

those properties. A price is paid for every property measured and consideration should be given as to whether the gain in control of the project through the use of a test method is worth what it costs. These costs include not only the direct cost of testing but also the cost increases that the variation of the test method adds to the interpretation of the test results through misunderstandings and confusion on the job.

An example might help to clarify this relation. Some years ago, a state highway department was writing a specification requirement for controlling the variation of asphalt content in bituminous mixtures. They decided that a specification limit of ± 0.3 percent would be set for asphalt content of bituminous concrete. I pointed out that the major component of variation is due to the distribution of the various individual pieces of aggregate. In other words, the asphalt content of large pieces of aggregate is much lower than that of smaller pieces of aggregate. Therefore, the asphalt content of a test portion rises or falls with the number of large pieces of aggregate that it contains. This is a chance variation that had been shown to have 95 percent probability limits of ± 0.5 percent for bituminous concrete of the type specified. I pointed out that about 20 percent of the test results would be outside the specification limits of ± 0.3 percent due to chance causes in the measuring system. This was something about which the contractor could do nothing. The state highway department said that they wanted to set a goal for contractors to strive to attain.

I went back after one paving season and asked how the ± 0.3 -percent specification was working. I was told that it was performing very satisfactorily. On examining the test results, a little more than 20 percent of them were outside the specification limits. No action had been taken in connection with any of the out-of-specification material. This specification was, in fact, not a specification because no mechanism was set up for eliminating any material no matter how far out of the specifications it might be. If a specification is to be written,

it is important to set the limits so that they are meaningful and realistic in relation to the testing and sampling variation.

Abdun-Nur, in a paper in this Record, spoke eloquently of the need to focus on the whole process of obtaining quality in a contract or project. He urged us not to be sidetracked into only a portion of the quality picture or into fruitless controversy or adversary relations. He emphasized the importance of considering the total system for controlling quality.

Steele and Higgins, in another paper in this Record, emphasized the importance of being fair. Under our system of open bidding, unfairness nearly always results in higher costs, often without compensating benefits. They also stressed keeping channels of communications open in order to improve performance and save money.

Thompson, also in a paper in this Record, spoke of the importance of the contractor's knowing how to produce a quality product at a high level of productivity. He also spoke of the fact that the contractor could put all of his or her efforts into increasing productivity and quality under a properly devised quality system. Waste or increased costs are the result of a poor quality system, where the contractor cannot meet the required specifications no matter what he or she does because the specifications were improperly devised.

Dunn, in a paper in this Record, spoke of a proper quality-assurance program from the point of view of the Federal Highway Administration. He commented that the West Virginia Department of Highways used the same work force in the 1970s as in the 1960s to meet a work load that was five times higher than that of the 1960s. Further, although perfection was not achieved, the quality-assurance system is working in practice.

Halstead, also in a paper in this Record, spoke of optimizing state-contractor relations from the research point of view. He spoke of the problems that can arise between an engineer and contractor and how each can diminish them through reasonableness and conciliation.

Contractual Requirements and Design Philosophies Employed to Minimize Adversary Relationships: Eisenhower Memorial Tunnel, Second Bore

PHILLIP R. McOLLOUGH

The Colorado Department of Highways awarded a contract to construct the first bore of the Eisenhower Memorial Tunnel on October 3, 1967. The tunnel was opened to traffic on March 8, 1973, two years behind schedule and had a cost overrun of approximately 125 percent. Substantial difficulty was encountered in constructing the tunnel due to the bad ground conditions that existed in the eastern half of the tunnel. A redesign was necessary and the project contract was modified to a cost contract to complete the eastern portion of the tunnel. Not only did the ground conditions deteriorate, but the working relationship between the owner and contractor developed into a classical adversary relationship. With the previous construction history indelibly impressed in the owner's mind, steps were taken in June 1973 to develop a design to complete the facility by driving the second bore. Considerable attention was given to development of a workable design and equitable contract

provisions that would share and minimize risks involved. The second bore contract incorporated equitable contract provisions along with two new provisions that provided for the establishment of a project review board to handle major construction disputes and escrow documents (contractor's bid documents) to serve as a basis for evaluating the contractor's bid. The escrow documents would also facilitate equitable settlement of major construction disputes. The contract for the second bore was awarded to the joint venture contractor of Peter Kiewit Sons Company and Brown and Root on August 11, 1975. The contract was completed successfully nine days early, within budget, and approximately three percent under the engineer's estimate. The contract and its provisions, along with the design, helped to produce an outstanding product.

The Eisenhower Memorial Tunnel, located on Interstate-70 approximately 95 km (60 miles) west of Denver, passes under the Continental Divide at the elevation of 3350 m (11 000 ft). The twin 2700-m (8900-ft) tunnels carried 8200 average daily traffic in 1973 and will carry about 14 000 average daily traffic in the year 2000.

As early as the 1930s, highway planners realized that a vehicular tunnel would be the ultimate answer for handling the projected traffic volume across the Colorado Rockies. Due to steep grades, sharp curves, severe winter conditions, and maintenance problems of conventional high mountain passes, the tunnel alternative was investigated. Preliminary sites were examined, and in 1943 a small bore was tunneled beneath Loveland Pass. However, extensive problems arose that illustrated the need for further studies. The result of these studies culminated in the selection of the route that follows the Straight Creek Valley, and the pilot bore along this route was completed in 1964.

Construction of the first bore and ventilation buildings started March 13, 1968, at the west portal. The project was opened to traffic March 8, 1973. The project encountered many difficulties and gained notoriety when construction costs escalated from \$54 million to \$108 million and completion was delayed by approximately two years.

Early in the project a number of problems were encountered with foundation materials in the west ventilation building. Many claims were submitted during this time from the subcontractor via the prime contractor to the owner.

Tunneling of the west heading proceeded relatively smoothly while the ventilation buildings were under construction. After driving 1325 m (4350 ft) on the west heading, a chamber was constructed for the installation of the shield. Simultaneously, the east heading was started and driven approximately 550 m (1800 ft) before severe structural deformation problems began to occur.

On December 6, 1969, the east heading advance was halted. Heavy loading resulted in unexpected convergence and deformation of the steel support sets in the east heading. Extensive remedial work such as rock bolting, buttress concrete, shotcrete, grouting, rock reinforcement, and jump sets were eventually required to stabilize this heading. Three months prior, excavation that used a full face shield was stopped in the central section of the mountain because the shield developed mechanical problems. This method was later abandoned.

For the next year underground construction was at a standstill while discussions ensued among the owner, contractor, consultants, and Federal Highway Administration (FHWA) engineers on methods of resolving construction problems.

On September 5, 1969, the contractor notified the owner that underground conditions existed that were beyond the scope of the contract and claimed that a breach of contract existed. A redesign of the tunnel was necessary to accommodate the difficult geological conditions encountered and the original unit-price contract was renegotiated to a cost contract to complete the tunnel portion of the project. As a result of negotiations, the owner became intimately involved with the contractor's organization and problems because the owner paid the costs directly of completing the underground work by using the multiple-drift method. In other words, the owner's supervisory personnel had to transfer their attention from payment of bid items and documentation to concern with all aspects of costs and construction methods involved. This partnership produced the desirable effect of immediately improving relations between the owner and the contrac-

tor. On January 7, 1971, construction resumed.

The owner's involvement in the first bore project varied markedly before and after renegotiation of the original contract. The owner's staff became substantially more involved in construction and administrative matters, which are generally and historically assigned to the contractor in the original contract. It was interesting to observe the improved cooperation between the owner and contractor. As a result, the work progressed at a substantially improved rate and the adversary relationships that had previously existed were, in some cases, greatly diminished or nonexistent.

Due to the success of the renegotiated contract, the multiple-drift method, and other refinements to the tunneling methods, the holing-through occurred on March 1, 1972, and the tunnel was officially opened to traffic March 8, 1973.

PROJECT PLANNING

Planning and design work started on the second bore of the Eisenhower Tunnel in June 1973. It was decided to use the in-house capabilities of the department of highways to accomplish the planning and design of the second bore. The consulting firm of Leeds, Hill, and Jewett of San Francisco was engaged to assist the department's designers on an as-needed basis in planning, design, specification preparation, and construction of the project. I was assigned the task of coordinating the planning and design efforts.

All information relative to the construction history of the first bore was reviewed in considerable detail by the design and planning group. Considerable time was employed in analyzing why the construction of the first bore met with severe difficulty and what factors contributed to those problems. Particular attention was given to the adversary relationship that developed during the construction of the first bore. The planning group concluded that the following elements should be addressed in the design, contract, and specifications for the second bore as well as in other contracts that would be used to complete the entire facility:

1. Type and number of contracts,
2. Advertising period,
3. Contract time and working hours,
4. Disclosure,
5. Safety,
6. Prequalification,
7. Contingencies and exculpatory language,
8. Payment for materials on hand,
9. Mobilization,
10. Labor adjustments,
11. Adjustment of material costs and adjustments for changes in common-carrier rates,
12. Escrow documents,
13. Cost accounting,
14. Dispute resolution,
15. Detailed plans,
16. Financing, and
17. Other elements.

The planning group considered other related elements separately that were deemed important to the administration of the contract for the second bore, such as the following:

1. Staffing of the owner's construction team,
2. Qualification of the owner's construction team,
3. Authority and lines of communication for the construction team, and
4. Training of project inspectors.

CONTRACT

The planning group considered several types of contracts that ran the gamut from a cost contract, at one extreme, to a fixed-price contract, at the other. It was concluded that the unit-price contract would be the most appropriate, considering the constraints imposed on governmental agencies. However, it was believed that the historic unit-price-cost contract typically used by government agencies could be modified to promote more equitable sharing of risks between the owner and contractor. Thus, a more equitable unit-price contract was employed for the construction of the second bore.

Number of Contracts

The planning group noted the difficulty experienced by both the owner and contractors in handling and coordinating the single large contract employed for construction of the first bore. These difficulties existed in the areas of providing space for each contractor in a very limited work area at the tunnel portals, coordination and sequencing of the work, materials procurement, and labor disputes. In light of these problems and in recognition of advantages of stage financing to construct the entire second-bore facility, the planning group concentrated on clearly defining and separating the total work necessary to construct the facility. The following contracts were decided in the sequence shown:

1. Ventilation and electrical equipment procurement and installation in the portal ventilation buildings; this project was designated as I-70-3(82);
2. Tunneling, concrete lining, and tunnel drainage; this project was designated as I-70-3(81);
3. Bridge construction east portal tunnel approach; this project was designated as I-70-3(80);
4. Finishing work in the tunnel including installation of tile walls, suspended ceiling, and ventilation ducts, safety curbs, tunnel paving, electrical conduit, wiring, cabinetry, and mechanical equipment (i.e., carbon monoxide sampling equipment); this project was designated as I-70-3(83);
5. Paving tunnel approach roads; this project was designated as I-70-3(84); and
6. Landscaping work at the tunnel portals and the east and west approaches to the tunnel along I-70; this project was designated as I-70-3(85).

Although this paper is principally concerned with the tunneling contract (number 2), it is important to note that many of the provisions and concepts of the tunneling contract were used in contract numbers 1 and 4.

Prospective bidders for the contract for the second bore were advised of the number and sequence of all projects planned. This information was listed in subsection 105.07 of the project specification.

Advertising Period

The planning group recognized that the shorter advertising period (3-4 weeks) customarily used by the owner on highway contracts was not appropriate in considering a tunneling project of this magnitude. Consequently, a 6-week advertising period was eventually employed due to the time constraints that had developed by the summer of 1975. However, the consensus of opinion of the planning group was that a 12-week advertising period would have been more appropriate and desirable.

Contract Time and Working Hours

This provision of contracts is one of the most-important facets that should be determined through thorough analysis by the designer and construction personnel. All too often contract times are set based on little or no analysis.

In the interest of developing realistic and reasonable contract times for the entire project, the owner's design and construction group scheduled all contracts and related work activities on the basis of reasonable construction rates and floattime that were achieved during construction of the first bore. Construction rates available from other tunnels were also considered. Thus, the tunneling contract time for the second bore was established at 940 working days or approximately 3.5 years. This type of procedure was used in setting the contract times for all contracts.

In setting contract times for this contract, additional explanation is necessary to convey the owner's reasoning based on conclusions reached during the construction of the first bore. The owner noted several circumstances during construction of the first bore that were worthy of consideration in setting the contract time and in developing the contract-specification provisions.

During the first bore construction, when the contractor was compelled to conduct many work activities in close proximity to one another, there was a greater exposure of all work force in those congested areas to accident. By being a bit more liberal in setting the contract time, a contractor could minimize this exposure of the work force by reducing the work activities in a given location and thus reduce the congestion and promote greater safety for the work force.

It was observed that, when the first-bore contractor worked a three-shift, seven-day week, the work force would work the premium time shifts on the weekends and then be absent during the straight time shifts during the week. Absenteeism on Mondays and Tuesdays ran as high as 45 percent. A general decrease in productivity was also evident on the weekend shifts. In addition, the contractor, although adequately equipped with the numbers and type of equipment to conduct the work, was hard pressed to maintain the equipment due to the lack of adequate maintenance time imposed by the scheduled seven-day workweek.

A general observation concluded that the supervisory personnel of both the owner and contractor were overly fatigued by the seven-day workweek and the adverse environment at this location [i.e., the 3350-m (11 000-ft) elevation and generally nine months of snow and subzero temperatures]. The contract time for the second bore was set at 940 working days based on a mandatory five-day workweek. The contract time requirements are listed in subsection 108.06 of the project specifications.

DISCLOSURE

The owner's planning group recognized that prospective bidders for the second bore should have available all possible information that related to the design and construction of the first bore as well as that developed for design of the second bore.

The design and construction group assembled, filed, and recorded two complete copies of virtually every report, photograph, article, as-constructed plan, and engineering construction record available. This information was made available to all contractors during the prebid period at a prebid room located at the division headquarters in Denver.

The owner's prebid room was manned by knowledge-

able construction personnel and a procedure was employed so that a list of available information was provided to the bidders, who could then request to review any of the documents in the prebid room and order copies of those documents that they desired.

The prebid room also contained one geological model and a construction model that depicted the owner's design for the second bore. A list of information available to bidders was listed in section M-16 of the project specifications.

SAFETY

The planning group unanimously endorsed the development of plan and specification provisions that would promote safety during construction, such as the workable design details evident in the project plans and specification provisions that would pay the contractor directly for safety-related items. Further, the planning group thought that the owner should promote safety where possible in a direct way and thereby eliminate some of the contingency risks associated with the items of work.

Specification provisions that relate to project safety were incorporated in the second bore contract as follows:

<u>Specification</u>	<u>Provision Number</u>	<u>Unit</u>
First aid attendant	625	Hour
Ambulance driver		Hour
Ambulance attendant		Hour
Furnish ambulance		Each
Traffic control supervision	614	Day
Flagging	614	Hour
Pedestrian overpass	521	Each
Rock reinforcement	211	Each

One can readily conclude that the construction group employed on the first bore felt that the owner could and should provide greater emphasis on project safety by participating directly in the costs as well as by addressing safety aspects in the design of the tunnel structure.

PREQUALIFICATION

The planning group recognized the need for employing a highly competent contractor who had an adequate organization and resources, including personnel, to accomplish this difficult project. The group thought that prospective bidders should have a substantial track record of successful completion of similar tunnels of this size, length, and difficulty to be eligible to bid on work for the second bore. Subsequently, specification subsection 102.01 was prepared and included in this contract.

CONTINGENCIES AND EXCULPATORY LANGUAGE

Inasmuch as the general use of exculpatory language employed historically in contracts was of little if any value and could contribute to the development of the adversary relationship, the planning and specification groups diligently endeavored to preclude this type of language from the plans and specifications.

Further, the group recognized that certain types of work would be difficult to define and quantify for bidding purposes, and the decision was made to direct the contractor to conduct this work on a force-account basis, as provided by specification subsection 109.04. Items of work directed to be completed on a force-account basis were as follows:

<u>Item</u>	<u>Estimated Cost (\$000s)</u>
On-the-job trainee	16.8
Erosion control	100.0
Construction monitoring	140.0
Furnish employee shuttle bus	25.2
Trial testing for rock reinforcement	4.2
Miscellaneous work	70.0

Payment for Materials on Hand

The planning group recognized the need for a contract provision that would allow payment for permanent materials procured by the contractor. This contract provision (specification subsection 109.07) was included as an aid to assist in the financing of the project.

Mobilization

A mobilization item, specification section 626, was included to assist in financing the project.

Labor Adjustments

The project planning group recognized the need for inclusion of a labor adjustment provision to provide relief and minimize this risk (see subsection 109.09 in the specifications). At this time (1973-1975), inflation was running rampant and, in consideration of the duration of this contract, it was decided that a contractor could not reasonably assess this risk. Therefore, a specification provision, patterned closely in concept to that used by the U.S. Bureau of Reclamation in federal contracts, was employed.

A review of the labor adjustment payments made to the contractor reveals the following:

<u>Year</u>	<u>Labor Adjustment Payments (\$)</u>
1975 (August)	0, not eligible
1976	0, not eligible
1977	314 000
1978	991 924
1979	363 974
Total	1 669 898

The total of the labor adjustment payments represents 90 percent of the actual escalation incurred by the owner during the allowed escalation period. Adjustments for labor costs were not allowed during the first 545 calendar days of the contract. The total amount of labor adjustment allowed represented 1.62 percent of the contract amount bid.

Adjustment of Material Costs and Adjustments for Changes in Common-Carrier Rates

A provision for adjustment of selected material costs was deemed appropriate for inclusion into the contract based on the inflationary trends (1973-1975), shortages of various steel shapes, and energy-dependent products. In general, American Association of State Highway and Transportation Officials (AASHTO) guidelines were used with some modification. Materials determined to be eligible for cost adjustments were structural steel, reinforcing steel, gasoline, diesel fuel, liquid petroleum gas, and electrical power (refer to specification subsection 109.10). The following tabulation reflects the material adjustment costs through July 1979:

<u>Item</u>	<u>Material Cost Adjustment (\$)</u>
Structural steel	856 434
Reinforcing steel	101 721
Gasoline	26 971
Diesel fuel	34 540
Liquid petroleum gas	84 647
Electrical power	228 196
Total	1 332 509

This total amount of allowed material cost adjustment represents 1.30 percent of the contract amount bid.

A provision that would allow adjustment for changes in the common-carrier rates was included as part of the contract. This provision is normally included in all Colorado highway contracts (refer to specification subsection 109.08). This adjustment amounted to \$50 054 during the life of the contract.

ESCROW DOCUMENTS AND COST-ACCOUNTING SYSTEMS

In consideration of the complexity of this project, the risks involved, and the construction history of the first bore, a provision was included in this contract to require the contractor to submit to the owner virtually any and every piece of information used to arrive at the bid. It was required that the unit prices for each bid item be supported and separated into a cost breakdown that consisted of labor, equipment, material, on-project fixed costs, and off-project fixed costs. Since mobilization was a separate bid item in this contract, it was supported by the same type of cost breakdown as specified for all other unit price items.

The owner's reasoning for requiring submission of the contractor's bid documents was to establish and ensure that the basis of bid would be available for review to facilitate determination of just and fair compensation in the equitable settlement of major disputes that might arise during the course of construction.

The owner and others remember the unavailability of such documents during the construction of the first bore. Also, the escrow documents documented the basis of a bid and provided a means of evaluating the contractor's bid proposal.

The owner established procedures to ensure that the contractor's bid documents would be maintained confidential, such as storage in a bank safe deposit box with access attained only by mutual consent and presence of designated officials for the contractor and the Colorado Division of Highways.

Appropriate portions of the escrow documents were reviewed on occasion to facilitate adjustments made in accordance with specification subsection 104.02, "alteration of character or quantities of work". This use greatly facilitated this type of adjustment.

The contractor, although not obligated to do so, volunteered to make the documents available to members of the project review board in the event of a dispute where resolution of the dispute could be facilitated through use of the documents.

On completion of the project and agreement to final payment, the escrow documents were jointly removed from the safe deposit box by the owner's representative and the contractor's project manager and returned to the contractor.

A cost-accounting system was required by project specification subsection 108.03 to be maintained by the contractor. The cost-accounting system would assimilate costs incurred on a current basis and would be structured to identify costs of labor, equipment, materials, fixed costs on-project site, fixed costs off-project site, and other costs.

These cost records were available to the engineer as required for monitoring project costs.

One can readily see how the escrow documents and the cost-accounting system could be used to quantify costs and facilitate determination of just compensation in the event of a claim or major dispute during the course of work.

DISPUTE RESOLUTION

The need for an outside, nonbiased authority to facilitate resolution of project disputes was demonstrated during construction of the first bore.

Provisions were incorporated into the contract for the second bore to provide for a three-member review board to resolve disputes that might arise during construction. The board consisted of three authorities in the construction field who were contracted with individually by both the owner and contractor to monitor progress of the construction and to hear disputes between the owner and contractor. The board routinely visited the project at 90-day intervals for joint briefings by the contractor and owner. Approximately 15 meetings were held at the site for routine briefing purposes and resolution of three disputes that involved claim amounts of approximately \$580 000.

The costs of using the project review board amounted to approximately 0.045 percent of the contractor's bid price for construction of the project and approximately 8.06 percent of the amount of claims presented to the board. The cost of the review board was shared equally by the owner and contractor.

The concept of the review board worked well on this contract and was very effective in settling the disputes that arose during construction of the project. The owner's construction personnel thought that the presence of the review board probably precluded the development of other disputes during the construction. In other words, the review board's presence, in addition to the stature of the individual board members, exerted an unwritten stabilizing influence over both the owner's and contractor's supervisory personnel, which precluded the potential for development of the adversary relationship.

Specification subsection 105.17 was also included in the tunnel finish contract and electrical-mechanical contracts.

DETAILED PLANS

The owner's planning group concluded that the plans for this project should be carefully and completely detailed to convey the owner's and designer's intent for a workable, buildable design. Thus, the project plans and specifications were developed accordingly. The contractor followed the plans and specifications in constructing this project, and few revisions were necessary.

CONCLUSION

The contract and contract provisions for this project were very workable. The contract came in within budget, slightly under the contract time allowed, and 3 percent under the engineer's estimate. The adversary relationship common to most contracts did not develop. Substantial credit must be given to the contractors, Peter Kiewit Sons Company and Brown and Root, for their outstanding organization and management of the project and to the department of highways' consultant, Tom Lang of the firm Leeds, Hill, and Jewett, Inc., for his expertise during design and construction.

ACKNOWLEDGMENT

I wish to thank the Federal Highway Administration Division, Region, and Headquarters for their participation during the development of the design and specifications and the division assistance during construction. It is also appropriate to acknowledge

the valuable reference the National Academy of Sciences has provided through the report, Better Contracting for Underground Construction. Complete provisions on the contract for the second bore of the Eisenhower Memorial Tunnel can be obtained from my office.

Minimizing Adversary Contractual Relationships for the Eisenhower Memorial Tunnel, Second Bore

H. RAY POULSEN, JR.

The Colorado Division of Highways awarded the contract for the Eisenhower Memorial Tunnel, second bore, in August 1975, and the project was completed on schedule in June 1979. This difficult underground construction project was built without major claims or delays. The contract included the changed-condition clause and other provisions for cancellation, quantity variation, and time extension. The contract included new provisions for this state government agency, including a provision for the establishment of a review board for settlement of claims and disputes. A second provision was the requirement that contractor's bid documents be presented with the bid and held in escrow for use in determining adjustments. The division's design for the tunnel was well done and the division maintained responsibility for the design. The contract kept contractual adversary relations to a minimum. It was well administered by the division and the work was well managed by the contractor. Reasonable people, working under this contract, successfully accomplished a difficult project.

Construction contracting is a service profession; it is one of the few businesses that, by and large, functions on a directly competitive basis. When a contractor signs and seals the bid, he or she is committed to perform a service for a specified amount. In this act, he or she wagers (a) that his or her appraisal of the conditions and requirements is sufficiently accurate, (b) that his or her judgment of the cost of accomplishing the work is sufficiently correct, (c) that his or her organization and resources are sufficiently strong, and (d) that his or her physical and mental health are adequate to accomplish the work on time and at a cost that results in a reasonable profit.

The contractor must assess the risks involved in the work for each bid and prepare a proposal that includes a profit margin that is consistent with such risk. This is difficult to do and varies with every job. The degree of variance in the work and the amount of risk is greater in underground construction than in general construction or building construction. A contractor must, therefore, include substantially more markup on underground or tunneling bids than on building bids.

Due to the higher risks in underground work and the resulting higher markups, owners have realized that fair contract provisions that minimize some of the risks can result in lower bids and savings in project costs. The Colorado Division of Highways devised such a contract for the Eisenhower Memorial Tunnel, second bore.

Contractual relationships become people relationships; an adversary relationship, in my opinion, is one that exists between opponents. We certainly endeavor to maintain relations that will not hinder our performance. Yet, our human nature leads us to

assume the adverse or opposing view when we expect that another person's position may harm us.

When a potentially harmful situation develops, we react to protect ourselves. One immediate reaction is to watch what we say. This is often done by lessening the pressure to coordinate fully, or worse yet, by avoiding full, free discussion and review of our problems with the opponent. The result, of course, is inadequate communication. Communication is probably the most important part of any relationship. A decrease in communication, the exchange of information, has an immediate effect on a construction job--requirements are misunderstood, work may have to be removed and rebuilt, and delays occur while clarifications are obtained. Costs go up, production and level of quality go down, and time goes on. All of these results are bad for both the contractor and the owner. It is then apparent to me that we should remove as many potentially harmful provisions from our contracts as possible. At the same time, we should maintain and add provisions for the reasonable protection of the parties in an equitable manner.

The contract for the second bore included provisions for price and time adjustment for delays, adjustment of alteration of character or quantities of work (including changed-conditions clause), and a review board. The review board consisted of three experts in the field organized to hear and decide on claims for adjustment and disputes in a nonbinding arbitration procedure. The contract provided for payment adjustments for escalated costs of labor (partial), energy, and specific major materials. The division accepted the responsibility for its design. These provisions (and several additional equitable provisions) removed many of the problem areas that precipitate adverse relations during the performance of the contract.

The following comments are offered regarding some of the provisions included in the division's contract that do significantly minimize contractual adversary relationships. The last paragraphs of this text offer suggestions on items of lesser magnitude that could further improve contractual relationships on similar projects.

CANCELLATION OF CONTRACT (Subsection 108.09)

This provision reads as follows:

The division reserves the right to cancel this contract or any part thereof if it is determined