

Reader's Comment

PROJECT DEVELOPMENT CONCEPT

MALCOLM E. DUDLEY

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Comments by Walter L. Meyer, Associate Professor of Architectural Engineering, University of Colorado, Boulder, Colorado.

Walter L. Meyer: The concept to include the contractor, subcontractors, and material suppliers in the design process is sound, and the traditional competitive bid system in building construction is rapidly being replaced by the negotiated contract which serves the team approach. More and more private owners are turning to some form of the design/construct method, or turnkey construction, for their building requirements, recognizing the importance of performance and timely completion.

In Mr. Dudley's paper he rightfully stresses the benefits that result from the cooperative effort beginning early in the design stage, although not particularly recommending turnkey construction per se. Today, the tremendous increases in costs of material and labor also require more efficient construction management. The time consuming "low bidder" procedure, still necessary on public work, is primarily limited to a price consideration; however, the use of a selected list of

bidders, wherever possible, permits a prior evaluation of the invited contractors' reputation and experience, financial condition, available supervision and manpower, necessary equipment, and generally his ability to perform. The emphasis now, however, should be placed on the additional contribution the contractor, subcontractors and suppliers can give the job during the design period. This assistance to the designers can also be rendered by the construction consultant who would not participate as a contractor in the construction phase later.

The minimizing of construction costs is the key to the success of almost any building venture today, and the design team must get current cost information from the contractors and materials suppliers who have the historical costs and the experience to provide reliable cost data and projections. The owner's budget for the contemplated project is the most important factor and it must be met. The impact of full employment and manpower shortages

on productivity varies but is a sizable one. The development of new construction materials and methods is being expedited today to lower overall construction costs, and building codes and standards are rapidly being up-dated to permit their use. New and better equipment is sought to improve production. It is hoped that the increased application of prefabrication and mass-production techniques, such as those employed in HUD's Operation Breakthrough program for housing, will result in lowering construction costs generally. The name of the game is to achieve lower costs with improved and more efficient performance resulting in a better construction product.

I agree that the construction industry's failure to advance is due, at least in part, to the lack of the team approach. There is no room in the construction industry today for the design prima donna who refuses to listen to the materials suppliers and the contractors in construction matters. The government is promoting a greater use of cost reduction incentive procedures, also called value engineering, in its contracts. The U.S. Army Corps of Engineers and the Bureau of Reclamation, who are particularly including such contract clauses, want cost savings on their work, and they care less who comes up with the ideas. A contractor-initiated cost savings proposal is no affront to the design professionals on a job and should not be discouraged. If the contractor and his construction team or the construction con-

sultant are utilized before and during the design process the result is bound to be better and more complete input for effective design.

The frequently made charge that choosing the general contractor for a certain project without taking competitive bids and receiving a fixed price is more costly to the owner is a myth. To engage the best qualified general contractor to be the manager of all aspects of the construction of a certain project generally provides the best value for the owner. Most large projects have 70 to 80 percent of the project work performed by subcontractors and these subs can be chosen by the competitive bid process if desired. Therefore, the other 20 to 30 percent of the contract price is negotiated and not subject to competition but includes the contractors' management service, his overhead and profit. Effective management provides the increasingly important planning, scheduling, and control of field operations and the integration of the many specialty contractors. The prestressed concrete subcontractor is such a specialist with a product that is becoming a major part of today's buildings. His expertise should be sought with that of the general contractor in prestressed concrete work.

It is time the "Constructor" professionalism of construction management is recognized as such and accepted as a service for a fee.

The team approach is a construction industry innovation and a good one. Let's use it more often.

REALISTIC REQUIREMENTS FOR UNBONDED POST-TENSIONING TENDONS

KENNETH B. BONDY

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Comments by Jacques Paul Kourkene, Prestress Service International, San Francisco, California; closure by the author.

Jacques Paul Kourkene: There is no argument with the expert array of numbers. But that is not the issue of what is reasonable vs. what is not, if such an issue does exist. The dispute would be with the impressively proclaimed philosophy that the least requirements you can get away with are the most realistic, that less is more.

We are not dealing here with abstractions of Miesian architecture, where this concept would most certainly make some solid sense. A much more reasonable argument is made in favor of the philosophy that the most you can offer at no increase in cost is indeed in the best interest of the public.

No great wisdom and no great skill in numbers are needed to demonstrate that three necessary conditions for perfection in 100 percent of post-tensioning projects, whatever their life environment may turn out to be, are:

1. In acceptance tests of end connection assemblies for bonded or unbonded tendons, the end connections shall allow all ruptures consistently to take place in the body of the tendons, well away from the end connections.

2. In bonded or unbonded construction, tendons shall be inserted in rigid watertight galvanized steel tubing.
3. In primarily unbonded multi-span construction, sufficient bonded reinforcement shall be provided to assure over-all structural stability against collapse in the event of failure in any specific span.

The reasons are as follows, respectively:

1. Multiple requirements on strengths and elongation proposed by others are arbitrary and are not foolproof. They allow inconsistent performance. They will not prevent the possibility of a brittle link in the complete tendon assembly while in service.

A test on elongation on a 10-ft. length of tendon is too expensive and unnecessary. The proposed single requirement is easy to verify in a foolproof manner. The proposed acceptance test is a straight pull to rupture, the most economical test possible. A 1-ft. length of tendon is sufficient.

All post-tensioning material commodities and all proprietary

systems can now meet the proposed requirement completely. It will eliminate the possibility of a brittle link. The proposed simple requirement for an acceptance test merely recognizes the higher standards reached by the post-tensioning industry in recent years and is designed to preserve these standards. It is a complete, logical and simple requirement.

The proposed acceptance test gives the materials the reserve to accommodate all variables arising from manufacturing tolerances.

Meeting the proposed requirement is the only method through which the anchorages can develop the total strain energy of the tendon.

There should be no difference in these requirements between bonded and unbonded tendons.

2. Paper sheathing has no place in a wet concrete environment. The use of paper sheathing and plastic tubes in concrete structures designed to withstand fires is questionable judgment. By requiring that tendons be inserted in metal tubing, it will always be possible to remove them and replace them should this be necessary. It is impossible to insert a new tendon to replace a paper-sheathed one.

Steel tubing and tendon and end connections are readily available at a price far below that of paper-wrapped, greased tendons which must be purchased as specialty items, since they must be pre-assembled. Using steel tubing, no pre-assembly is required.

Rigid steel tubing provides the bonded mild steel reinforcement necessary to meet local flexural safety factor requirements and partially to assure over-all struc-

tural stability against collapse in the event of failure in any given span in unbonded construction.

There should be no difference in these requirements between bonded and unbonded tendons.

3. In unbonded construction, continuous over several spans, failure of the tendons or of the concrete in one span due to any cause, such as overload, fire or corrosion, will inevitably lead to collapse of the whole member throughout its length and endanger the whole structure.

The method to prevent this is to require bonded reinforcement, either bonded tendons or reinforcing steel, in sufficient quantity so that the remaining structure will still carry safely the loads for which it is designed. Since a failure can originate in any span, it is necessary to provide such bonded reinforcement in all spans and at enough supports to assure the functioning of the structure in such an event.

Nominal mild steel reinforcement, sometimes used in unbonded construction to meet local flexural safety factor requirements, is insufficient for the purpose of assuring such over-all structural stability against collapse.

Author's Closure: Writer Kourkene has completely missed the point. The purpose of the paper is not, as Kourkene suggests, to advocate that "less is more", but to point out that current specifications for unbonded post-tensioning tendons are conservative, and to demonstrate numerically and logically the extent of the conservatism. Kourkene's argument

in favor of the philosophy that "the most you can offer at no increase in cost" is inapplicable. What "public interest" is served by a prestressing tendon with a strength of 270,000 psi when the concrete surrounding the tendon has failed in compression at a tendon stress of only 200,000 psi? Obviously none, and this is the point which apparently escapes Kourkene.

Kourkene's statement that his three listed conditions for tendons will guarantee "perfection in 100 percent of post-tensioning projects" is irresponsible and is a perfect example of the type of potentially dangerous thinking the author attempted to point out in the last paragraph of the paper. Adherence to such criteria, which are unrealistic and unsubstantiated, and thinking that such adherence will guarantee "perfection" in post-tensioned projects, provides no useful purpose and merely clouds the issue of the more important aspects of post-tensioned design and construction.

It is interesting to point out that Kourkene recently attempted to have his "conditions for tendon per-

fection" adopted by the International Conference of Building Officials for inclusion in the next revision of the Uniform Building Code. Logic prevailed, however, and at its August 14-15, 1970, meeting in San Diego, California, the General Design Subcommittee of ICBO disapproved Kourkene's conditions 1 and 2, stating they were "unnecessary and unsubstantiated". The committee had the following to say about condition 3, which is really more a matter of design than tendon performance: "The proposal raises questions that deserve further study. As submitted, it is vague and indefinite. The subject is being studied by SEAOC, ACI, and others and should remain on the agenda to determine a course of action when such studies are complete." In all probability, the studying agencies mentioned will adopt the published recommendations for this subject appearing in Reference 1, "Tentative Recommendations For Concrete Members Prestressed With Unbonded Tendons", which are adequate to eliminate the problem.