BEFORE THE
MARYLAND STATE BOARD OF CONTRACT APPEALS

Appeal of GRANITE CONSTRUCTION COMPANY	)	
	)	Docket No. MDOT 1014
Under MTA Contract No. NW-04-04	)	

December 20, 1983

Specifications - Implied Warranty - When specifying the use of Formex spacers to support and align conduits, the Mass Transit Administration (MTA) impliedly warranted that they were adequate to withstand the surface loads expected to be encountered in constructing the work.

Specifications - Implied Warranty - Where specifications contained a composite of design and performance requirements, it was necessary to test each portion of the specification to ascertain responsibility for an inadequate result. Here the inadequate result was due to a defect in the design specification resulting in a constructive change.

Specifications - Implied Warranty - Where the contractor deviated from the MTA's design for the support of electrical conduits, it was not precluded from recovering the costs of correcting the support where failure of that support system resulted from a defective element of the MTA's design which was relied upon by the contractor.

Constructive Change - A breach of the implied warranty that the MTA's design specifications were adequate for the purpose intended rendered the MTA liable under the contract "Changes" clause.

Contract Interpretation - A contractor was found to have reasonably interpreted the contract so as not to require the enclosure of electrical conduits in a protective plywood box.

Contract Interpretation - The MTA was unable to demonstrate a contemporaneous interpretation as to the required installation of a plywood box for protective purposes.

Constructive Change - The directive to enclose electrical conduits in a plywood box constituted a constructive change to the contract.

Jurisdiction - The Board had jurisdiction to consider the contractor's claim for the costs of resupporting electrical conduits because (1) the claim was presented to and addressed by the MTA procurement officer and (2) the claim properly was raised in Board proceedings in such a manner so as to avoid surprise and permit the MTA to prepare a defense.

Equitable Adjustment - Actual Costs - Where the MTA was able to demonstrate that the actual costs incurred by the contractor in performing changed work were unreasonable, the Board rejected such costs as a measure of the equitable adjustment due the contractor.

Equitable Adjustment - Jury Verdict - Where the parties presented conflicting estimates as to the reasonable cost of work performed, the Board used a jury verdict approach to weight the probative value of cost estimates and arrive at a decision as to the amount of the equitable adjustment due the contractor.

Equitable Adjustment - Theft of Materials - A percentage factor estimated as the value of materials lost to theft was considered by the Board to be unreasonable and not includable in the equitable adjustment due the contractor.

Equitable Adjustment - Field Overhead - A contractor was entitled to additional field overhead costs as part of its equitable adjustment. These costs were computed based upon the percentage relationship of field costs on the project to direct contract costs. The percentage obtained was multiplied by the direct costs of the changed work to obtain the allocable field overhead costs. The actual percentage rate requested, however, was reduced to correct for certain overhead costs which already had been included fully in the contract price.

Equitable Adjustment - Home Office Overhead - The contractor likewise was permitted to recover, as part of an equitable adjustment, home office overhead costs. These costs were computed by determining the ratio of the contractor's home office expenses to total project costs for the time period appropriate to the changed work. This percentage was applied to the direct costs of the changed work to ascertain allocable home office expenses.

Equitable Adjustment - Subcontractor Costs and Markups - A subcontractor's actual overhead costs were accepted as reasonable since they were unchallenged by an MTA audit. The prime contractor was limited, however, to a 10% commission on subcontractor costs and was not entitled to the full overhead and profit markups applied to its own work.

Equitable Adjustment - Interest - The contractor was entitled to predecision interest as an element of its equitable adjustment. Post decision interest, at the statutory rate, likewise was assessed.

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OPINION BY CHAIRMAN BAKER

This timely appeal is taken from a decision issued by the Maryland Mass Transit Administrator denying Appellant's claim for an equitable adjustment for work performed in realigning and separating electrical conduits and, thereafter, enclosing these conduits in a plywood box. The Mass Transit Administration (MTA) contends that the conduit spacers required by the contract improperly had been installed by Appellant's subcontractor, thus resulting in their collapse under earth, traffic and equipment loads. Further, Appellant allegedly was obligated contractually to protect the electrical conduits and represented that it would do so by enclosing them with plywood. Both entitlement and quantum issues are before the Board.

I. Findings of Fact - Entitlement

A. Introductory

On May 17, 1978, Appellant was awarded the captioned contract in the amount of $36,283,000. The contract involved the construction of a segment of the Baltimore Region Rapid Transit System to include the Laurens Street Station and portions of twin tunnels running south to the Bolton Hill Station and north to the North Avenue Station. This work was to be performed, almost entirely, beneath Pennsylvania Avenue in downtown Baltimore.

The Laurens Street Station, accompanying vent shafts, and a tunnel shaft at the intersection of Pennsylvania Avenue and Gold Street (Gold Street shaft) were to be constructed using "cut and cover" methods. This involved stripping away, i.e., cutting, the existing street surface at Pennsylvania Avenue and excavating to a depth of approximately 100 feet where construction of the station structure was to commence. The excavation was to be covered by timber decking in order to permit traffic to utilize Pennsylvania Avenue during this lengthy construction process.

In performing work of this type, it is necessary to support the existing utilities (water, gas, sewer, telephone, electrical lines, etc.) which commonly run beneath the street surface. This support must remain in place until construction of the subsurface structures is complete and earth is backfilled to the elevation of the utilities. The present dispute involves the protection and support of primary and distributive electrical conduits running through the Laurens Street Station area and providing power for nearby businesses and the subway project.

B. Relocation and Support of Electrical Conduits - General

At the outset of the project, existing electrical service in the contract area was furnished by a conduit system running beneath and along the west side of Pennsylvania Avenue. In drafting the contract, however, the MTA recognized that these existing conduits would obstruct the installation of the soldier piles necessary to support both the street decking and excavation. Accordingly, the contract was written to require the establishment of new electrical service along the east side of Pennsylvania Avenue so as to permit the abandonment of the obstructing facilities.

The electrical service was one of a number of utilities on both sides of Pennsylvania Avenue which required relocation prior to the driving of soldier piles and the installation of street decking. Complicating matters, the contract further mandated that half of Pennsylvania Avenue be maintained for traffic during most of the day.[1] For this reason, it was necessary to perform the utility work in stages. With regard to the electrical service, the staging of the work required that the new conduits be constructed along the east side of Pennsylvania Avenue and then backfilled with earth so as to permit the street surface to be temporarily restored. (Tr. 264, 274). Thereafter, when the remainder of the utility work beneath Pennsylvania Avenue was complete, the temporary street surface was to be replaced by street decking and full scale excavation was to proceed. As the excavation reached the backfilled electrical conduits, they were to be uncovered and supported from the decking system above.

C. Details of Proposed Electrical Conduit and Support System

Two new electrical duct banks were to be installed by Appellant's subcontractor, Truland Corporation, under the east side of Pennsylvania Avenue. (Tr. 318-319). Each duct bank was to house from eight to ten conduits[2] through which electrical cables eventually were to be pulled and routed by the Baltimore Gas & Electric Company (BG&E). (Tr. 28-29).

Although the new electrical conduits ultimately were to be encased in concrete, the contract specified the use of direct burial conduit so as to minimize the potential for damage to the system during the period of temporary backfill. (Tr. 37, 256). The contract also required the use of Formex spacers, or their equivalent, to maintain spacing and alignment of the conduits and further to provide independent support for the conduits under earth loads.

With regard to the method of supporting the conduits during the excavation and construction phases of the work, contract drawing U-53 specified the following:

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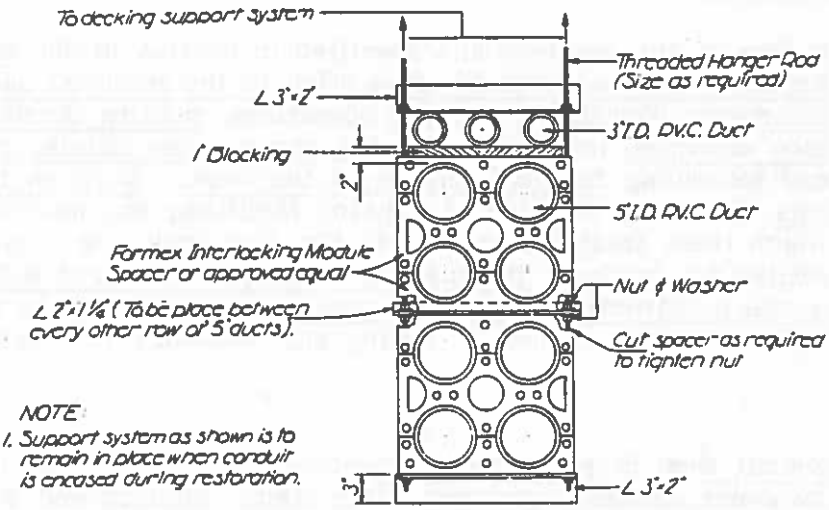
[1]See contract drawings G-11-1 and G-12-1 (sheets 11 and 12).
[2]The conduits used here consisted of PVC plastic pipe of varying diameters designed to protect electrical lines from damage. (Appeal file, Tab IV(17)).



CONDUIT SUPPORT DETAIL

NOT TO SCALE

Appellant utilized this conduit support detail in preparing its shop drawing of the planned installation. This shop drawing (#GU-10) was submitted to the MTA Resident Engineer on June 29, 1978 and, later, was rejected for reasons unimportant to this dispute. (Tr. 290, Exh. B). The shop drawing ultimately was resubmitted for approval on August 3, 1978 and was approved on October 10, 1978. (Tr. 295; Exh. C; Tr. 298).

The approved shop drawing essentially depicted the conduit support detail shown on contract drawing U-53. It further specified that the hanger supports were to be fastened to the steel deck beams at 12 foot centers and that one inch diameter hanger rods were to be used. Additionally, the entire system was to be encased in 1/2" plywood with banding iron for support. (Tr. 296-298, Exh. C).

D. Contractual Requirement For and Significance of Shop Drawings

Section 02550 of the contract Special and Standard Provisions contains specifications for " . . . the maintenance, support, protection, relocation, reconstruction and adjusting-to-grade, restoration, construction of new facilities and abandonment of existing utilities affected by the construction work." Under this section of the contract Special Provisions, Appellant was required to submit drawings[3] and calculations as follows:

[3]The term drawings refers to shop or working drawings. "Shop Drawings shall consist of fabrication, erection and setting drawings, schedule drawings, manufacturer's scale drawings, wiring and control diagrams, cuts of entire catalogs, pamphlets, descriptive literature, and performance and test data. Working Drawings shall be accompanied by calculations or other sufficient information to completely explain the structure, machine or system described and its intended manner of use." (Standard Specification Section 01300, ¶

1.02 Submittals

A. In lieu of the requirements specified in Section 01300, submit to Engineer, not less than 60 days prior to the intended date to commence operations, working operations, working drawings and shop drawings, in [sic] applicable, showing the details, procedure and scheduling for performance of the work. Show on the drawings the actual location of existing facilities; any interferences which these facilities present to the new work, the location of settlement markers; the method proposed to proceed with the actual construction; details of proposed support system; and, if, applicable, the method of testing and procedure for restoration.

* * *

F. Submit shop drawings for all temporary support and protection of manholes, conduits, gas and water mains, sanitary and storm sewers, utility house connections, temporary street lights and Transit and Traffic facilities required during temporary support within cut and cover areas. Submit computations to justify selection of details and methods of attachment to excavation support and decking systems. (Underscoring added.)

As further set forth in Section 01300 of the contract Standard Specifications, "[w]hen Shop and Working Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer." See para 1.03 B(10).

E. Actual Installation of Conduit Support System

Truland Corporation began installation of the electrical conduits in August 1978, prior to the approval of Appellant's shop drawings. The support system was installed concurrent with the conduits and spacers. In this manner, it would become possible thereafter simply to extend and attach the hanger rods to the decking system as soon as the re-excavation operation reached the top of the duct banks. (Tr. 42). Contrary to the representations contained on the shop drawings, however, Truland installed 3/8" threaded hanger rods at seven foot centers and did not install the steel angles between every other row of conduits. (Tr. 305). Additionally, plywood was not utilized to enclose the duct banks.

Although Appellant admits that it originally had planned to construct a plywood enclosure as protection during the temporary backfill phase of its work,[4] closer scrutiny of this approach led it to become concerned over the

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1.03 B.(1).

[4]Contract Special Provision Section 02550, ¶3.09 A(3) mandated that "[a]dequate structural protection shall be provided conduit installations that are temporarily backfilled prior to completion of the street decking system." This requirement influenced Appellant to originally propose the plywood enclosure. (Tr. 87-88).

integrity of such a structure under heavy earth, traffic and equipment loads. Specifically, it was feared that the plywood enclosure would have created a void in the subsurface only a few feet below the street level which, in turn, could have resulted in a collapse of the plywood and damage to the conduit system. (Tr. 89).[5] For this reason, it was suggested to the MTA Resident Engineer that plywood not be installed and that sand be used to backfill around the duct banks, thereby providing a more stable support. (Tr. 91-92). The MTA Resident Engineer approved this change in August 1978. (Tr. 34, 300).

F. Evolution of Claim

The electrical conduits were re-exposed during the period from March - May 1979. (Tr. 40). At this time, it was learned that most of the Formex spacers had been crushed and that some of the conduits had been damaged. (Tr. 40). The damaged conduits immediately were replaced by Truland at no cost to the MTA. Spacing of the conduits, however, was not corrected at this time in view of Appellant's belief that the failure of the Formex spacers was caused by a design defect. (Tr. 41).

Appellant began connecting the conduit hanger support rods to the decking system on April 23, 1979. (Appeal file, Tab IV(15)). In early June 1979, Mr. Edward Krause, the BG&E coordinator for the captioned contract, visited the site and observed that the support system for the conduits had not been installed in accordance with the approved shop drawings. (Tr. 390). Mr. Krause met with the MTA Resident Engineer and Appellant's Project Manager on June 12, 1979 and discussed these discrepancies as summarized in the following pertinent paragraphs of the MTA minutes of this meeting:

> 4. Baltimore Gas & Electric expressed their concern over the fact that much of the electrical duct system has been hung -but [sic] not in accordance with the approved shop drawings. The primary discrepancies were pointed out as:
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> a. ducts are hung from timber stringer[6] instead of from the deck beams
> b. ducts are not encased in plywood
> c. ducts do not have required horizontal angle supports at each support location

[5]In November 1976, during the design of this contract, BG&E's Carroll Barnes registered the same concern. (Exh. 4, ¶ A.1.).

[6]Timber stringers, each six inches square, were suspended above the conduits from the bottom flange of the deck beams. (Appeal file, Tab IV (23)).

5. Granite presented calculations backing up the use of timber stringers and pointed out that the ducts was [sic] supported more often than called for in the shop drawings. Granite stated that the plywood encasement was meant as protection during backfilling operations and, therefore, because DB conduit was used, the plywood encasement was not necessary.

6. Baltimore Gas & Electric will begin review of the calculations backing up the use of timber stringers while awaiting formal submittal through the Construction Manager's Organization. BG&E stated that the plywood encasement is necessary for protection of the conduits while they are supported.

7. Baltimore Gas & Electrical requested that, while they review the Contractor's calculations on timber stringers, and any other resubmital [sic] the Contractor chose to make, the Contractor [should] begin immediately to modify the in place support system to meet the requirement of the approved shop drawings.

8. The Resident Engineer's Office will study the situation with the assistance of Technical Services personnel and notify all parties as to their decisions in regards to immediate actions to be taken.

(Appeal file, Tab IV(19)). Although not summarized above, BG&E further raised the possibility of installing a plank bottom in the plywood enclosure to lend support for future cable pulling operations. (Tr. 396; Appeal file, Tab IV(2)).

On June 15, 1979, the MTA's Utility Engineer verbally was instructed by BG&E representatives to direct the installation of a 2" plank bottom in the plywood enclosure required for protection of the conduits. (Appeal file, Tab IV(32)). In subsequent meetings with BG&E, the MTA further was told that additional bracing was desired so as to permit cables to be pulled through the conduits while they were being supported from the deck beams. (Appeal file, Tabs IV(15, 34)). However, on July 26, 1979, BG&E agreed to accept a plywood structure without the plank bottom or additional supports. (Appeal file, Tabs IV(32, 15)). On this same day, the MTA Resident Engineer directed Appellant to:

1. Correct the spacing between ducts where spacers have been crushed. Two inch blocks located adjacent to the existing spacers is a suggested method. Advise us as to the method you propose to use.

2. Provide the plywood enclosure as indicated by your approved shop drawing No. GU-10.

(Appeal file, Tab IV(3)). These directives were amended by letter dated August 8, 1979 so as to require plywood protection for the primary and distributive conduit runs only. (Appeal file, Tab IV(6)). Appellant immediately notified the MTA Resident Engineer that it considered the foregoing directives to be a constructive change to the contract and later submitted a request for a change order in the amount of $286,097.41. (Appeal file, Tabs IV(4, 7&8)). This change order request was limited to Appellant's increased

direct costs and the applicable markups thereon. Appellant reserved the right to claim added costs stemming from delays to the project and/or acceleration. The change order request was denied by the MTA Resident Engineer by letter dated October 15, 1979. (Appeal file, Tab IV(10)).

Although BG&E and MTA representatives also had expressed concern as to the size of the hanger rods and the use of timber stringers rather then deck beams for support, Appellant was able to justify the structural integrity of its installation. In this regard, calculations and drawings were submitted during the June 12, 1979 meeting establishing that the timber stringers and hanger rods could sustain the loads imparted by the electrical conduits. (Appeal file, Tabs IV(22, 23, 24)). These calculations and drawings were approved on September 12, 1979. (Tr. 313). Because the foregoing submittals did not contemplate the use of a plywood box for protection, however, Appellant was required to augment its calculations to establish the sufficiency of the support system upon installation of the plywood box. (Appeal file, Tab IV(34); Tr. 311). This was accomplished on or about September 19, 1979 and approval was given on October 10, 1979. (Appeal file, Tabs IV(25, 28)). Work began on the installation of new spacer blocks and the plywood protective box on September 6, 1979, prior to the approval of Appellant's revised shop drawings. (Exh. 1, Sch. 1.1).

A hearing was conducted on the foregoing dispute by the MTA Administrator on December 20, 1979. Appellant supplemented its oral presentation by letter dated January 10, 1980. (Appeal file, Tab IV(16)). After consideration of the facts presented to him, the MTA Administrator denied Appellant's claim, in its entirety, by final decision dated April 16, 1980.

G. General Contractual Requirements for Performance of Utility Work

Paragraph 3.01A of Section 02550 of the contract Standard Specifications required Appellant to "[c]onform to the specifications and standard practices of the affected utility owners." During the hearing, BG&E's Mr. Krause testified that it was not the standard practice of his company to require temporary plywood protection around electrical conduits. (Tr. 408). Contract General Provision Section 7.17, however, required that "[a]t points where the Contractor's operations are adjacent to properties of railway, telegraph, telephone, and power companies, or are adjacent to other property, damage to which might result in expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made by the Contractor."

H. Description of Structural Items In Dispute

Although the MTA initially voiced concern over the sizing of the hanger rods and adequacy of the timber stringers for support of the system, these elements ultimately were approved for use. What remains in dispute is the sufficiency of the Formex spacers and the need for plywood encasement. These two elements are described below.

1. Formex Spacers

The conduit support detail shown on contract drawing U-53 indicated that the electrical conduits were to be separated by a Formex interlocking

module or approved equal. Appellant chose the Formex spacer for its operation and submitted manufacturer's catalog cuts for approval by the MTA Resident Engineer. (Appeal file, Tab IV(17)). These catalog cuts represented that the Formex spacer was designed to separate conduits accurately and maintain alignment thereof so as to reduce resistance when cables are pulled through the conduits. The spacers further were said to be appropriate for use in the concrete encasement or direct burial of the electrical conduits.

Formex spacers are made from high density polyethylene and their strength is said to be unaffected by extremes in temperature. The spacers snap together around electrical conduits and may be secured by a reinforcing bar or, in this instance, by the use of "all thread" rods placed through each side of the stacked units. Holes in the spacers permit the flow of concrete around the support system so as to preclude the formation of voids in the encasement process.

Formex spacers further are designed to support independently each of the conduits enclosed. Vertical loads are transmitted through the columnar structure of the spacers and not through the successive duct tiers. As a result, excessive weight is not transmitted to the lower level conduits thereby avoiding their deformation or breakage.

The strength of the Formex spacers when buried was not indicated in the manufacturer's catalog as being dependent upon the use of steel angles or other support between every other tier of conduit. However, the catalog cautioned that the spacers could be broken under very heavy equipment loads. Sample specifications prepared by the manufacturer further indicated that the spacing of supports should depend upon " . . . [s]oil conditions, type and sizes of duct to be used, foreseeable loads, etc. . . . " As a general guide, for plastic duct of the size used here,[7] a minimum of three spacer locations was recommended for each 20 foot length of plastic duct.

A substantial number of the Formex spacers placed by Truland indisputably were crushed while backfilled. During this time, heavy construction equipment was operating on the street surface above the electrical conduits for the purpose of driving soldier piles and installing street decking. (Tr. 306). Further, only a thin layer of paving had been placed over the backfill in view of the temporary nature of the street restoration. (Tr. 306). These factors were identified by the MTA Resident Engineer as being contributory to the spacer failures. The MTA's Resident Engineer also testified that the crushing of the Formex spacers could be attributed both to Appellant's inability to compact the soil properly around the conduits and to the omission of the specified steel angles between every other row of conduits.

BG&E's Mr. Barnes testified that his office, in consultation with Mr. Edward Krause, had designed the support detail appearing on contract drawing U-53 because of concern over the need to "support" the conduits. (Tr. 261). As testified to by Mr. Krause, the support detail was not intended to depict the protection necessary during backfill. (Tr. 388). Instead it was intended to describe the support of the system when suspended from the street decking during the period of excavation for the Laurens Street Station. Consistent

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[7] Appellant used plastic conduit pipe of varying sizes up to 5" in diameter. (Appeal file, Tab IV(17)).

with this testimony, Mr. Barnes testified that the conduit support detail was adapted from a design commonly used to suspend conduits from the underside of bridges rather than one used to protect buried conduits. (Tr. 261).

Regardless of what may have been the intended use of the conduit support detail, however, BG&E's Mr. Barnes further testified as to his belief that the middle steel angle, if installed, would have taken weight off of the lower spacers and conduits and increased the structural strength of the system. (Tr. 260-62). Without the middle angle, Mr. Barnes concluded that higher loading densities possibly could have contributed to the collapse of the lower spacers. (Tr. 262).

In response to Mr. Barnes' assertion, Appellant's Mr. Anderson testified that the middle steel angles would not have assisted the spacers in resisting loads. This is because both the top and bottom angle supports were to be fastened by a single nut and washer to the "all thread" hanger rod. The required positioning of these nuts was such that the top steel angle would not have been restrained from pushing down on the top spacer and the bottom steel angle would not have been restrained from pushing up on the bottom spacer. See contract drawing U-53. The foregoing was said to be significant since when loads were transmitted to the conduit system from the street surface, they were resisted by an equal, opposing force applied by the earth to the bottom steel angle. Given that there was nothing other than the spacers to restrain the movement of the top and bottom steel angles towards each other, the vertical earth and traffic loads, in effect, were being transmitted directly to the top and bottom spacers. The only thing preventing the duct bank from crushing under these circumstances was the integrity of the spacer units themselves. Therefore, whether the spacers internally were pressing against each other or a stationary middle steel angle, they had to be capable of withstanding the full vertical load being imparted to them by the backfill, traffic and equipment above. (Tr. 530-534). If they could not, this would be evidenced by a uniform crushing of both the top and bottom spacers. This, according to Mr. Anderson, is what occurred. (Tr. 534).

After considering the foregoing evidence, we conclude that the middle steel angles, required as part of the MTA support design, would not have absorbed or better helped to distribute any of the earth loads transmitted from the surface. Mr. Anderson's testimony convincingly demonstrates that the equipment loads from the street surface and the resulting passive pressure from the earth below would have been imparted directly to the Formex spacers. It was essential, for this reason, that the polyethylene material, on its own, be able to withstand such forces. The manufacturer's caveats as to the possibility of breakage and the need to place the spacers at proper intervals also were consistent with Mr. Anderson's testimony that both the top and bottom tier of spacers would crush if forced to absorb extreme vertical loads.

The record does not indicate that any problem existed with regard to the installation of the Formex spacers. While there initially was an objection as to the degree of compaction being obtained by Appellant's forces when backfilling the conduits, Appellant's practices were improved shortly after the MTA Resident Engineer voiced displeasure. (Tr. 324). This inadequacy, therefore, could not have been the cause of such widespread failures as occurred here.

2. Plywood Enclosure

Neither the conduit support detail depicted on contract drawing U-53 nor any other contract provision expressly requires the plywood encasement of electrical conduits. (Tr. 403, 426). The directive to enclose the electrical conduits in plywood was premised entirely upon contract General Provision GP-7.17. (Supra, pp. 10-11). This contract provision generally imposed a duty on Appellant to protect utilities from damage which ". . . might result in expense, loss, or inconvenience." Although BG&E's representatives testified that they originally had requested the MTA to specify a plywood enclosure for the electrical conduits, it ultimately was decided by the MTA to leave the method of protection up to the contractor. (App. Exh. 4; Tr. 427; Tr. 404; Tr. 263).

Appellant's witnesses testified that a form of protection dedicated to the conduit system alone was unnecessary. In July 1979 when the directive to install a plywood enclosure was given, all of the suspended utilities were covered by 12" thick timber deck mats and the excavation work was proceeding 50 feet below. The conduits and other utilities thus were said to be isolated and safe from the dangers otherwise inherent in a construction project.

Appellant's witnesses admitted that rock was encountered when excavating approximately 60 feet below the surface and that this rock had to be blasted with explosives in order to remove it. (Tr. 54). Appellant's Mr. Anderson, however, testified that the conduits were not endangered by this blasting operation since protective mats were placed above the blasting area. (Tr. 54). These mats were constructed of heavy woven rubber and customarily were stretched beyond the blasting area. (Tr. 534, 314). Appellant's Mr. Facchia also testified that even if it was possible for a rock fragment to be projected above the blasting mat, the plywood would not have been capable of deflecting it since it did not have structural strength. (Tr. 197-98).

BG&E insisted on plywood protection because of concern over potential damage caused by the raising and lowering of materials into the excavation from the surface. (Tr. 257). Appellant's general practice, however, was to utilize its vent shafts at each end of the station to raise and lower equipment and materials. (Tr. 537). Whenever it was necessary to lift a deck mat to move supplies and equipment into the interior of the station construction, Appellant did so in an area where utilities did not pose an obstruction. (Tr. 537, 335). The MTA Resident Engineer, while confirming Appellant's practice in this regard, did caution that the existence of various utilities under both sides of Pennsylvania Avenue provided only a limited clearance when attempting to move bulky equipment and supplies through the decking. (Tr. 335).

As to the use of blasting mats, the MTA Resident Engineer questioned their effectivensss to control all rock shot from the blasting operation. (Tr. 314). The Resident Engineer further testified that blasting mats, in his experience, had a tendency to lift from the effects of the blast, thereby permitting rock projectiles to escape. (Tr. 314). The Resident Engineer[8] did

[8]The MTA Resident Engineer during the evolution of the claim was Mr. Horace Carmichael. Mr. Carmichael left the job sometime prior to the blasting

not observe the blasting operation on this project, however, except with regard to the Gold Street shaft excavation. (Tr. 349). It was this observation which served as the basis for his opinion. (Tr. 349). The Resident Engineer also acknowledged that there were differences between the blasting operations at the Gold Street shaft and the Laurens Street Station and, for this reason, could not state with certainty whether vertical projectiles were probable in the latter operation. (Tr. 350).

Appellant's Mr. Anderson contrasted the Gold Street shaft excavation with the operation at the Laurens Street Station as follows:

> . . . Gold Street was a circular shaft being driven down and the technology or the blasting technology in driving a circular shaft was to create a blast to raise, to bring it up in the center. Intentionally trying to induce a vertical movement of the rock. [sic] That would lead one to see more fly rock, more vertical projectiles. As well, the blasting mat covering that takes place in the shaft, you have square blasting mats trying to contain a circular area and it is difficult to have the blasting mats cover completely all of the rock that is being shot especially on the outside edges.
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> . . . The blasting method at the station was such that we had a vertical face in which to direct our blast, a plateau, if you will, that we would be drilling on top of the plateau and putting off our first shots along the edge of the plateau causing it to move the rock horizontally rather than trying to move it vertically. (Tr. 535-36).

Although the MTA Resident Engineer testified that he observed vertical rock projectiles which reached the surface at Gold Street, there was no testimony concerning such an occurrence in the Laurens Street Station area.

The MTA Resident Engineer also testified that the plywood would help protect against damage to the conduits caused by vibratory equipment employed in the backfill operation. (Tr. 316-17). BG&E's Mr. Krause likewise listed this as a source of concern. (Tr. 401). However, whenever electrical conduits are installed, the earth must be compacted around them. Nevertheless, the standard practice of BG&E in constructing duct banks below ground is not to utilize plywood enclosures for protection. (Tr. 408-09). Mr. Krause, in fact, could not recall any other situations in 30 years of experience where the plywood encasement of electrical lines was required. (Tr. 409). It is clear, therefore, that the special circumstances involved in subway construction, requiring operations and blasting beneath the exposed conduits, fostered BG&E's desire for the plywood protection. While plywood indeed may have offered some degree of protection against the careless use of hand tamping equipment, we find that the express requirement for such an expensive installation would not reasonably have been gleaned either from contract General Provisions G.P.-7.16[9] or G.P.-7.17. Put another way, there

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operation.

[9]G.P.-7.16A. provides, in pertinent part, that the "... the Contractor shall have the charge and care thereof and shall take every reasonable precaution against injury or damage to any part [of the work] thereof by the action of

was no evidence that the normal compaction of earth beneath the conduits could be expected to result in a loss of electrical service or inconvenience to BG&E due to severed cables or broken conduits and therefore necessitate plywood protection.[10]

II. Decision - Entitlement

A. Respacing of Conduits

The crushing of the Formex spacers indisputably necessitated corrective action by Appellant's subcontractor. In this regard, Appellant contends that it is entitled to recover for this work since the contractually specified Formex spacers were inadequate to withstand the traffic and equipment loading encountered during the decking installation. The MTA maintains that the spacer claim is not an issue in this appeal and, in the alternative, that the spacers were crushed as a result of Appellant's failure to install certain steel angles and properly backfill the conduit support system.

Although the MTA indicates in its counterstatement of costs (Exh. G, p.3) that it does not consider the respacing of the conduits to be part of the dispute before the Board, it neither has attempted to explain its position nor otherwise has moved to strike testimony pertaining to this issue. For the following reasons, we conclude that the respacing claim properly is before the Board and that the MTA is not prejudiced by our consideration thereof.

In determining whether an issue may be considered, the Board generally is faced with two questions. First, does the issue involved flow from the claim or claims decided in the particular procurement officer's final decision serving as the vehicle for appeal. Second, has notice of that issue properly been given so as to avoid surprise and permit opposing counsel to prepare a defense. In this instance, both of these questions may be answered in the affirmative.

The instant appeal results from the MTA Resident Engineer's July 27, 1979 directive to (1) correct the spacing between conduits where spacers were crushed and (2) provide a plywood enclosure for the conduit system. (Appeal file, Tab IV(3)). Appellant immediately filed a claim with the Resident Engineer premised upon both aspects of the directive. (Appeal file, Tab IV(4)). The Resident Engineer acknowledged receipt of Appellant's claim and assigned it a single change notice number for purposes of internal reference and control. (Appeal file, Tab IV(5)). Thereafter, Appellant submitted a unified cost proposal addressing both the spacing claim and plywood box claim and the MTA Administrator proceeded to consider these claims as an entity.

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the elements, or from any other cause, whether arising from the execution or from the non-execution of the work...."

[10]The only compaction in the vicinity of the exposed conduit would have been in the area up to six inches below. (Tr. 210). At this point, the conduits were to have been encased in concrete.

(Appeal file, Tab IV (8, 12, 15, 16)). As further testified to by the MTA Resident Engineer, the re-establishment of conduit spacing always was considered as part of the claim involving conduit protection. (Tr. 528).

Appellant's complaint in the captioned appeal alleged that additional work was required as a result of the directive to re-establish conduit spacing. (Complaint, ¶ 21). In a memorandum to the Board submitted prior to the first prehearing conference, Appellant again indicated that an issue existed as to the adequacy of the Formex spacers. This issue, however, was not included by the Board in its statement of the issues prepared at the initial prehearing conference of September 18, 1980. Whatever the reason for this omission, the Board is satisfied that it did not stem from any agreement between the parties that the Formex spacer claim would not be litigated. Further, the Board expressly stated at this conference that the listed issues could be broadened so long as adequate notice was provided opposing counsel.

Thereafter, Appellant submitted its statement of proof of costs pursuant to a Board Order. This statement included a subcontractor cost of approximately $5214 for the respacing work. At this point, or certainly during discovery, it should have been clear to the MTA that the spacer claim was being litigated by Appellant. The parties, in fact, each presented substantive evidence in this regard at the hearing and no objections as to jurisdiction, relevance or surprise were raised.

We now address the substantive matters raised by the spacer claim. Specifically, did the conduit support detail depicted on contract drawing U-53 represent a complete design for the support of the conduits and, if so, was it adequate for the period during which the conduits temporarily were to be backfilled.

When the State contracts for construction services to be performed in accordance with its own design specifications, there is an implied warranty that if those specifications are followed, a satisfactory result will be obtained. Dewey Jordan, Inc. v. The Maryland - National Capital Park and Planning Commission, 258 Md. 490 (1970); United States v. Spearin, 248 U.S. 132 (1918). There is no duty imposed upon the construction contractor, under such circumstances, to investigate whether the specified design indeed would produce the desired result. Compare R. M. Hollingshead Corporation v. United States, 124 Ct.Cl. 681 (1953).

A design specification simply is one which tells a contractor what to do and how to do it. This is distinguished from a performance specification which sets forth the desired result but vests responsibility for the design, engineering and implementation with the contractor. See generally, Monitor Plastics Company, ASBCA No. 14447, 72-2 BCA ¶9626. Here the specification was a composite of these two types in that the MTA did not specify the diameter of the threaded hanger rods or the precise spacing of the supports. These determinations were to be made by the contractor. Accordingly, it is necessary to test each portion of the specification to ascertain responsibility for the inadequate result. A. C. Doyle Company, ASBCA No. 15363, 71-2 BCA ¶9137.

We initially note that contract drawing U-53 required that the threaded hanger rods be attached to the decking support system. The decking support system consisted of soldier piles, cap beams and deck beams.[11] Since the deck

beams were the only members of the decking support system which extended over the excavation itself, the conduit support detail thus, in actuality, required that the hanger rods be attached to these members. Spacing of the deck beams was to be determined by Appellant based upon the design criteria set forth in contract Standard Specification section 02430, ¶1.02.[12] The resultant design placed these deck beams at 12 foot intervals. (Tr. 71). The hanger rods, and concomitantly the spacers which were part of the same assembly, thus contractually were to be installed at 12 foot intervals as well.

What the foregoing tells us is that Appellant's design responsibility solely was related to the structural adequacy of the decking system and the hanger rods necessary to support the conduits. As long as Appellant properly carried out this design responsibility, it had a right to rely upon the remainder of the MTA's conduit support detail as being adequate to withstand the loads expected to be encountered under temporary backfill.

Complicating matters here, however, is the fact that Appellant installed the support system in a manner different than was specified on either contract drawing U-53 or its own approved shop drawing GU-10. Instead of suspending the support system from the deck beams at 12 foot intervals the hanger rods were attached to timber stringers at seven foot intervals.[13] Further, the middle steel angle was omitted. The issue remaining, therefore, is whether the crushing of the spacers was caused by Appellant's failure to follow fully the MTA's design or by the inadequacy of that portion of the MTA's design upon which it relied. Put another way, did some defect in the contract specification, relied upon by Appellant, actually cause the spacers to crush. If so, Appellant may recover even though it deviated from the MTA's design. Robert Whalen Co., ASBCA 19720, 78-1 BCA ¶13,078 (1978); compare Gulf & Western Precision Engineering Co. v. United States, 211 Ct.Cl. 207, 543 F.2d 125 (1976).

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[11]Soldier piles are placed vertically along both sides of the excavation. Cap beams rest on top of the soldier piles and run parallel to the sides of the excavation. Deck beams run perpendicular to the sides of the excavation at intervals adequate to support timber deck mats and the traffic loads thereon. (Tr. 71).

[12]This section provided that the contractor shall be responsible for the design of all decking in compliance with the contract drawings and the following:

"A. Design for AASHTO HS20 loading, indicated earth pressures, utility loads and other applicable live and dead loads, including contractor's construction equipment.

"B. Design structural steel in accordance with Section 05120. Use ASTM A36 or ASTM A440 material.

[13]Although there was testimony concerning a directive by the MTA electrical inspector to install the supports at seven foot intervals, it is unnecessary, for purposes of this dispute, to determine whether this directive constituted an authorized change to the contract. See Tr. 330-31.

Here neither the resizing of threaded hanger rods nor the use of timber stringers had any affect upon the integrity of the conduit system when backfilled. This portion of the design pertained only to the support of the conduits when suspended during excavation. For reasons previously discussed in our findings, the same can be said for the middle steel angle. Its absence had no affect on the ability of the Formex spacers to withstand earth and equipment loads when buried. Although Appellant's installation of the Formex spacers at different intervals than contractually specified did affect the loading on each Formex spacer, we conclude that it did not contribute to the failure. In this regard, one does not have to be an engineer to understand that the earth and equipment loads on individual spacers would be reduced if the number of spacers was increased and the distance between them diminished.

In summary, we conclude that the failure of the Formex spacers was due solely to vertical loads which were greater than the spacers were capable of withstanding. When specifying the use of these spacers, the MTA warranted that they would be able to withstand the equipment loads necessary to install the decking system. Failure of the Formex spacers under such loads constituted a breach of this warranty and rendered the MTA liable under the contract "changes" clause.

B. Installation of Plywood Box

Appellant contends that the contract did not require plywood protection for the electrical conduits during the period when they were suspended from the deck beams. Our task, therefore, is to determine whether a reasonably intelligent contractor with knowledge of all the operative usages and knowing the circumstances prior to and contemporaneous with the execution of the contract would reach the same conclusion. Glassman Construction Co., Inc. v. Maryland City Plaza, Inc., 371 F. Supp. 1154 (D.Md. 1974); Granite Construction Company, MSBCA 1011, July 29, 1981 (rev. on other grounds, Cir. Ct. for Balto. City No. 82197713, Mar. 24, 1983); Restatement Contracts §230 (1932).

Contract General Provision GP 7.17, among other things, required Appellant to protect the electrical conduits where its operations might result in damage thereto and expense, loss or inconvenience. A method of protection, however, neither was depicted on contract drawing U-53 nor otherwise was specified in the contract. Further, it was not the prior practice of either BG&E or Appellant to enclose electrical conduits in a plywood box for purposes of protection. Accordingly, the contract cannot be read to mandate expressly the use of an enclosure as protection.

Even if a plywood enclosure expressly was not required by the contract, the MTA contends that the need for a plywood or other type of enclosure was implicit. However, a contractor cannot be required to exercise clairvoyance in determining its contractual responsibilities. Corbetta Construction Company, Inc. v. United States, 198 Ct.Cl. 712, 461 F.2d 1330 (1972). The State has an obligation to put its contractors on notice as to what it expects of them. Abe L. Greenberg Co., Inc. v. United States, 156 Ct.Cl. 434, 300 F.2d 443 (1962). Here the MTA has estimated the cost of

installing, maintaining and removing the plywood to be in excess of $40,000.[14] (Exh. G). While this may not be a substantial sum in relation to the contract price of approximately $36 million, it certainly is more than an incidental expenditure. Given that the conduits were to be suspended in the air, high above the construction activity and beneath 12 inch timber decking, and further given the absence of a trade practice requiring the enclosure of supported conduits, it was reasonable for a contractor, in submitting a competitive bid, to conclude that an enclosure or some other extraordinary protection was not necessary.

In support of this conclusion, we also note that GP-7.17 equally applies to all utilities in and around the construction site. Further, although the MTA included details of the means of support for the water mains, electrical conduits, gas mains and telephone conduits in the contract drawings, only the telephone conduit system expressly was required to be protected by plywood. See contract drawings U-37-1 (sheet 71), U-53 (sheet 87), U-61 (sheet 95), and U-64 (sheet 98). Thus, it likewise was reasonable for a contractor to conclude that where extraordinary protection was deemed necessary by the MTA during the utility support phase, the MTA would so specify explicitly.

Notwithstanding the foregoing, the MTA contends that Appellant actually interpreted the contract as requiring plywood protection for the conduits. This interpretation supposedly was evidenced by Appellant's submittal of shop drawing GU-10 showing a plywood enclosure around the electrical conduits. The shop drawing was entitled "Temporary Manhole & Conduit Support" and was intended, we are told, to apply to the support rather than the backfill phase of the work. The submittal of this drawing not only is said to be confirmative of the reasonableness of the MTA's interpretation of the contract, but also is considered by the MTA to be persuasive evidence of the true intentions of the parties at the time they entered into the contract.

The construction which the parties have placed on a contract by their acts and conduct may be resorted to in order to determine the real meaning of an ambiguous, doubtful, or obscure contract. Granite Construction Company, MDOT 1012, December 5, 1982; Della Ratta, Inc. v. American Better Community Developers, Inc., 38 Md. App. 119 (1977). This secondary rule of contract interpretation, however, is not applicable where a contract is plain and free from all ambiguity. Powers Foundry Company v. Miller, 166 Md. 590 (1934).

Here we cannot say that the contract is free from all ambiguity. After all, the word "protection" is broad enough to cover virtually any measure taken to assure that utility service would not be affected by the subway construction. Further, the use of plywood reasonably may have been considered necessary for protection depending upon the methods to be used by a particular contractor to raise and lower equipment into the excavation and/or the means chosen to control blasting debris. Accordingly, we may consider the acts and conduct of the parties prior to the dispute to ascertain whether Appellant actually relied upon the interpretation which it reasonably has set forth or whether the parties mutually interpreted the contract to require plywood protection during the support phase of the work.

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[14] Appellant, by contrast, estimates this cost at over $90,000.

Appellant's Mr. Anderson testified that shop drawing GU-10 was intended to apply both to the backfill and support stages of the work. (Tr. 86-87). We accept this testimony as credible in that the shop drawing was submitted prior to the installation of the new conduits and much of the work presented thereon was to be performed prior to the temporary backfill operation. (Tr. 87). Further, shop drawings for all temporary support and protection of manholes and conduits, under contract Special Provision 02550, ¶1.02F, were required to be submitted for approval prior to the performance of such work. It is undisputed that no other shop drawings were submitted pertaining to the planned protection of the conduits when temporarily backfilled.

Shop drawing GU-10 did represent that a plywood enclosure was to be utilized as protection for the conduits. Appellant's witnesses, however, testified that this enclosure was intended to provide structural protection for the conduits during the period of temporary backfill. Under this plan, the plywood would have remained in place during the support phase only because it would have made little sense to remove it. Sometime prior to the resubmittal of GU-10 for approval, Appellant decided that the plywood enclosure would not offer adequate structural protection to the conduits when backfilled. With the MTA Resident Engineer's approval, Appellant therefore backfilled the conduits with sand in lieu of enclosing them as originally planned. Appellant maintains that it had no intent thereafter to construct a plywood box around the conduits as to do so would not have served a useful purpose.

The MTA never was told that plywood would not be installed during the support phase. Further, shop drawing GU-10 was not corrected to delete the plywood protection. For this reason, the MTA believed that Appellant still planned to install the plywood after the conduits were re-excavated and supported off the deck beams. Appellant's actions, however, clearly were consistent with the testimony of its witnesses that a plywood enclosure was not considered to be essential to protect the conduits or otherwise required by the terms of the contract. First, Appellant made no effort to construct the plywood enclosure prior to the onset of the dispute. Second, Appellant's June 6, 1979 submission of required calculations demonstrating the structural adequacy of the timber stringers and hanger rods was not premised upon the necessity to support a plywood structure. (Appeal file, Tab IV(22); Tr. 60, 63, 78). These calculations likewise were submitted prior to the issue being raised at the June 12, 1979 meeting between the parties. Accordingly, we do not find a basis to conclude that the parties contemporaneously interpreted the contract in the manner urged by the MTA.

Finally, the MTA contends that the interpretation given the contract by Appellant would render nugatory Special Provision 02550, ¶1.02F which, in pertinent part, mandates the submittal of " . . . shop drawings for all temporary support and protection of manholes, conduits, gas and water mains, sanitary and storm sewers, utility house connections, temporary street lights and Transit and Traffic facilities required during temporary support within cut and cover areas." We disagree. The foregoing clause merely sets forth a general obligation and procedure for submitting shop drawings describing support and protection where a given utility elsewhere is required by the contract to be supported and/or protected during the temporary support phase

of the work. The fact that the contract did not require special protection for all utilities within the construction area did not strip the foregoing clause of its significance.

In accordance with the preceding discussion, we conclude that the directive of the MTA Resident Engineer to provide a plywood enclosure for the electrical conduits constituted a change to the contract.

III. Findings of Fact - Quantum

A. Summary of Respective Cost Positions

The respective positions of the parties as to the appropriate equitable adjustment due Appellant are as follows:

Cost Item	Appellant	MTA	Alternate[15] Appellant Position
1. Direct Costs (incurred)			
A. Labor	$10,938.30	$10,938.00	
B. Material	23,163.64	8,584.00	$17,784.41
C. Equipment	1,247.40	1,247.00	
D. Equipment Operating Labor	698.76	699.00	
2. Future Work Activities - Plywood Maintenance			
A. Labor	12,444.60	2,881.00	
B. Material	2,873.89	263.00	1,713.12
C. Equipment	2,880.00	2,304.00	
3. Future Work Activities - Disassembly Plywood			
A. Labor	9,839.52	4,342.00	7,425.78
B. Equipment	1,219.68	1,130.00	1,765.50
4. Small Tools (5% of labor)	1,696.06	943.00	1,540.42
5. Insurance (1.286% of labor)	436.23	243.00	396.20
6. Labor Burden (8.75% of labor)	2,968.10	1,650.00	2,695.73
7. Subcontract	5,213.62		
Subtotal	$75,619.80	$35,224.00	$66,743.47[16]

[15]Appellant's alternate cost position was presented during rebuttal. It essentially addresses the reasonableness of the estimates prepared by the MTA.

[16]This subtotal uses Appellant's actual costs and estimates where alternate positions were not prepared.

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8.	Markups			
	A. Field Overhead	11,774.00 (15.48%)	0.00	10,331.89
	B. Home Office Overhead	6,641.93	0.00	5,857.73
	C. Profit (10%)	9,403.57	3,522.40	8,293.31
	D. Bond (0.46% of items 1-8C)	475.82	197.76	419.64
	E. Bond (0.63% of item 7)	32.85	26.75	
	Subtotal	$103,947.97	$38,970.91	$91,678.89
9.	Subcontract		4,245.75	
	Total	$103,947.97	$43,216.66	$91,678.89

See Exh. L. The Board's findings of fact hereafter will be confined to those cost items in dispute.

B. Item 1. B. - Material

Appellant established a cost center within its accounting system for purposes of segregating all costs attributable to these claims. (Tr. 52, 107). This cost center recorded actual material expenses of $23,163.64 and is supported by paid invoices. The MTA auditor verified that these invoices existed and were coded and recorded in the manner alleged by Appellant. (Exh D. Sch. 1).

The materials involved in these claims essentially consisted of lumber and aluminum stages. The lumber quantities and costs were summarized by the MTA auditor as:

Description	Units	Cost
4' x 8' x 1/2" CDX Plywood sheets	845[17]	$10,086
2" x 3" x 8' #2 SPF	1,570	2,718
2" x 4" x 16' #2 KD	240	1,250
Miscellaneous	-	316
Total		$14,370

(Exh D, Sch. 1). With the exception of a portion of the 2" x 3" lumber used in respacing the conduits, all of the foregoing lumber was said to have been used in enclosing the conduits with plywood. (Tr. 111-113).

[17]The MTA auditor totaled 844 sheets of plywood. The invoices indicated that 845 sheets were purchased. Tr. 164.

The aluminum stages were used as working platforms[18] to construct the plywood enclosure. The stages were necessary because the conduits were 40 to 50 feet above the excavation by the time the directive was given to install the plywood. Appellant purchased 12 stages and handrails at a cost of $9,218.37 and they were used solely for the work necessitated by the claim. (Exh 1, §1.2; Tr. 109; Tr. 618). The MTA auditor confirmed the amounts paid for aluminum stages but opined that a credit should be given the MTA for the residual value of these items as determinable at the completion of the claimed additional work. (See Exh. D, p. 7; Tr. 363).

1. Lumber and Miscellaneous Material

With regard to the lumber, Appellant's Mr. Anderson testified that this material was segregated within a fenced storage area for use on the work necessitated by the claim. (Tr. 110). However, he could not state with assurance that all of the lumber purchased and segregated was used towards this end. (Tr. 111). On a project of this type, Mr. Anderson testified that it is difficult to protect fully against theft or use of available materials on general construction work. (Tr. 111).

The MTA contends that the quantity of lumber charged to the claim by Appellant was far in excess of what reasonably should have been used in respacing the conduits and enclosing them with plywood. In order to establish this point, the MTA had its office engineer for the Laurens Street Station project, Mr. Steven Hunt, diagram the plywood installation performed by Appellant. Mr. Hunt accomplished this assignment by walking along the waler[19] closest to the conduits on the east side of the excavation. (Tr. 452-53). At each end of the station, he was close enough to the conduits actually to measure the plywood dimensions. In between, he was forced to estimate. (Tr. 453). At most, Mr. Hunt testified that he was 10 to 20 feet from the conduits when estimating the size of the plywood box. (Tr. 449, 453). Mr. Hunt further testified that despite this distance, he could ascertain whether a full or partial sheet of plywood was used. (Tr. 454). Given the known dimensions of a plywood sheet, Mr. Hunt estimated his accuracy at plus or minus six inches where less than a full sheet was used. (Tr. 454).

The diagram prepared by Mr. Hunt denoted the size and configuration of the plywood box and each point along the excavation where it changed. (Exhs. E, F). The distances along the excavation accurately were determinable by using the survey markings placed on the soldier piles and a tape measure. (Tr. 450). However, corrections as to length were not made for any changes in elevation. (Tr. 455).

Using this diagram and the dimensions thereon, Mr. Dan Simmons, a claims estimator for the MTA construction management organization, computed the total square footage of plywood utilized. This was accomplished by determining the perimeter of each section and multiplying by the

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[18]The stages and handrails were placed across the steel struts which had been installed horizontally at various levels to support the excavation.

[19]A waler is a steel member used to support the excavation. It is welded to the soldier piles at various levels and runs parallel to and against the sides of the excavation.

length of conduit wherein the configuration remained the same. (Exh. G, p. 2 of 6). Mr. Simmons, after visual inspection of the plywood, further concluded that a six inch overlap occurred at the seams approximately 30% of the time. (Tr. 501). He then computed the square footage of plywood required to overlap the seams and added a figure for waste. (Tr. 502, Exh. G, pp. 2 and 3 of 6). The resultant total was 14,559 square feet or 455 sheets of plywood. Additionally, Mr. Simmons determined that 9084 linear feet of 2" x 3" lumber would have been necessary to construct the transverse and longitudinal frame to which the plywood was to be attached. (Exh. G, p. 4 of 6). This included a figure for waste encountered in constructing the transverse frames only. (Tr. 505). The estimate for framing later was amended to delete the transverse framing quantity.[20] The MTA position as to lumber costs is summarized below:

Item	Units	Unit Cost	Total Cost
2"x 3" framing	4152 linear feet	0.22	$ 913.44
Plywood	455 sheets	11.50	5,233.00

The MTA also includes a sum of $150 for nails and $202 for banding iron in its estimate. These costs were not disputed.

Although Appellant primarily relied upon its recorded expenditures as the reasonable measure of material costs, alternatively it adopted an estimated measure of quantum. (Tr. 541, Exh. 9). Using the MTA's Exhibit G and visual observation, Appellant's Mr. Anderson adjusted the MTA estimate for a consistent lapping of 10 inches, or 30 additional plywood sheets. Further, he added 15 sheets for situations where the MTA had to use judgment in determining width and height, 41 sheets for theft and miscellaneous loss, and 4 sheets for repairs incurred to date. (Exh. 9; Tr. 544-45). In sum, Mr. Anderson contended that 545 sheets of plywood were necessary to construct the enclosure.

After considering the foregoing evidence, we find that the MTA's method of estimating plywood usage was reasonable. Although the lap was difficult to determine because it varied substantially, the six inch estimate made by the MTA appears to be a fair average. (Tr. 622-23). Rather than apply it 30% of the time, however, we find that the six inch overlap should be calculated at each seam. (Tr. 614, 624). This would result in an increase of 26 sheets to the MTA estimate.[21] Additionally, we would allow another 15

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[20]During the rebuttal phase of the hearing, Appellant's Mr. Anderson submitted adjustments to the MTA's estimate of incurred material costs. (Exh. 9). He testified that Appellant accepted the MTA's estimate of 4554 linear feet of 2" x 3" lumber as the proper measure for the transverse frames. Mr. Anderson did not personally know, however, whether the transverse frames actually were installed on 4 foot centers. (Tr. 594). Following this testimony, the MTA's Mr. Simmons testified that the allowance for transverse frames should be deleted since there was no certainty as to their installation. (Tr. 622-23).

[21]The overlap calculated at 6" intervals requires 1144 square feet of plywood. (Exh. G, p. 2 of 6). The MTA allowed 30% of this or 343 square feet. The remaining 70% totals 801 square feet to which a 2% factor for waste should

sheets of plywood for errors in judgment created by the necessity to estimate dimensions at a distance of 20 feet, and 4 sheets as representing actual repairs made to date. For reasons which we will discuss later in our decision, we conclude that the recommended adjustment for loss, theft etc. is unreasonable. Accordingly, we find that Appellant reasonably required 500 sheets of plywood at a cost of $12.00 each in performing the changed work.[22]

With regard to framing lumber, Appellant agreed with the accuracy of the MTA's initial estimate as to the linear feet required to construct a frame around the conduits. Appellant's Mr. Anderson, however, contended that the more expensive 2" x 4" lumber primarily was used in building the longitudinal sections of the frame. On cross examination Mr. Anderson admitted that he did not have first hand knowledge that 2" x 4" lumber actually was used to construct the longitudinal frames. (Tr. 547). Further, Mr. Anderson earlier had testified that the frame was constructed with less expensive 2" x 3" lumber. (Tr. 98). This earlier testimony was consistent with Appellant's own shop drawings which depicted the planned use of 2" x 3" lumber in erecting the longitudinal frame. (Tr. 616; Appeal file, Tab IV (28)). Accordingly, we do not find any factual basis to conclude that 2" x 4" lumber was used to construct the longitudinal frame for the plywood.

As to the MTA's deletion of transverse framing from its estimate, we find this to be reasonable. The evidence of record, particularly Appellant's shop drawing submitted at the time work was being performed, does not indicate that a transverse frame was constructed. (Appeal file, Tab IV (28)).

Appellant's estimate of 1580 linear feet of 2" x 3" lumber[23] as the quantity necessary to respace the conduits is reasonable. Although the MTA would reduce this number by a 50% factor to compensate for those spacers which were not crushed, we see little reason to do so. The predominant testimony was that most of the spacers had been crushed and we are satisfied that this is what occurred. While we recognize that the 1580 linear feet of lumber is calculated on the basis of replacing all spacers, our acceptance of this estimate assumes that a certain degree of waste was encountered in cutting the 2" x 3" lumber to fit between duct banks.

On the basis of the foregoing, we accept as reasonable the following quantity of framing lumber for use in performing the changed work:

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be added. The result is 817 square feet of additional plywood, or 26 sheets.

[22]This unit price is obtained by dividing the number of sheets actually purchased (845) into the actual expenditure ($10,080). (Tr. 98; See Exh D, Sch. 1).

[23]Appellant's shop drawing indicated that 2" x 4" lumber would be used to respace conduits. Appellant, however, did not contend that it performed the work in this way. (See Appeal file, Tab IV (25)).

4152 linear foot (LF) of 2" x 3" lumber for longitudinal frame
1580 LF of 2" x 3" lumber for respacing conduits

Total = 5732 LF

The cost of this lumber was $0.21 per/LF.

2. Aluminum Stages

The MTA contends that the aluminum stages and handrails should be charged to the claim on a rental basis only. Permitting 10% of the purchase price per month as rent, the MTA would allow $1028.00 for 27 days of work. (Exh. I; Tr. 472). Mr. Simmons, on behalf of the MTA, however, admitted that if the stages and handrails could be rented, the rental normally would be for two full months. (Tr. 504-505). Thus, the allowable amount, under the MTA estimate, would be $9218/12 mo. x two mo. rental = $1537.34. There was no testimony adduced as to the availability of these stages on a rental basis or as to commercial rental rates. Further, the need to use the stages to perform maintenance work was not considered by the MTA.

Appellant admits that its actual costs should be reduced to reflect the salvage value of the aluminum stages. In this regard, it proposes a 10% salvage value computed on the basis of the original purchase price for the stages. (Tr. 145, 552). This amounts to $921.80. The salvage value was estimated by Appellant's Mr. Anderson and was not verified independently through any other testimony or source of reference. (Tr. 145). Mr. Anderson also testified that the stages had no residual (resale) value.

C. Item 2, Plywood Maintenance

The parties each have estimated the cost of maintaining the plywood until removed. This maintenance was expected to continue for a period of nine months following the hearing. The common denominator with regard to the respective estimates is the crew size and labor cost per hour. The distinction lies in the amount of maintenance foreseen.

Appellant estimated that it would have to devote one day per week for maintenance during the period from November 30, 1980 to June 12, 1981. During this period it anticipated the repair of 20% of the lumber originally used in building the plywood enclosure. (Exh. 1). Appellant thus envisioned replacing 169[24] sheets of plywood over 30 weeks, or approximately five to six sheets per week. It is undisputed, however, that through March 1981, only four sheets of plywood actually had been replaced.

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[24]Appellant's position is that it took 845 sheets of plywood to build the enclosure. By taking 20% of this figure, we arrive at 169 sheets. Mr. Anderson, however, also testified that the replacement should be limited to 109 sheets. This was based on the estimated use of plywood rather than Appellant's actual purchases. (Tr. 602).

The MTA estimated that a total of 12 pieces of plywood would have to be replaced. (Exh G, p. 5 of 6). In each instance, the MTA further estimated that it would require a crew to spend two hours raising and lowering the decking and setting the work platform (aluminum stages) and two hours for a carpentry crew to repair each sheet. Appellant likewise determined that it would require two hours to raise and lower deck mats. It further estimated that it could repair five to six sheets of plywood in six hours. (Exh 1, §3.1a). Accordingly, Appellant estimated approximately one hour per sheet for repair when replacing five to six sheets. We find that Appellant's efficiency would be reduced when repairing fewer sheets of plywood and conclude that the two hour per sheet estimate of the MTA is the most reasonable. In each instance, therefore, where a single piece of plywood is to be replaced, Appellant reasonably should incur the following direct labor costs:

Crew to Raise and Lower mats and set stages
$54.86/hr. x 2 hr. = $109.72/sheet

Crew to Repair Encasement
$50.85/hr. x 2 hr. = $101.70/sheet

The equipment necessary to raise and lower the decking for repair purposes consisted of an 18 ton crane. Four hours of usage at $48.00 per hour would provide a $192 equipment expenditure for each plywood repair.

This leaves for determination the extent of repair work reasonably to be anticipated. It is clear from the record that some of the existing plywood is warped, sagging and that there is rusting and/or breakage of banding devices. (Tr. 434-35; 199). Nevertheless, the MTA Resident Engineer, Mr. Waeshe[25], testified that the existing plywood would not require much additional maintenance. (Tr. 431). The plywood, although not perfect, was considered by him to be secure and safe.

In considering the foregoing evidence, we cannot accept Mr. Anderson's testimony that 169 sheets of plywood (or even 109 sheets) would be replaced during the nine month period between the hearing and the disassembly of all plywood. The disassembly process was scheduled to begin three months after the hearing and continue for six months thereafter. Unless it was absolutely necessary for the safety of the workmen, it is difficult to believe that replacement of plywood sheets would be ordered. For this reason, we accept the MTA's estimate of 12 sheets of plywood as the material quantity to be replaced.[26]

In making the foregoing finding, we have not ignored the testimony of Appellant's Mr. Facchia[27] who endorsed Mr. Anderson's estimate that 20% of

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[25] Mr. Waeshe was the Resident Engineer at the time of hearing.
[26] We already have credited 4 of these sheets under the direct material expenses.
[27] Mr. Facchia was Appellant's project manager for the Laurens Street Station work at the time of hearing. (Tr. 180).

the plywood would have to be replaced. Mr. Facchia, however, also testified that:

> . . . The job is progressing rapidly at this point in time, and with the proviso that there is [sic] no outside loads introduced on the duct system per se, it is a marginal call, but I think that perhaps the duct, with some additional maintenance, but of a minor nature, would, in fact, be capable of being maintained in its present condition. The proviso being that we progressed rapidly with the project, and, in fact, begin our backfill and restoration phase as intended sometime in May or June . . . (Tr. 200-201).

The replacement of 169 sheets of plywood requiring 30 crew days of work is not minor maintenance. The thrust of Mr. Facchia's testimony, being inconsistent with Mr. Anderson's estimate, thus renders his endorsement thereof meaningless.

Finally, Appellant also indicates that anticipated cable pulls by BG&E adversely would affect the plywood encasement, thus increasing maintenance. In this regard, the record does indicate that cable to service the North Avenue Station was expected to be pulled in June 1981. (Tr. 248-50). However, we find that the effect of this operation on plywood maintenance is speculative and that there is no reasonable basis to project maintenance increases resulting therefrom.

For the preceding reasons, therefore, we find that the reasonable cost of foreseeable maintenance is as follows:

Material	
8 sheets of plywood at $12.00/sh.	= $ 96.00
Miscellaneous (nails, banding, 2" x 3" lumber)	= 300.00
Labor	
12 sheets x $109.72 per crew to raise and lower decking	= 1,316.64
12 sheets x $101.70 per crew to remove old plywood and repair	= 1,220.40
Equip Operator 2 extra hrs./shift x 12 shifts x $14.33/hr.	= 343.92
Equipment	
12 sheets x $192/sheet	= 2,304.00
Total	$5,580.96

D. Item 3, Disassembly of Plywood

Appellant estimated its costs of disassembly of the plywood enclosure at $11,059.20. This estimate was premised upon the assumption that it would take a six man carpenter crew a total of 12 work days to dismantle the plywood and a labor crew a total of six work days to load and haul the debris. (Exh. 1, §3.1b; Tr. 126). After presentation of the MTA's estimate

for this same work, Appellant abandoned its estimating approach and embraced the MTA's analysis with certain changes. The respective cost positions of the parties are set forth, once again, below:

	MTA	Appellant
Labor	$4,342.00	$7,425.78
Equipment	1,130.00	1,765.50
Total	$5,472.00	$9,191.28

In order to determine labor costs, the parties have chosen to break the project down into eight foot sections. There is no dispute either as to the crew size or composition necessary to perform the work or the labor costs per hour. What must be determined initially, therefore, is the number of eight foot sections involved and the time it would take Appellant's work forces to dismantle each eight foot section and haul the debris away.

The parties agree that the total encasement length was approximately 1040 feet. The MTA simply divides this length by 8 feet to arrive at a total of 130 sections. This method does not fully take into account sections which are 8 feet high or the plywood overlap at the seams. Accordingly, we adopt, with certain refinements, Appellant's computation as follows:

45 feet of duct encasement 8 feet high/3.5[28]	=	12.86 sections
992 feet of duct encasement 4 feet high/7.5	=	132.27 sections
Total		145.13 sections
		(rounded to 146 sections)

With regard to the time necessary to disassemble an eight foot section of plywood and then haul it away, the MTA has concluded that 15 minutes is sufficient for each operation. Disassembly involves cutting the steel bands, removing the plywood sheets and hammering the nails out of these sheets for safety purposes. (Tr. 126). Hauling requires the material to be stacked below ground, lifted to a dump truck and transported to a disposal site. Given the fact that four carpenters and two laborers would be assigned to the disassembly work and four more laborers and a boom truck operator would be assigned to the hauling operation, the MTA contends that its estimate is reasonable.

Appellant submits that it takes 20 minutes to remove an eight foot section of plywood and another 20 minutes to remove the debris. (Exh. 10). In this regard, Appellant's Mr. Anderson noted that the work would be done under the decking in areas where there was limited headroom. (Tr. 127). Further, the restoration work was to be accomplished in eight segments over a six month period. The disassembly work thus would be discontinuous and less efficient than if done in one operation. (Tr. 128).

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[28]The four foot wide plywood overlaps six inches, thus making an eight foot high section only 3.5 feet in width. Similarly an eight foot wide by four foot high section, in actuality, is only 7.5 feet wide.

We find that Appellant's work force should have been capable of disassembling an eight foot section of plywood every 15 minutes. In making this finding, we note that a crew of six[29] was assigned to remove plywood which was in a weakened condition. Further, we doubt that the removal of plywood by carpenters is so unique an effort as to require a prolonged learning curve. Thus, despite the performance of this work in segments, efficiency should not have been affected to any measurable degree.

The hauling of materials was more difficult. We find that it would take somewhat longer to maneuver sheets of disbanded plywood up through the decking and load them onto a dump truck then it would to disassemble them. Accordingly, we find Appellant's estimate of 20 minutes per eight foot section to be reasonable.

Our findings as to the reasonable labor costs for disassembly and loading thus may be summarized as follows:

Crew to disassemble encasement		$74.43/hr.
Crew to load encasement		$56.13/hr.
Cost to disassemble one 8' section =	1/4 hr. x	$74.43/hr.= $18.61
Cost to load one 8' section =	1/3 hr. x	$56.13 = $18.71
Combined disassembly and hauling cost =		$37.32/eight foot section

Total Labor Cost = $37.32 x 146 sections = $5448.72

Both sides agree that a boom truck, with a rental rate of $25.41 per hour, will be necessary to lift the plywood debris from the excavation. Since we have found that it would take 20 minutes to remove the debris from each eight foot section, a boom truck will be required as follows:

1/3 hr. x 146 eight foot sections = 48.18 hours (rounded to 48 hours)

The total cost of this equipment thus is $1219.68.

The parties also agree that to haul the plywood away will require a 5 ton flat bed at a rental rate of $7.50 per hour and a teamster to operate the equipment. It likewise is agreed that the round trip haul time is two hours and that the teamster and his equipment will be necessary during the loading period. (Tr. 517-18). Given that the disassembly work will be performed in eight, noncontinuous segments, a total of eight trips will be required to haul away plywood and other debris. Accordingly, we find the following hauling costs to be reasonable:

labor $12.33/hr. (teamster) x (16 hrs. hauling + 48 hrs. loading)
= $789.12

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[29]We recognize that the foreman essentially supervised and did not perform to the same extent as his other carpenters. Nevertheless, the crew size still is significant.

equipment 7.50/hr. x (16 hrs. hauling + 48 hrs hrs. loading)
= $480.00

In summary, therefore, the reasonable cost of disassembling the plywood and hauling away the debris is:

Labor	$5448.72
Equipment	1219.68
Hauling	1269.12
Total	$7937.52

E. Item 7, Subcontract

Truland Corporation submitted a claim to Appellant in the amount of $5213.62 for the labor involved in respacing the conduits. (Exh. 1, §1.3). This claim included $3733.05 in direct costs, $1006.60 (26.95%) in overhead and $473.97 (10%) in profit. Appellant included this total amount in its claim as direct costs which then were used to compute applicable field overhead, home office overhead, profit and bond fees. (Exh. 1, p. 2).

The MTA auditors simply tested the mathematical accuracy of the subcontractor claim without auditing Truland's books. (Exh. D, p. 11). Pursuant to the Board's Order On Proof of Costs, the MTA, therefore, admits that said costs were incurred and were recorded accurately in Truland's books of account.

Notwithstanding the admitted accuracy of Truland's recorded overhead rates, the MTA initially allowed markups of 10% for field overhead and 7.6% for home office overhead. (Exh. G, p. 1 of 6). Bond fees of 0.46% for the prime contractor and 0.63% for Truland likewise were accepted. When these markups were multiplied by the direct cost figure of $3733 and added thereto, a total of $4912 resulted. This total was included in the MTA estimate of Appellant's reasonable costs. Prime contractor markups were not permitted on this amount. During the hearing, the MTA reduced the foregoing amount by deleting all overhead costs. This change in position was based on the MTA's understanding of this Board's decision in the Appeal of Calvert General Contractors, MDOT 1004, March 4, 1981, issued during the hearing.

Based on the foregoing, we find that Truland's direct costs of $3733 represented the reasonable cost of performing the respacing work. Further, the subcontractor overhead markup represented the actual rate being incurred by Truland during the claim period. The proper application of this rate and other markups is a legal question which will be addressed hereafter in our decision.

F. Item 8, Overhead Rates

1. Field Overhead

Appellant has allocated field overhead by taking 15.48% of its direct job costs. (Tr. 136). The source for this percentage markup was a report prepared by the MTA auditor in conjunction with an earlier claim litigated before this Board. (Exh. 8). In that report Appellant's field overhead costs

were reported through April 30, 1980. The MTA auditor, however, did not compute the foregoing rate nor does the record before us indicate what the incurred direct expenses were as of April 30, 1980.

For purposes of this claim, Appellant's field overhead costs were audited through October 31, 1980. (Exh. D, p. 14). Field overhead costs for Appellant's Mondawmin and Laurens Street projects, however, were collected in one cost pool and it thus was necessary to allocate field overhead costs to each project in order to determine the ratio of direct to indirect costs applicable to this claim. The MTA auditor, by taking a ratio of the original contract amounts of the two projects, concluded that 76.14% of the field overhead recorded should be allocable to the Laurens Street project. (Exh. D, p. 19). This would result in field overhead expenditures of $3,899,522 on the Laurens Street project through April 30, 1980. When compared to the direct costs of $26,366,647 incurred by Appellant at Laurens Street through the same date, a percentage of 14.79 is obtained.

The MTA originally allowed a markup of 10% as the reasonable cost attributable to field overhead. This figure was not based upon the audited data but rather upon the belief of its estimators that 10% was adequate for heavy construction work. (Tr. 496-97).

During the hearing, the MTA amended its estimate by striking the allowance for field overhead altogether. This action was taken based upon the MTA's reading of this Board's decision in Calvert General Contractors, supra, and the alleged absence of evidence indicating that field overhead costs had been increased by the changed work. A listing of field overhead accounts is set forth in Appendix 1.

2. Home Office Overhead[30]

Appellant has alleged home office overhead costs at a rate 7.6% of its claimed direct costs. This rate was based on the results of an MTA audit performed on another claim for calendar year 1978. (Exh. 8, p. 40). The plywood encasement and respacing of conduits, however, was performed in calendar year 1979. The MTA auditor, therefore, computed Appellant's home office overhead rate for calendar year 1979. The audited rate of 8.37% for calendar year 1979 then was adjusted to exclude certain expenses which are unallowable under Federal regulations. The adjusted rate obtained was 7.39%. (Exh. D, p. 22).[31]

The MTA estimate originally included a markup of 7.6% representing the home office overhead costs attributable to the changed work. (Exh. G, p. 1 of 6). This was deleted from the MTA estimate during the hearing based upon the Board's decision in Calvert General Contractors, supra., and the MTA's conclusion that home office overhead had not been increased by the changed work.

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[30]Home office overhead represents the indirect costs incurred at Appellant's home office in California. (Tr. 141). This is distinguished from those indirect costs incurred at the job site, i.e., field overhead.

[31]These expenses included interest, contributions, amortization expenses, life insurance and traffic fines. (Exh. D, p. 24).

IV. Decision - Quantum

A. MTA's Motion to Dismiss Quantum Case

As part of its affirmative case, Appellant submitted evidence supporting its contention that it was entitled to an equitable adjustment in the amount of $103,947.97. With regard to the direct costs incurred in constructing the plywood enclosure, Appellant presented its actual cost records and invoices. This information further was provided to the MTA prior to hearing and its books of account were made available for audit. As to the future maintenance and disassembly of the plywood, Appellant prepared estimates as to its anticipated costs. These estimates were presented and explained by Appellant's project manager who is a graduate engineer. Markups on all of these costs were supported by reference to Appellant's books of account. At the conclusion of this presentation, Appellant rested.

The MTA proceeded at this point with its defense. Where quantum was concerned, it contended that Appellant's position generally was unreasonable and offered its own estimates as to the proper measure of the equitable adjustment which would be due in the event Appellant succeeded on the merits. These estimates differed in approach from those offered by Appellant.

During rebuttal, Appellant reiterated its belief that the actual costs incurred for material were reasonable. Nevertheless, it offered testimony concerning certain perceived errors in the MTA estimate of these costs in the event this Board ultimately concluded that its actual costs should not be used. Further, Appellant abandoned its estimates for future costs and adopted the MTA estimates with certain modifications. The foregoing modifications to the MTA estimates all were summarized in exhibits 9, 10, 11. The MTA objected to the introduction of these exhibits on the basis that they were intended to "correct credibility" and that it would have difficulty in preparing for cross examination.[32] (Tr. 541, 553, 562). All three exhibits were admitted over these objections.

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[32]A continuation of the hearing was granted for this purpose.

In its brief, the MTA argues that its objections at hearing now should be treated as a motion to dismiss. These objections, we are told, were intended to test the legal sufficiency of Appellant's evidence and that the Board, therefore, ". . . was placed in a position analogous to that of a trial judge under Rule 535 of the Maryland Rules of Civil Procedure. . . . "[33]

Assuming, without finding, that a motion of the type provided for under Rule 535 of the Maryland Rules is appropriate to our proceedings, and further assuming that the MTA's evidentiary objections amounted to a motion to dismiss Appellant's quantum case, such a motion was untimely. A motion to dismiss, under this rule, is in order only at the conclusion of the opponent's case. Smith v. State Roads Commission, 240 Md. 525, 539, 214 A.2d. 792 (1965). As stated by the Maryland Court of Appeals in Lewis v. Germantown Insurance Company, 251 Md. 535, 541 (1967):

> . . . The main purpose of the rule [535] is to allow a party to test the legal sufficiency of his opponents evidence before submitting evidence of his own. Should he prevail at this point he avoids the necessity of going further and as well the risk that this own evidence may supplement his opponent's evidence enough to provide the missing legal sufficiency. If he waits until the close of evidence, then the motion becomes a nugacity because all of the evidence is then before the trier of facts and the determination of its legal sufficiency becomes an inseparable and necessary part of his decision . . .

Although the MTA's objections were made prior to the close of evidence, both sides already had produced evidence as to the equitable adjustment due Appellant. The question no longer was whether Appellant was due any money, but rather which estimates, if any, were indicative of the cost of performing the changed work. In view of this and given the MTA's admission that certain costs were due Appellant, a motion to dismiss was inappropriate and is denied.

B. Applicable Cost Principles

This Board previously has concluded that an equitable adjustment is intended to safeguard a contractor against increased costs generated by the performance of changed work. C. J. Langenfelder & Son, Inc., MDOT 1000, 1003, 1006, August 15, 1980, p. 19. In determining the altered position of the contractor, the reasonable cost of performing the work as changed is compared to the reasonable cost of performing as required originally. As further stated by the U. S. Court of Claims in Bruce Construction Company v. United States, 163 Ct.Cl. 97, 324 F.2d 516 (1963):

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[33]Rule 535 of the Maryland Rules provides that:

> In any action tried by the court without a jury at law or in equity, any party, without waiving his right to offer evidence in the event the motion is not granted, may move at the close of evidence offered by an opponent for dismissal on the ground that upon the facts and the law he has shown no right to relief. Unless the court otherwise specifies, such a dismissal operates as an adjudication upon the merits.

> . . . the standard of reasonable cost 'must be viewed in the light of a particular contractor's costs' . . . , and not the universal, objective determination of what the cost would have been to other contractors at large.
>
> To say that 'reasonable cost' rather than 'historical [actual] cost' should be the measure does not depart from the test applied in the past, for the two terms are often synonymous. And where there is an alleged disparity between 'historical' and 'reasonable' costs, the historical costs are presumed reasonable.
>
> Since the presumption is that a contractor's claimed cost is reasonable, the Government must carry the very heavy burden of showing that the claimed cost was of such a nature that it should not have been expended, or that the contractor's costs were more than were justified in the particular circumstance." (Underscoring added)

Thus, where Appellant relies upon its actual costs to establish the equitable adjustment due, such costs shall be presumed reasonable.

Where the presumption of reasonableness is overcome or actual costs are unavailable, estimates and supporting data may be utilized to establish additional costs. In this regard, it is well settled that:

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

Electronic & Missile Facilities, Inc. v United States, 189 Ct.Cl. 237, 416 F.2d 1345 (1969); Calvert General Contractors, supra, pp. 38-40. The process by which a judge or a Board determines this fair and reasonable approximation is referred to as the jury verdict approach. It requires that the trier of fact:

> ". . . weight the probative value of the various estimates that are placed into evidence and arrive at a judgment as to the amount of the equitable adjustment that should be given in view of the conflicting testimony and proof that has been introduced. In performing this task of weighing the evidence, they see themselves functioning in the role of a jury arriving at a verdict, and this does appear to be a relatively accurate reflection of the process that occurs.

R. Nash., "Government Contract Changes," p. 441 (1975); see also S. W. Electronics & Manufacturing Corp. v United States, 228 Ct.Cl., 655 F.2d 1078 (1981); Dyer & Dyer, Inc., ENGBCA 3999, 80-2 BCA ¶14563; Calif. Shipbuilding & Dry Dock Co., ASBCA No. 21394, 78-1 BCA ¶13168.

C. Direct Material Costs

1. Lumber Costs

Although Appellant presented evidence of its actual lumber costs, we conclude that the MTA met its heavy burden of establishing that these costs were greater than was justified for the performance of the changed work. Appellant purchased 845 sheets of 1/2" plywood, 12,560 linear feet of 2" x 3" lumber and an additional 3,840 linear feet of 2" x 4" lumber and coded these materials and costs to an account set up for the performance of the plywood encasement work. The MTA, however, demonstrated by estimates that the lumber necessary to perform the work substantially was less than the quantity actually purchased. Appellant was unable either through cross examination or rebuttal evidence, to establish that these estimates were not indicative of the lumber quantities required to perform the changed work. Appellant's own estimate of the lumber quantities necessary to encase the conduits, submitted in response to the MTA estimates, in fact, conclusively demonstrated that the actual material quantities purchased were far in excess of those reasonably required to perform the changed work. Accordingly, the Board has considered the estimates submitted by the parties, and the expert testimony pertaining thereto, in determining the reasonable lumber costs incurred by Appellant. (See pp. 31-36, supra).

2. Aluminum Stages

We accept as reasonable the purchase of aluminum stages by Appellant. The MTA has failed to establish that these stages could have been rented and that it would have been less expensive to do so. Although an estimate was prepared which calculated the allocable costs for the stages on the basis of a rental rate equal to 10% of cash value per month for two months, there was no testimony that this rate was available commercially. Likewise the two month period did not consider the need to maintain the plywood at various times during the project.

The actual cost of the 12 stages and handrails purchased by Appellant totalled $9,218.37 including sales tax. However, the parties agree that some salvage or residual value should be assessed against this amount to determine the portion of the stage costs allocable to the claim. Appellant suggests a salvage value of 10% of the purchase price, or $921.84.

While we recognize that Appellant may not have had any use for the stages on its other subway work in Baltimore and that the cost of transporting the stages to another site elsewhere in the country perhaps would have exceeded the salvage or residual value of the equipment, we cannot give credence to Mr. Anderson's testimony that the stages had to be disposed of as scrap metal. These stages were fabricated out of aluminum and as such should not have weathered significantly over the two year period during which they were on the job site. Further, in looking at the invoices for the stages, it appears that they were stock items manufactured by the Werner Company and distributed by Safway Steel Products. If a market exists for the purchase of new aluminum stages, it seems reasonable that certain firms in the construction trades may wish to buy them used at considerable savings.

Here we admittedly are faced with a record which does not permit us to determine salvage or residual value with mathematical precision. Nevertheless, it is evident that the stages and handrails did have value at the completion of the changed work. In this situation, it is appropriate that we employ a "jury verdict" approach to arrive at a figure which is fair and reasonable.

The MTA estimate of the allocable cost of stages is $1,537.34. (See findings of fact, p. 37). Given the $9,218 purchase price of the aluminum stages, the MTA, in essence, argues that they would retain approximately 83% of their value after two years of use and storage on the site. Appellant's estimate conversely places the net salvageable value at 10%. For reasons previously discussed, we believe both numbers to be extreme and unreasonable. We conclude that the net residual value would approximate 35% of original purchase price, or $3,226. This works out to a unit resale price of $269 which we believe is reasonable. The allocable cost of the stages and handrails thus is the difference between the purchase price and residual value, or $5,992.

D. Theft of Materials

Appellant's Mr. Anderson testified that theft of materials was an unavoidable problem in the Laurens Street area. (Tr. 545). Despite the fact that Appellant stored its materials in a fenced yard with a heavy "T" beam placed on top of the plywood and hired a security guard for periods when the job was unmanned, theft of lumber was estimated at 8% of the material purchased. (Tr. 545-46, 585-89). When asked at hearing whether theft would constitute an indirect or overhead expense, Mr. Anderson stated that it would appear on Appellant's books as a direct material expenditure. (Tr. 608).

In order to recover costs of this type, Appellant must show that they reasonably were incurred in the performance of the changed work. We conclude that this burden has not been met.

From a general standpoint, the allowance of costs stemming from theft is unreasonable. Allowance of such costs would constitute a disincentive for a contractor to properly inventory and dispense materials and secure them when the job is unmanned. Further, carelessness in the storage and security of materials, in a claim setting, constitutes a failure to mitigate damages.

Additionally, we note that Appellant has failed to establish by credible evidence that theft losses could be expected to equal 8% of the lumber purchased. All that was presented was the self-serving and uncorroborated estimate of Appellant's project manager. Compare Missile Systems Corp. of Texas, ASBCA No. 8306, 1964 BCA ¶4434; Maryland Painting Company, ENGBCA 3337, 73-2 BCA ¶10,223. Further, there was no testimony as to the existence of insurance covering such losses. We presume that if Appellant's experience in urban areas was that lumber and certain other materials would be stolen in quantities up to 8% of the total purchased for a large construction project, some contingency would have been placed in the bid or an insurance policy purchased. For all of the above reasons, therefore, this portion of Appellant's cost claim is rejected.

E. Overhead

1. Field Overhead Markup

In Calvert General Contractors Corp, supra, we denied a subcontractor's request for field overhead and general and administrative expenses (G&A) calculated on a percentage basis of direct labor costs. Appellant, however, here argues that the foregoing decision established too rigorous a standard of proof for practical application. In view of the difficulty inherent in clearly allocating overhead costs to the performance of specific work activities, it is more reasonable, we are told, to permit recovery based on the actual overhead rate being incurred at the time the work in question is being performed. This criteria not only would be administratively convenient, but over the course of contract performance would assure that a contractor did not reap a windfall.

The Calvert decision essentially involved a determination of the increased costs due a subcontractor who had performed work which had been modified substantially. The subcontractor's books were relatively simple and its accounting centers were few. Based on the record before us, we were satisfied that those field overhead costs claimed by the subcontractor had been included in its claim as direct costs and hence that any further markups would have been duplicative and inappropriate. Consistent therewith, the Armed Services Board of Contract Appeals has stated the following:

> The fact of the matter is that it is always more desirable to reimburse a contracting party for its actual expended or incurred indirect costs, exactly in the same manner as direct costs, provided that is practicable or feasible. Such treatment of indirect costs is usually neither practicable nor feasible. That is the primary reason why indirect costs are gathered together in various cost centers, expressed as a ratio of some base, and then distributed to different parts of an organization or different simultaneous work being performed by an organization, by use of the rate and a reasonable scheme of allocation . . .

Kemmons - Wilson, Inc., (Florida) and South & Patton, Inc., A Joint Venture, ASBCA No. 16167, 72-2 BCA ¶9689 at p. 45,254.

Although we did reject the percentage markup for field overhead in Calvert General Contractors Corp., supra, we did not mean to imply that its use was inappropriate in every instance. The key is whether the percentage rate derived, if applied to a particular base cost pool, would allocate reasonably the indirect costs attributable to the performance of contract work. Where an overhead percentage rate has been deemed reasonable, we have applied it to determine allocable overhead amounts. See C. J. Langenfelder & Son, Inc., MDOT 1000, 1003, 1006, August 15, 1980, pp. 51, 56, 60.

What this Board objects to is the blind application of a contractor's actual overhead rate to ascertain allocable indirect costs. For example, Appellant's field overhead accounts (Appendix 1) indisputably include substantial incurred costs for such items as an office trailer, setup yard, vans, a change house and a supply house. The record, however, does not indicate how such items were treated in determining Appellant's bid price. If the anticipated cost of each was included in the bid price, then permitting recovery

of overhead based on Appellant's actual rate would constitute a windfall. Similarly, if the supervisory and equipment fees included as direct costs in Appellant's claim were not removed from the indirect cost pool prior to calculating its markup percentage, a double recovery likewise would result.

In sum, we accept the argument that it is reasonable to allocate field overhead to direct costs incurred on a percentage basis. Where done consistently, each dollar of direct costs will bear its fair share of field overhead. Here, however, it has not been established that Appellant bid its work in this manner or that it has taken steps to remove from its indirect cost pool those items which either were identified as the direct costs of performing the changed work or otherwise were being recovered fully under the contract price.

Notwithstanding our rejection of Appellant's overhead computation, we find that is is entitled to a markup for those field overhead costs reasonably allocable here. Although we cannot determine the appropriate markup with precision, the MTA's witnesses have conceded that a 10% markup, based on total direct costs, customarily is applied where heavy construction is involved. (Tr. 496-97). Accordingly, we find this rate to be reasonable for application here.

2. Home Office Overhead

In Calvert General Contractors Corp., supra, we rejected a subcontractor's home office G&A markup because it was evident that this cost pool was comprised of fixed expenses which were not affected by additional work performed within the same time period of the initial contract work. We recognize, however, that the problem associated with allocating fixed overhead expenses under such circumstances is one which never has been resolved adequately through litigation. R. Nash & J. Cibinic, "Federal Procurement Law," Vol. II, (3rd Ed. 1980), p. 1420.

Appellant here experienced home office expenses of $17,699,575 in calendar year 1979. Of this total, approximately $4.7 million was incurred by its engineering division and the remainder was for general administrative expenses. These indirect costs respectively were incurred against total engineering division job costs of $152,183,255 and total consolidated job costs of $327,516,433. When dealing with operations of this size, it does not appear reasonable to require a contractor to allocate its fixed indirect costs precisely to the performance of a contract or to changed work. The better, and perhaps common, practice would be to allocate home office expenses on a percentage basis of direct costs incurred. In this manner, each dollar of direct job costs would absorb its proportional share of overhead. Compare Savoy Construction Co., Inc., ASBCA Nos. 21218 et al., 80-1 BCA ¶14,392, recon. denied, 80-2 BCA ¶14,724, aff. 1 FPD ¶120, 2 Cl.Ct. 338 (1983). Accordingly, to the extent that Calvert General Contractors Corp., supra, may hold otherwise, it expressly is overruled.

Appellant has requested compensation for its allocable home office overhead at the adjusted rate of 7.6% of its direct job costs. This adjusted rate was calculated by the MTA auditor for calendar year 1978. (Exh. D, p. 20).

However, since most of the changed work was performed in calendar year 1979, the audited adjusted[34] rate of 7.39%, determined for that period, is deemed reasonable.

F. Subcontractor Costs and Markups

The MTA has accepted Truland's direct costs of respacing the conduits as reasonable. What it objects to are the overhead and profit markups added by Truland and Appellant. The respective positions of the parties are summarized as follows:

	Appellant	MTA
Direct costs	$3,733.05	$3,733.00
Subcontractor overhead (26.95%)	1,006.60	0
Subcontractor profit (10%)	473.97	0
Subtotal	$5,213.62	$3,733.00
Prime contractor field overhead (10%)	521.36	373.33
Prime contractor home office overhead (7.39%)	385.29	275.87
Subtotal	$6,120.27	$4,382.20
Prime contractor profit (10%)	612.03	438.22
Total	$6,732.30	$4,820.42

Unlike many federal contracts, this particularly contract did not contain a clause setting forth limitations as to the number of markups permissible. Accordingly, as with any portion of an equitable adjustment, we are governed by a standard of reasonableness in determining the applicable markups.

Appellant contends that Truland's price of $5,213.62 represented the actual cost incurred in performing the work. For this reason, it is presumed to be reasonable. Further, Appellant includes in its field and home office direct cost pools all subcontractor costs. (Tr. 375-76). Accordingly, its overhead rates for field and home office likewise are computed on the basis that subcontractor costs bear a fair share of prime contractor indirect costs. We are told, therefore, that it is reasonable to allow Appellant's markups in order to permit its overhead costs to be fully absorbed by the changed work.

Here the contract permitted substantial portions of the work to be performed by subcontractors.[35] Where a subcontractor is used, the prime contractor obviously is going to incur a direct cost. As long as the subcontractor's price is reasonable, therefore, there is no basis to deny recovery for such costs. Compare D.C. Edwards & Co. v. Fisher, 610 S.W.2d 546 (Tex. Civ. App. 1980).

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[34]This Board makes no findings or conclusions as to the propriety of the adjustments made. Appellant appeared willing to accept the adjusted 1978 rate and, for this reason, the adjusted 1979 rate is used.

[35]Contract General Provision GP-8.01 required only that Appellant perform at least 50% of the original contract work with its own organizational forces.

Truland's direct costs are uncontroverted. While its actual overhead percentage is somewhat higher than Appellant's, it has not been shown to be unreasonable. The subcontractor's total costs, therefore, are accepted together with a 10% profit.

Appellant's markups, on the other hand, are rejected as unreasonable. While Appellant may have provided its own supervision for Truland's work and incurred certain other administrative costs, it reasonably cannot be said that Appellant incurred indirect costs to the same extent on subcontractor work as it did on work performed with its own forces. Similarly, it should not be entitled to the same profit markup for subcontractor work as it is for work performed with its own resources. For this reason, we conclude that Appellant, when acting essentially as a broker, is entitled only to a commission. This commission, determined by the Board to be 10%, amply compensates Appellant for its overhead and profit on Truland's work.[36]

G. Interest

1. Predecision Interest

In Maryland Port Administration v. C.J. Langenfelder & Son, Inc., 50 Md. App. 525, 543 (1982), the Maryland Court of Special Appeals stated as follows:

> "The underlying object . . . [of an equitable adjustment] is to make a contractor "whole," to safeguard him against increased costs engendered by the modification that he is forced to complete. In that regard, the comment of the Senate Committees with respect to the Contract Disputes Act is apposite — that there can be no equitable adjustment until the contractor recovers the entire cost of doing the extra work, and that the cost of money to finance that additional work is a legitimate cost of the work itself. That is true whether the cost of the money is in the form of interest paid on borrowed funds or the loss of income on the contractor's own capital invested in the additional work. We therefore think that compensation for such a cost — the cost of money — is an appropriate element in calculating an "equitable adjustment," and that the allowance of that cost may be expressed in the form of predecision interest.

The Court further stated that the recompense " . . . as nearly as possible, is to be actual, and not necessarily by reference to an artificial rate that may have little relevance to the contractor's actual cost of money." Id. at p. 544.

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[36] For comparison purposes, it is instructive to look at contract General Provision GP-9.02 wherein the subcontractor receives fixed percentages for overhead and profit and the contractor receives a commission thereon. This method of marking up subcontractor costs generally is specified in the contract with the percentages varying. See D.C. Edwards & Co. v Fisher, supra, at p. 549; Blake Construction Co., GSBCA no. 1724, 66-1 BCA ¶5336.

Appellant's briefs in the captioned appeal were filed prior to the foregoing decision of the Court of Special Appeals. In accordance with this Board's prior ruling which precipitated the appeal to the Court, Appellant requested interest only at the legal rate. See C.J. Langenfelder & Son, Inc., MDOT 1000, 1003, 1006, August 15, 1980. While the record is devoid of evidence as to any actual borrowings made by Appellant for the performance of work or the cost of funds between 1979 and the present, we take administrative notice of the fact that the 6% legal rate substantially is below those commercial rates prevalent during the period in question. Accordingly, we conclude that predecision interest should be recovered at the rate of 10% per annum as part of Appellant's equitable adjustment.

In determining when interest should begin to run, we consistently have attempted to ascertain when the State was in an adequate 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 payment of the claim, thus arriving at a date when interest should begin to accrue should payment not be made. C. J. Langenfelder & Son, Inc., supra, at pp. 32-34.

Here the MTA was given notice of Appellant's claim on August 1, 1979. A cost proposal later was forwarded to the MTA on September 4, 1979. Thereafter, Appellant's shop drawings concerning the performance of the changed work were reviewed and approved by October 10, 1979. As of this latter date, therefore, the MTA was in a position to determine its exposure and proceed to negotiate a change order. Allowing a 90 day period for development of an independent estimate and negotiations and 30 days thereafter as a reasonable period for processing payment, we find that Appellant was entitled to payment by February 10, 1980.

As of February 10, 1980, Appellant had incurred the expense of constructing the plywood enclosure and respacing the conduits. Interest on this portion of the equitable adjustment thus is payable from the foregoing date.

Plywood maintenance was sporadic and essentially was to proceed for an additional 9 months after the hearing. Interest on the amount previously determined for this activity, if commenced on September 1, 1981, would compensate Appellant fairly without unduly complicating the computations necessary to determine the amount due.

Finally, interest on the cost of disassembling the plywood should begin midway through the period required for this purpose. Based on the evidence adduced at hearing, this would be October 1, 1981.

2. Postdecision Interest

Postdecision 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.

Summary

On the basis of the foregoing, the appeal is sustained in the following amount:

Item	Amount	
1. Construction of Plywood Enclosure		
A. Labor	$10,938.00	(undisputed)
B. Material		
(1) Plywood	6,000.00	(p. 35)
(2) Framing lumber	1,203.72	(p. 36)
(3) Aluminum Stages	5,992.00	(p. 53)
(4) Nails	150.00	(undisputed)
(5) Banding iron	202.00	(undisputed)
C. Equipment	1,247.40	(undisputed)
D. Equipment Operating Labor	698.76	(undisputed)
Subtotal - Construction of Plywood Enclosure	$26,431.88	
2. Plywood Maintenance		
A. Labor	2,880.96	(p. 40)
B. Equipment	2,304.00	(p. 40)
C. Material	396.00	(p. 40)
Subtotal - Plywood Maintenance	$5,580.96	
3. Plywood Disassembly		
A. Labor	5,448.72	(p. 42)
B. Equipment	1,219.68	(p. 43)
C. Hauling	1,269.12	(p. 43)
Subtotal - Plywood Disassembly	$7,937.52	
4. Cumulative Subtotal - Appellant's incurred costs	$39,950.36	
Subtotal - Appellant's Labor Costs	$19,966.44	
5. Small tools (5% of labor costs)	998.32	
6. Labor burden & insurance (8.75% of labor costs)	1,747.06	
7. Insurance (1.28% of labor costs)	256.77	
8. Subtotal (4, 5, 6 and 7) Appellant's total direct costs	$42,952.51	
9. Field overhead (10% of Appellant's direct costs)	4,295.25	(p. 56)
10. Home office overhead (7.39% of Appellant's direct costs)	3,174.19	(p. 57)
11. Subtotal	$50,421.95	
12. Subcontractor costs (respacing work)	5,213.62	
Subtotal - Total costs incurred	$55,635.57	

13. Profit and Commission (10%)	5,563.58
Subtotal	$61,199.15
14. Bonds	
Prime contractor (0.46% of items 1-13)	281.52
Subcontractor (0.63% of item 12)	32.85
Total	$61,513.52

For purposes of computing interest, the equitable adjustment further may be broken down as follows:

1. Plywood enclosure and respacing	$42,439.97
2. Maintenance	7,766.00
3. Disassembly	11,307.55

Predecision interest, in accordance with our decision, may be calculated as follows:

Plywood enclosure and respacing:		
$42,439.97 x 10% per year/(365 days/yr.)	=	$11.63/day
Period from Feb.10, 1980 to Dec. 20, 1983	=	1,409 days
$11.54 x 1409 days	=	$16,386.67
Plywood maintenance:		
$7,766 x 10%/(365 days/yr.)	=	$2.13/day
Period from Sept. 1, 1981 to Dec. 20, 1983	=	841 days
$2.13 per day x 841 days	=	$1,791.33
Plywood disassembly:		
$11,307.55 x 10%/(365 days/yr.)	=	$3.10/day
Period from Oct. 1, 1981 to Dec. 20, 1983	=	811 days
$3.10 per day x 811 days	=	$2,514.00

Appellant's total equitable adjustment is:

$61,513.52	(Direct costs, overhead and profit)
20,692.10	interest
$82,205.62	Total

Postdecision interest shall accrue at the rate of $13.51/day computed from the date of this decision until payment is made to Appellant.

Appendix 1

FIELD OVERHEAD COSTS

Laurens Street and Mondawmin
October 31, 1980

Account Number	Account Description	Amount as Recorded at 10/31/80
1	Supervisory Personnel	134,869
2	Craft Shift Supervisor	576,150
3	Engineering	688,753
4	Office Personnel	259,966
5	Yard Personnel	187,457
9	Health Insurance	63,953
10	Office Trailer	20,026
11	Setup Yard	165,586
12	Vans	8,985
14	Change House	19,891
16	Warehouseman	56,526
19	Supply Office	177,621
21	Building Maintenance	63,981
23	Field Allowance	2,155
24	Living Allowance	2,030
25	Expense Account	126,677
26	Moving Expense	19,139
27	Corporate Travel	16,869
28	Consultants	136,466
29	Material Testing	23,957
30	CPM Data Processing	37,831
31	Telephones	112,959
32	Mobile Radios	19,792
33	Sanitation	102,164
34	Drinking Water	59,512
35	Water Supply	7,183
36	Power Distribution	134,278
37	Lights and Power	327,355
41	Safety Engineer	102,454
42	First Aid	100,248
43	First Aid Supply	20,863
44	Protective Clothes	168,625
46	Signs	9,878
47	Fire Control	12,071
48	Training Program	157
49	Infirmary	2,763
51	Master Mechanic	115,502
58	Pickups	173,718
70	Payroll Burden	202,465
83	Final Cleanup	-
84	Winter Maintenance	56,158
85	Move-In	99,657

87	Move-Out	18,602
88	ACC Fees	5,050
89	Equipment Insurance Deductible	18,638
91	Whole-Day	116,195
92	Legal Fees	27,744
96	Permits	2,844
	Total Overhead Costs	$5,121,516