both at street level and beneath the decking in cold weather. Temperature or wind chill factors between 32 degrees and 40 degrees will have a modest effect on production. Similarly, temperature or wind chill factors below zero will have a devastating effect on production. Although both parties have attempted to quantify production losses by means of mathematically correlating them to temperature or wind chill readings, a scientific basis for doing so has not been established. Based upon the testimony presented, however, we conclude that surface work on average, was 10% less productive than work performed in the sheltered environment of the shaft during winter months. In the case of the pile placement, when wind chill factors reached 32 degrees or less, production fell, on average, another 10%.

The foregoing factors do not ignore the various estimates assigning a 25% loss of efficiency to winter weather work. What they seek to recognize is that cold weather would have affected the excavation and bracing work which JAB, in the absence of delay, would have performed in the winter.[31] Our approach, therefore, is to seek to measure the increased loss of efficiency which JAB incurred in the winter of 1977-1978 as a result of performing its pile driving, fabrication and decking work instead of excavation and bracing.

In calculating JAB's efficiency loss, we initially conclude that equipment inefficiency would have been the same as labor inefficiency. Although the MTA contests this point, it presented no evidence to challenge the finding and, in fact, utilized the same assumption in both cost analyses which it submitted to the Board. The augering procedure was the most time consuming step in the pile placement operation. To the extent that crew members were slowed in changing drill bits, chiseling frozen mud from a kelly box, stabilizing or repairing the equipment, the equipment usage correspondingly was affected. Likewise, in the decking operation, it would seem that the hand labor involved in welding and excavation would pace the operations of the service crane.

JAB's efficiency loss resulting from its pile driving, fabrication and decking operations is as follows:

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[31]Exhibit H demonstrates that temperatures within the shaft did not differ significantly from surface temperatures. Accordingly, it would have been very cold in the shaft during the winter and efficiency would have been affected.

I. Pile Driving 12/5/77 - 2/21/78

A. Labor

41.25 day shifts worked (subfreezing conditions) at 20% lost efficiency = 8.25 shifts lost at $371.54/shift
= $3,065.62

29 night shifts worked (subfreezing conditions) at 20% lost efficiency = 5.80 shifts lost at $354.05/shift
= $2,053.49

3 day shifts worked (32 degrees plus) at 10% lost efficiency = 0.3 shifts lost at $371.54/shift
= $111.46

B. Equipment

41.25 day shifts worked (subfreezing conditions) at 20% lost efficiency = 8.25 shifts lost at $1,439.85/shift
= $11,878.76

29 night shifts worked (subfreezing conditions) at 20% lost efficiency = 5.80 shifts lost at $1,196/shift
= $6,636.80

3 day shifts worked (32 degrees plus) at 10% lost efficiency = 0.3 shifts lost at $1,439.85/shift
= $431.96

II. Fabrication[32] 12/5/77 - 2/21/78

A. Labor

44.25 day shifts worked at 10% lost efficiency = 4.43 shifts lost at $909.57/shift
= $4,029.40

B. Equipment

44.25 shifts at 10% lost efficiency = 4.43 shifts lost at $215.15/shift
= $953.11

[32]The assumption being made is that nearly all fabrication was done during this time period.

III. Decking 2/22/78 - 3/15/78

A. Labor

15 day shifts worked at 10% lost efficiency = 1.50 shifts lost at $1,281.16/shift

= $1,921.74

B. Equipment

15 day shifts worked at 10% lost efficiency =1.50 shifts lost at $1,655/shift

= $2,482.50

Total $33,564.84

Both parties recognize that certain adjustments properly should be made to the foregoing total. First, inefficiency losses encountered in the driving of piles for the sanitary sewer do not flow from the change involved here and, hence, those shifts wherein JAB worked on the sanitary sewer should be excluded. JAB computes the labor and equipment attributable to these shifts at $3,793.42[33] while the MTA is at $4,345.19.[34] The difference concerns whether JAB forces devoted the entire day shift on January 26, 1978 to the performance of sanitary sewer work, or merely two hours. Further, JAB applied a 21% efficiency loss factor both to day and night work whereas the MTA used 28% for the three night shifts involved. We accept JAB's estimate of the number of work shifts[35] and find that on each of these shifts, the wind chill index was 32 degrees or less. Accordingly, consistent with the approach followed previously, we apply a straight 20% efficiency loss factor as follows:

[33]Exh. 14, p. 10 indicates a credit of $3,313.76. However, at pages 30-31 of its post hearing brief, JAB concedes that an additional credit of $479.66 is due.

[34]The MTA also submitted an alternate computation showing an efficiency loss of $5,660.86. This figure was derived by equating wind chill factors to alleged efficiency loss and applying the resultant efficiency loss percentage to labor and equipment costs on a daily basis. Because we have rejected this formula basis for computing loss of efficiency, we do not accept the resultant figure as reasonable.

[35]Page 7 of Exhibit F indicates that only two hours were spent on sanitary pile work on January 26, 1978.

7.25 day shifts at $1,811.39/shift[36]	=	$13,132.58
3 night shifts at $1,550.05/shift	=	4,650.15
	Total	$17,782.73
JAB sanitary pile driving cost	=	$17,782.73
loss of efficiency at 20%	=	$3,556.55

The MTA credit thus should be $3,556.55.

The parties similarly agree that a credit is due for the efficiency losses associated with the direct costs previously paid under change order 12. This amount has been stipulated as $4,055.10.

The next category for which a credit is sought involves equipment breakdowns and other miscellaneous occurrences which stopped production. The MTA seeks a credit for all shifts where progress was delayed as a result of the foregoing. We disagree.

One of the cost elements being measured by the foregoing efficiency loss factors is the increased time required to repair equipment in cold weather. Equipment breakdowns are a normal part of construction work and their occurrence necessarily does not demonstrate inefficiency or negligent maintenance. Accordingly, so long as equipment breakdowns appear to be the result of ordinary wear and tear and so long as they are repaired within a reasonable time period in the field, they should be included in the analysis of cold weather efficiency loss.

Miscellaneous problems such as an auger bit or casing being stuck in a hole or a hole collapsing again appear to be the type of disturbances which also would be expected to some degree. The evidence demonstrates that Peter Kiewit Sons' Co. likewise encountered these problems in performing its drilling on an adjacent project. Accordingly, so long as negligence is not shown as the cause for such happenings, they too should be included in an efficiency loss analysis.

While there is no evidence that JAB was negligent in its operations, the MTA has identified one occurrence of equipment breakdown which must be excluded from our cost analysis. The drill rig leased from The George Hyman Construction Company broke down during its first shift of operation on December 8, 1977. The mechanical problem was diagnosed as transmission related and repairs were not made in the field. Productive drilling operations ceased from this point until the night shift of December 15, 1977 when a new, truck mounted crane was obtained. This period of nonperformance was unusual in nature and unrelated to the cold weather. Augering thereafter was not accomplished for a total of four day shifts and one night shift. Since this loss of production was not attributable to the cold weather and was extraordinary, the lost shifts should be deducted from our efficiency loss calculations as follows:

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[36]This figure is derived by adding the applicable labor and equipment rates.

Labor			
2 day shifts (subfreezing)	x 20% x $371.54/day	=	148.62
1 night shift (subfreezing)	x 25% x $354.05/day	=	88.51
2 day shifts (32 deg. plus)	x 10% x $371.54/day	=	74.31
Equipment			
2 day shifts (subfreezing)	x 20% x $1,439.85/day	=	575.94
1 night shift (subfreezing)	x 20% x $1,196.00/day	=	239.20
2 day shifts (32 deg. plus)	x 10% x $1,439.85/day	=	287.97
	Total		$1,414.55

The MTA also seeks a credit for the loss of efficiency incurred in assembling the George Hyman rig. However, the assembly was a normal and required activity and hence should be included in the efficiency loss analysis.

The MTA also contends that a deduction must be made for any loss of efficiency related to the sanitary sewer work, other than the placement of soldier piles. In this regard, MTA Exhibit K presents a credit computation for efficiency loss in the amount of $3,218.[37] JAB opposes this credit because the ". . . work was performed concurrent with the original shaft work, did not affect that work, and was minor in nature." (App. brief, p. 31.)

The test as to whether the efficiency loss incurred in the remainder of the sanitary sewer work should be deducted as a credit involves a consideration of whether such costs were contained in the original computation of efficiency loss. Put another way, our concern is whether the stipulated labor cost per shift included the cost of those crew members assigned to the sanitary sewer work. A breakdown of the $1,281.16 figure for day shift labor does not appear in the record. However, since JAB has admitted that this figure includes labor costs other than those related to pile driving and given JAB's failure to controvert the computation made by the MTA, we conclude that JAB's calculation of efficiency loss was premised upon all labor costs incurred through March 15, 1978, including those incurred in the sanitary sewer relocation. (Tr. 151-154). Accordingly, we accept the credit of $3,218 as reasonable.

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[37] Exhibit K contains inspection reports for the period from 2/15/78 to 3/15/78. Labor and equipment assigned to each work activity are extractable from these reports. The MTA used these reports to segregate the labor and equipment necessary to the sanitary sewer work. Although exhibit K shows a credit of $3,508, JAB challenged the computation at hearing by showing that the 966 Cat Loader was off the job by February 28, 1978. (Tr. 683). The MTA, in its brief, accepted this testimony and corrected its computation to reflect the credit of $3,218. See Resp. brief, p. 55.

Finally, both parties have included a consideration of weather days and holidays under the heading of efficiency loss. Standby costs incurred as a result of weather days and holidays, in our view, are distinguishable from loss of efficiency costs and thus will be considered separately hereafter.

In summary, therefore, JAB is entitled to the following loss of efficiency costs:

	$33,564.84
	(3,556.55) Sanitary Sewer pile driving
	(4,055.10) Change Order 12
	(1,414.55) Equipment downtime
	(3,218.00) Sanitary Sewer - Miscellaneous
Total	$21,320.64

C. Extended Overhead

JAB's extended overhead computation has two components. The first component is the delay attributable to the approval of shop drawings. JAB contends that this period is 48 calendar days while the MTA agrees to only 39 calendar days. The difference depends on whether JAB was authorized to proceed with the construction shaft work based on shop drawings marked "approved as noted, resubmittal required," or whether it properly awaited final approval of such drawings. The second component of the extended overhead claim is the delay attributable to lost efficiency. JAB alleges 34 calendar days while the MTA recognizes no time lost. Both parties agree, however, that JAB's overhead during the extended performance period was $381 per day.

As to the drawing delay, we reject the MTA's contention that JAB was authorized to commence construction shaft work on November 14, 1977. Standard Specification section 01300, paragraph 1.03B(12) provides that:

> The Contractor shall be responsible for, (sic) and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of the work prior to the approval by the Engineer of the necessary shop and working drawings.

By letter dated November 14, 1977, the MTA Resident Engineer returned JAB's construction shaft drawings marked "approved as noted, resubmission required." (Appeal File, Tab 18). Although the MTA contends that this notice represented final approval, the evidence indicates otherwise. First, the Resident Engineer's November 14, 1977 letter stated that:

> Approval of these drawings is contingent upon receipt of your proposed cost credit to MTA for the savings mentioned above. Please provide the proposal by November 28, 1977 in order that the work may proceed as planned. (Underscoring added).

While JAB concedes that it never submitted the requested cost proposal by the specified date, it nevertheless is clear from this language that JAB was not authorized, as of November 14, 1977, to proceed with the work. Secondly, Standard Specification section 01300, paragraph 1.03B(11) requires that a contractor supply clean copies of approved shop drawings, prior to the commencement of work, ". . . if the drawings have been approved subject to

certain revisions." Here the shop drawings were approved subject to resubmission and, hence, JAB was not authorized to commence the shaft work prior to the resubmittal. For these reasons, we find that JAB was not authorized to begin work on the construction shaft until the morning of November 23, 1977, the date upon which the resubmitted shop drawings were approved and returned. A 46 calendar day delay thus resulted.[38]

Turning to the delay resulting from the cold weather loss of efficiency, our analysis begins with the additional costs incurred by JAB due to its loss of efficiency, or $21,320.64. Translating this dollar figure into a time delay requires that we determine the average labor and equipment cost per day incurred by JAB. In this instance, we conclude that JAB's average labor and equipment cost per day for the period from 12/5/77 to 3/15/78 was $3,452.82.[39] Accordingly, we find that the production loss due to cold weather extended JAB's performance period by 6.17 work days,[40] or 9 calendar days.

JAB also contends that it experienced an additional 11 weather days and holidays which similarly extended its performance period and entitled it to extended overhead. The MTA maintains that JAB is entitled to payment only for one additional holiday, Memorial Day.

"It is well settled that where delays are occasioned by factors beyond the control of the contractor or the government, a contractor cannot recover damages from the government for the delays, nor can the government properly assess liquidated damages against the contractor. However, where government-caused delays force the contractor into more costly operations, the government will have to respond in damages for the resulting outlays." J. D. Hedin Construction Co., Inc., 171 Ct.Cl. 70, 98, 347 F.2d 235 (1965). Thus, when weather adversely interferes with work which would have been completed in the absence of government-caused delay prior to the commencement of bad weather, any increased costs resulting from the impact of the bad weather are recoverable. J. D. Hedin Construction Company v. The United States, supra, at 171 Ct.Cl. 100; Robert L. Rich, DOTCAB No. 1026, 82-2 BCA ¶15,900.

The facts establish that JAB planned to perform the pile driving and decking work between October 7, 1977 and December 9, 1977.[41] Ultimately, it performed this work between December 5, 1977 and March 15, 1978. During this period of actual pile and decking installation, JAB encountered a total of eight days wherein its work was stopped due to bad weather. JAB contends

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[38]Pursuant to the approved CPM, shop drawings were to be approved by October 7, 1977. As a result of the redesign mandated by change order, approval did not occur until November 22, 1977. (Tr. 98). This represented a calendar day delay of 46 days.

[39]JAB's labor and equipment costs on day shift equaled $2,936.16. At night it was $1,550.05. Since JAB worked a double shift 33% of the time during the period in question (29 night shifts out of 88 total shifts), the average cost per day would be $2,936.16 plus $516.68, or $3,452.84.

[40]This figure is obtained by dividing $21,320.64 by $3,452.84.

[41]See Resp. Exh. A, activities 1104 to 1108, 1108 to 1110, 1110 to 1115 and 1115 to 1120; findings of fact, supra. at p. 9.

that since its original schedule called for it to be performing excavation and bracing work in the December 5, 1977 to March 15, 1978 time frame and since this latter work is not affected by rain, it lost eight days to weather which it otherwise would not have.

Accepting JAB's contention that work beneath the decking would not have been stopped by rainfall, JAB's claim presentation omits consideration of the effect which weather would have had on its pile driving and decking operations in the absence of MTA-caused delay. Although it is difficult to determine precisely in retrospect whether pile driving work would have been stopped by rainfall during the period from October 7, 1977 to December 9, 1977, the MTA's Mr. Brayman analyzed the inspection reports and attempted to do so. He concluded that work would have been stopped by rainfall on October 14, 26, 27 and November 7 and 29, 1977. (Tr. 655-659). JAB's Mr. Bucher did not deny this possibility. (Tr. 233-235). Additionally, JAB actually was stopped from performing on December 5, 1977. We find, therefore, that JAB would have lost six work days to bad weather during this earlier period. The net impact to its performance as a result of weather thus was two work days.

With regard to holidays, JAB planned to perform its soldier pile, decking and excavation work from October 7, 1977 to May 11, 1978. During this period, it would have had three holidays affect its production.[42] Since JAB actually performed the same work between December 8, 1977 and July 13, 1978, its production was affected by four holidays. Hence, JAB is entitled to an additional work day due to the impact of holidays on its performance.

On the basis of the foregoing, JAB is entitled to extended overhead as follows:

Drawing delay	46 days
Efficiency loss impact	9 days
Weather/holidays	4 days[43]
Subtotal	59 days (calendar)
Deduct - concurrent delay compensated for under C. O. 12	10 days
Total	49 days (calendar)

49 days at $381/day = $18,669.00.

In finding JAB entitled to a 49 day time extension, we are cognizant of the fact that JAB previously has been given a 34 calendar day extension under change order 12 together with extended overhead for those days. Except for a ten day overlap recognized above, the delays experienced under

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[42]These were Thanksgiving, Christmas and New Years Day.

[43]We found that JAB lost two work days to weather and one work day to holidays. By multiplying work days by a factor of 1.4, we convert the work days to calendar days.

change order 12 were not concurrent with those experienced as a result of the untimely shop drawing approval. Accordingly, assuming payment pursuant to this decision, JAB will have been paid for 83 calendar days of extended overhead. The MTA contends that the maximum number of calendar days it is liable for is 63, or the period from May 11, 1978 to July 13, 1978.

Although Appellant's approved CPM indicated that the construction shaft work was to be completed by May 11, 1978, JAB submitted a schedule to Appellant, prior to performance, outlining a plan for earlier completion. While JAB's projected completion date is somewhat unclear, it appears to have been approximately April 19, 1978.[44]

In calculating the 59 day delay here, we have measured only the actual impact which the drawing delay and weather had on JAB's work. Absent this impact, we have concluded that JAB would have completed its work 59 days earlier. Since change order 12 likewise was entered into after the completion of JAB's work, we conclude that it also was premised on the actual impact which the steam line relocation and support of excavation modification had on performance. Accordingly, we find that the true impact on JAB's work was 83 days and that, in the absence of change order 12 and the delay in drawing approval for the shaft construction, JAB would have completed its work on April 21, 1978. This conclusion, we believe, is supported further by the original JAB schedule which projects a similar completion date.

It is well settled that ". . . an owner may not prevent a contractor's early completion of his assignment with impunity." State v. Cherry Hill Sand & Gravel Co., 51 Md. App. 299, 310, 443 A.2d 628 (1982); Owen L. Schwam Construction Co., Inc., ASBCA No. 22407, 79-2 BCA ¶13,919; Sydney Construction Co., Inc., supra. Accordingly, since we are satisfied that JAB would have completed its work by April 21, 1978 absent the MTA-caused delays, it is entitled to be compensated for the net 49 calendar days of extended overhead found due here.

D. Labor Escalation

It is uncontroverted that wage rates for laborers and operators increased on May 1, 1978. In this regard, the MTA concedes that JAB is entitled to recover its additional costs resulting from the new labor agreement to the extent that the change order involved here caused work to be performed beyond the time when JAB otherwise would have been on the job.

JAB completed its work on July 13, 1978. We previously have found that JAB was delayed by 59 calendar days as a result of the late construction shaft drawing approval. In the absence of this change alone, JAB thus would

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[44]JAB's schedule shows completion of excavation and support work to elevation 40 by February 28, 1978. The remainder of the excavation work is not detailed. JAB's schedule assumed that ten feet of the shaft could be excavated and supported every 21 calendar days. Extrapolating in this manner, we conclude that excavation of an additional 16 feet could have been completed by April 19, 1978.

have completed its work on May 15, 1978. Accordingly, it is entitled to the increased labor costs incurred due to the wage rate increase for the period from May 16, 1978 to July 13, 1978. This amounts to $1,359.45.[45]

E. Standby Costs

In addition to the overhead costs associated with the increased number of weather days and holidays experienced by JAB, standby costs also were incurred. The parties have stipulated that JAB incurred direct labor costs of $414.50 for each day shift not worked due to weather or holidays and no costs for night shifts. Equipment costs are $1,655 on day shift and $1,196 on night shift.

During the period from December 5, 1977 to March 15, 1978, JAB experienced a combined loss of eight day shifts due to holiday/weather days and seven night shifts due to bad weather. Our review of the MTA daily inspection reports for the period from October 7, 1977 to December 9, 1977 reveals that JAB would have lost six day shifts and one night shift had it performed its pile driving and decking work during this time period.[46] Accordingly, the difference between the as-built and as-planned weather/holiday impact would be as follows:

Day shift
8 holiday/weather day shifts minus 6 weather day shifts minus 1 holiday = 1 shift lost at $2,069.50/shift = $2,069.50.

Night Shift
7 weather night shifts minus 1 weather night shift = 6 shifts

6 shifts at $1,196/shift = $7,176.

Standby costs due JAB, therefore, total $9,245.50.

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[45]JAB computed its labor escalation costs for the period from May 1, 1978 to July 13, 1978 as follows:

Laborers	4,669.5 hours	0.35/hr.	$1,634.26
Operators	150.5 hours	0.36/hr.	54.18
		Total	$1,688.44

Although we accept these numbers as accurate, we correct the analysis to reflect the period from May 16, 1978 to July 13, 1978. To do this, we deduct all labor and operator hours registered through May 15, 1978. This totals 851.5 laborer hours and 86 operator hours. (Exh. 14, p. 28). The total labor escalation to be deducted from JAB's calculation thus is $298.03. Operator escalation to be deducted is $30.96. Net labor escalation is $1,688.44 minus $298.03 minus $30.96, or $1,359.45.

[46]The day shifts were on October 14, 26, 27, November 7, 29, and December 5, 1977. The night shift would have been lost on November 7, 1977.

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F. MTA Counterclaim

In issuing unilateral change order 18 in the amount of $33,909, the MTA contends that it erroneously failed to consider the loss of efficiency which JAB would have experienced in the absence of any government-caused delay.[47] Additionally, the MTA states that in auditing the instant claim, it realized that JAB had been compensated for extended overhead under change order 12 at a rate $108.20 in excess of JAB's actual overhead rate. Accordingly, the amounts which allegedly were paid improperly to JAB under change orders 12 and 18 are sought as a credit against the total equitable adjustment found due JAB as a result of the delay in approving the construction shaft shop drawings.

Initially, we must consider whether the counterclaim properly was raised and is within the purview of the Board's jurisdication. In this regard, we find that the counterclaim was not addressed in the Mass Transit Administrator's final decision dated December 17, 1980. (Appeal File, Tab H). For this reason, Appellant contends that the counterclaim is not properly before the Board.

This contract predated both creation of the Maryland State Board of Contract Appeals (MSBCA) and its predecessor, the Maryland Department of Transportation Board of Contract Appeals. As originally executed, the contract contained an administrative disputes procedure calling for initial consideration by the MTA Engineer with consecutive appeals thereafter to the Administrator and the Secretary of Transportation. The Secretary of Transportation's decision was to be final and conclusive unless found by a court to be unsupported by substantial evidence, fraudulent, capricious, arbitrary, or so grossly erroneous as to necessarily imply bad faith. The administrative resolution of legal questions, although not prohibited by the contract clause, was not to be considered final or entitled to a presumption of correctness if appealed to the courts.

Chapter 418 of the Laws of Maryland of 1978 established the Maryland Department of Transportation (MDOT) Board of Contract Appeals. Effective July 1, 1978, the MDOT Board was authorized to "hear and determine" all disputes within its jurisdiction pursuant to its own promulgated regulations and the provisions of the Maryland Administrative Procedure Act. (Ch. 418, §§2-603(A)(D), 2-604 (1978)). The jurisdiction of the Board expressly was stated as follows:

> "The Board shall have jurisdiction over all disputes arising under a contract with the Department, or as a result of a breach of a contract with the Department. The Board has no jurisdiction over the awarding of a contract with the Department. (Ch. 418, §2-603(B), 1978).

Only contracts entered into on or after July 1, 1978, however, were subject to this mandatory administrative remedy. (Ch. 418, §3, 1978).

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[47]This aspect of the counterclaim is now moot since we have found that Appellant and JAB are entitled to a sum in excess of $33,909 as a result of the drawing approval delay.

Faced with a pre-July 1, 1978 contract, the parties to this dispute entered into a supplemental agreement dated December 5, 1978 as follows:

> The Contract Disputes Article of the "General Provisions for Construction Contracts 1976", GP-5.15, is hereby deleted in its entirety and is superseded by the following:
>
> GP-5.15 Disputes
>
> All disputes arising under or as a result of a breach of this Contract which are not disposed of by agreement between the Contractor and Engineer shall be decided by the Administrator or his duly authorized representative who shall reduce his decision to writing and mail by certified or registered mail or otherwise deliver a copy thereof to the Contractor. Any such decision shall be final and conclusive unless within thirty (30) days of receipt of same the Contractor mails or otherwise furnishes a written appeal to the Department of Transportation Board of Contract Appeals. Pending any decision by the Board of Contract Appeals of a dispute hereunder, the contractor shall proceed diligently with the performance of the Contract and in accordance with the decision of the Administrator or his duly authorized representative.

Contract Supplemental Agreement No. 1. The degree to which the MTA may bring an affirmative claim, therefore, is limited by this contractual disputes procedure and is not otherwise affected by statute.

Our reading of the contract disputes clause bargained for by the parties leads us to conclude that all disputes, whether initiated by Appellant or the MTA, were intended to be resolved under the three tiered system described. Where the MTA had an affirmative claim, its Engineer was to present it to Appellant and then seek to resolve it. Failing a settlement, an appeal to the Administrator was provided for. If the Administrator affirmed the Engineer's position upon appeal, a written final decision was to be issued. This final decision was to be a condition precedent to any further appeal to the MDOT Board of Contract Appeals. Compare Titan Group, Inc., MSBCA 1135, November 8, 1983; Holly Corp., ASBCA No. 24975, 80-2 BCA ¶14,675.

The issue considered by the MTA Administrator in his final decision concerned the measure of quantum to which Appellant and JAB were entitled as a result of the construction shaft drawing approval delay. Whether an erroneous payment was made under change order 12 had no bearing on this determination and never was considered by the MTA Administrator. Accordingly, this issue contractually was not entitled to be raised as a counterclaim before the MDOT Board and, correspondingly, is not a matter within our jurisdiction.[48]

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[48]In creating this Board, the Legislature provided that:

> . . . all appeals pending before the Board of Contract Appeals of the Department of Transportation as of the effective date of this Act are transferred to the Maryland State Board of Contract Appeals. (Ch. 775, §22, 1980).

In its brief, the MTA further contends that its request for a credit under change order 12 is simply an affirmative defense in the nature of recoupment. For this reason, it submits that the Board has jurisdiction since both its regulations and those of the predecessor MDOT Board permit consideration of affirmative defenses.

While we appreciate the distinction made by the MTA and take notice of the practice in Maryland courts to permit such claims to be considered, we conclude that the contractual remedy agreed to did not contemplate an initial presentation of an unrelated issue before the Board, even if introduced in a defensive manner. Instead, all disputes were to be aired initially at the agency level so as to optimize opportunity for expeditious and inexpensive resolution. Failure to pursue dispute resolution in this manner operates as a bar to consideration by the Board.[49]

Even assuming, arguendo, that jurisdiction could be found, the MTA's counterclaim must fail. Change Order 12 was a bilateral modification to the contract executed, on behalf of the MTA, by its Administrator. It is uncontroverted that the MTA Administrator was the person authorized both to act contractually on behalf of the MTA and, pursuant to the disputes clause, resolve all disputes arising under the contract or relating to a breach of the contract. Although the terms of the modification, in retrospect, may not have been beneficial to the MTA, there are no grounds upon which to void the agreement and permit recovery of the money which allegedly was overpaid.

Like any contract document, a bilateral modification may be voided upon a showing of any number of factors such as mutual mistake, fraud, or

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Thus, the issues properly before the MDOT Board on July 1, 1981 were referred to us for resolution.

[49]This is not to say that claims which the procurement officer does not decide formally never can be raised as an affirmative defense at the Board. The test is whether the parties agree to litigate these claims initially at the Board, or whether the claims are related to the issues before the Board and essential to the resolution of the dispute under appeal. In a termination for default, for example, where the issue may involve whether a contractor could have completed its work within the contract period, all claims of government caused delay raised as affirmative defenses to the termination action properly would be before the Board.

misrepresentation of a material fact. Compare Maykat Enterprises, N.V., GSBCA No. 7346, 84-3 BCA ¶17,510. Where the government is a party, a modification also may be voided where the government agent or employee executing the agreement did not act within the scope of his authority. Foreman Industries, Inc., ASBCA No. 23948, 80-2 BCA ¶14,501.

In Foreman Industries, Inc., supra, the Armed Services Board of Contract Appeals ruled, at page 71,491, that:

> . . . when the Government makes an erroneous payment, whether through mistake of fact or law, those receiving the overpayments are bound to refund them and there is a corresponding obligation on the Government to seek recovery of such payments.

This is true even where the contracting (procurement) officer executes a modification agreeing to the payment of funds. A. Padilla Lighterage, Inc., ASBCA No. 17288, 75-2 BCA ¶11,406. The recovery of funds erroneously paid is not dependent upon express statutory or constitutional authorization. Instead the authority is inherent and the United States cannot be estopped from exercising it by the mistakes or unauthorized acts of its officers and agents. Commonwealth of Pennsylvania v. United States, 226 Ct.Cl. 444 (1981); DiSilvestro v. United States, 405 F.2d 150, 155 (2nd Cir. 1968), cert. denied 396 U.S. 964 (1969).

An erroneous payment, however, is one made as a result of an unauthorized agreement, or one not authorized by the terms of the parties' agreement. Maykat Enterprises, N.V., supra, at p. 87,212. Further, a procurement officer who pays money under a unilateral mistake of law or fact, is not, by necessity, acting in an unauthorized manner or contrary to the terms of the parties' agreement. Broad Avenue Laundry and Tailoring v. The United States [30 CCF ¶70,003, 681 F.2d 746 (Ct.Cl. 1982). In a contractual setting, the key is whether the disputed payment resulted from a procurement officer's settlement order. Compare Burnett Electronics Laboratory, Inc., ASBCA No. 23938, 80-2 BCA ¶14,618. If so, the government will be estopped to deny the contractual authority of its procurement officer to make the payment.

Assuming, without deciding, that the foregoing Federal principles relied upon by the MTA equally are applicable to contracts entered into by the State of Maryland, we proceed to evaluate the MTA's claim for repayment. First, the MTA does not allege that change order 12 was the result of fraud, misrepresentation or mutual mistake. Instead the MTA alleges that change order 12 is void because its Administrator acted under a mistake of fact, i.e., he believed that JAB's daily overhead rate actually was $489.20. The Administrator did not order an audit, nor did he apparently require the execution of a certificate of cost or pricing data.[50]

In Liberty Coat Company, ASBCA Nos. 4119, 4138, 4139, 57-2 BCA ¶1,576, the Government permitted its contractor to deviate from the contract specifications in return for a reduction in contract price. The resultant

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[50]There is nothing in the record to indicate that a certificate of cost or pricing data was mandated for modifications of the size and scope under discussion here.

modifications reduced the contract price but recognized only a fraction of the savings actually enjoyed by the contractor. The government subsequently sought to recover the additional savings not realized in the modifications by alleging that its contracting officer was only authorized to operate in a non-negligent manner. The Board rejected the claim as follows:

> . . . Under the terms of the standard "Changes" article of these contracts, and procurement regulations, the contracting officer had clear authority to make changes in the specifications of the contracts. Upon doing so he was specifically charged with the responsibility of determining whether the change caused "an increase or decrease in the cost of * * * this contract * * *," and, upon such a determination, the clause continues, "an equitable adjustment shall be made in the contract price * * * and the contract shall be modified in writing accordingly." The Government's argument, reduced to its lowest common denominator, is that while the contracting officer had authority to make a good bargain, he had no authority to make a bad one. We are unable to accept such an argument. It confuses the contracting officer's authority to act with the judgment displayed by him in performing the act. It seeks to measure authority by the results obtained upon its exercise. Counsel has not cited, and we have been unable to find, any cases supporting this method of measuring authority.

In negotiating change order 12, the MTA Administrator apparently elected not to expend time and perhaps public funds to audit JAB's claim for extended overhead. Acting upon the advice of his technical personnel who negotiated on his behalf, the Administrator accepted JAB's daily overhead rate as reasonable. This was an exercise in judgment. Clearly, the MTA Administrator was authorized to settle disputes in this manner and was not otherwise constrained by law or regulation to first determine the actual daily overhead being incurred. Accordingly, the modification is legally binding and the MTA is not entitled to the credit sought.

G. Interest

JAB asked for interest on that portion of the equitable adjustment still owed it by the MTA. No evidence of actual borrowings or applicable interest rates was adduced. Nevertheless, both predecision and post decision interest is allowable where the Board determines that it is necessary to permit the contractor to recover the entire cost of performing changed work. Maryland Port Administration v. C. J. Langenfelder & Son, Inc., 50 Md. App. 5258, 543 (1982); Granite Construction Company, MDOT 1014, December 20, 1983, at pp. 59-61.

Post decision interest is payable from the date of this decision at the legal rate of 6% simple interest. Md. Port Administration v. C. J. Langenfelder & Son, Inc., supra, at p. 546. Predecision interest, however, is more difficult to assess.

In determining when predecision interest should begin to run, we consistently have attempted to ascertain when the State was in a position to know the details of the claim and the extent of the equitable adjustment being requested. From this point, we add a reasonable period for review and processing of the claim, thus arriving at a date when the claim theoretically

became liquidated and the obligation to pay actually arose. Compare C. J. Langenfelder & Son, Inc., MDOT 1000, 1003, 1006, August 15, 1980, at pp. 32-34.

By letter dated February 4, 1980, JAB submitted its revised claim to the MTA Administrator in the amount of $160,688.17. (Appeal File, Tab H, p. 1). Although the claim package is not before us, it is evident that the claim was structured in the same format as ultimately presented in these proceedings. See App. Response to Proof of Cost dated May 27, 1981. Accordingly, we conclude that the MTA was sufficiently apprised of JAB's claim as of February 4, 1980 to enable it to audit and review the methodology. Allowing 67 days[51] for this purpose and another 30 days to process payment, we conclude that the MTA should be liable for interest from May 13, 1980.

Given the high prevailing interest rates existent in the period from 1980-1984, we conclude that the 6% legal rate is insufficient to compensate JAB for the loss of use of its funds. Without benefit of any evidence as to the appropriate interest rate, we conclude that a rate of 10% is fair and reasonable. Compare Granite Construction Company, supra, at pp. 59-61.

III. Conclusion

On the basis of the foregoing, we find that Appellant and JAB are entitled to the following equitable adjustment:

Direct Costs	0.00
Loss of Efficiency	21,320.64
Extended Overhead	18,669.00
Escalation	1,359.45
Standby Costs	9,245.50
Subtotal	$50,594.59
Less funds received under Change Order 18	(33,909.00)
Total	$16,685.59

Predecision interest totals 1633 days at $4.57 per day, or $7,462.81. The total equitable adjustment due, therefore, is $24,148.40. Post decision interest at 6% per annum, or $3.97 per day, shall accrue from this date until payment of the amount found due under this decision.

[51]In the Board's Order On Proof Of Costs, the MTA was given 60 days to audit and respond to JAB's proof of costs. After requesting an extension, the MTA ultimately filed its response 67 days after receipt of JAB's quantum claim.