

Concrete-missing a quarterback?

Someone is needed between the architect/engineer and concrete constructor...someone who understands the concrete process

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A concrete construction executive said in a meeting with superintendents and foremen, "Fifteen percent of our dollars spent for labor are actually spent to correct mistakes. We made an honest appraisal of our costs and were shocked by this discovery. Costs are always difficult to establish but we believe that most concrete contractors are in the same boat."

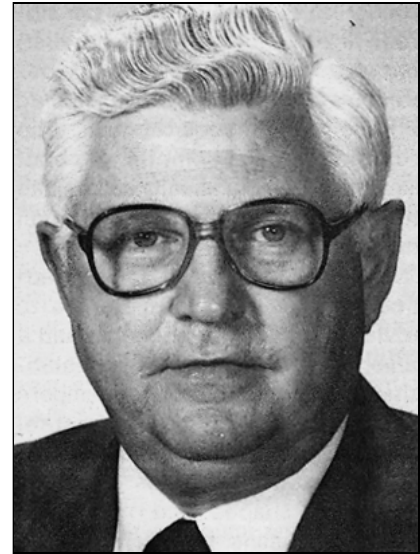
After reviewing numerous contributing factors the executive concluded that many of the mistakes he was correcting were caused by other people. "Mistakes" were too often designed into the jobs and, since they were difficult to spot in advance, they were almost impossible to prevent. This contractor is now paying far more attention to the technology of the concrete construction process, and he is consequently alert to opportunities to effect profit increases by avoiding costly corrective action.

As labor, materials and equipment costs are rising and time is becoming increasingly important, it is difficult for a concrete constructor to get by with practices that are less than the best. Ten years ago we weren't moving forms as fast as we can and must today. The mix could be souped up some and the forms left in place a little longer. Today we can't afford that luxury.

The concrete construction industry has advanced on the backs of strong men who have slugged it out to produce, under field conditions, a material which is equated to, and must compete and interact with, other structural components manufactured in factories and then brought to the field for assembly. Those were the early frontiersmen of our industry. Today we must find new frontiersmen to introduce advanced technology into the concrete construction process. Concrete contractors must, like other modern managers of construction projects, turn to computers, advanced technology and systemization rather than to brute force for increased productivity and lower construction costs.

The missing person

The concrete construction industry relies heavily on the judgment of the structural engineer. Is this a case of misplaced confidence? The academic curriculum for structural engineers is associated with the integrity and safety of components to buildings and the issuance of generalized specifications to guide the contractor's performance of the work. Few experience anything more in their academic training concerning the production of concrete than that found in a limited "Strength of Materials" course. Even



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this is now being deleted from some university curriculums.

The concrete supply and construction industry does have a number of skilled technicians, but these technicians are frequently familiar with only one facet of the entire concrete construction operation. There is no professional who verifies that the technology of various facets of the concrete construction process properly interface. The process can be likened to a jigsaw puzzle. Some of the parts of the puzzle are: contract documents, mix ingredients, the mix, reinforcing steel, forms, equipment, placement, compaction and management. The function of the missing person needed in the concrete construction industry is analogous to the function of the process metallurgist in the steel industry.

In a steel mill, operations personnel work with the process metallurgist to establish the work flow line to ensure that the product meets certain specifications. To plan the production of high quality steel this metallurgist must consider raw materials, temperatures, flow, process equipment, rolling, quenching and all of the many other technical factors of the process. As the product and mill conditions change, so must the process itself. It is the process metallurgist who directs the technical flow of materials and compen-

THE EDUCATION OF CONCRETE PROCESS PROFESSIONAL

The education should involve:

Engineering geology

Quality control and statistical analysis

Chemistry of the concrete process

Educational procedures

Equipment theory and design associated with pumps and consolidation devices

A structural engineering degree is not required.

Industrial engineering associated with systems and process development

Without people trained in the technology of the process we will continue to try to accomplish the unrealistic. With proper technology and leadership by such professionals we will be able to upgrade the industry and assure that concrete remains the most

Structural requirements and alternatives for reinforcing steel

sates for changes in the variables. Operations people do the work.

The operations personnel in a mill have little understanding of the reasons for adjustments made when the mill changes from mild steel to stainless steel. Their know-how is in the efficient operation of the mill once the process is established by the professional. The combination of process know-how and operations know-how produces a predictably high-quality material on a tight schedule at minimum cost.

How we are building with concrete

Now to get back to concrete. When a concrete building is being considered, the architect (a generalist) conceives how the thousands of different materials should be assembled to satisfy the needs of man. The architect knows something about many materials but usually he has had little opportunity to learn in detail how each material is manufactured.

Next, the structural engineer applies his knowledge of materials to provide structural components and a frame safe for occupancy. He establishes criteria for concrete members as he would for structural steel shapes. His design guidance is generally derived from tables on structural steel shapes and reinforced

concrete columns, beams, walls and slabs. Although he varies the characteristics of concrete by changing the reinforcement, concrete strength and source of materials, his expertise comes from his education in the use in design of structurally sound concrete members. He has little more than basic knowledge about the technology behind the complete concrete or steel manufacturing processes.

The next one to enter the building process is the contractor. He is operations oriented and experienced in assembling the materials prescribed by the design team. He follows the specifications. He is the doer.

The contractor relies upon suppliers to produce the materials prescribed. The bidding system frequently causes suppliers to be selected on the basis of price. Each supplier has developed the technology to produce a marketable item and is currently fighting the price war. Suppliers frequently do not consider the compatibility of their products with other products used in the concrete process, either because they do not have the opportunity or because they consider it to be someone else's problem.

Construction superintendents are historically pressure operators with the "can do" motto. As with the contractor, they are operations ori-

ented. Many don't bother to ask whether the elements they have to work with will function properly when combined.

The testing laboratory simply verifies that the components supplied meet the specifications. Though technically oriented, a testing lab relates to products and not to the process.

Among all of those involved with the project to this point, who is oriented to the process of making all of the components, equipment and materials work together as a system? Who is the equivalent of the process metallurgist? No one! This is the void in the concrete industry. We are trying to play a football game without a qualified quarterback.

Job problems we aren't solving

The contractor who spent 15 percent of his labor dollars to correct mistakes was doing so partly because of a failure to recognize that the process itself was invalid. Consider some of the things he may have had to put up with. Contractors are all too often faced with reinforcing steel details that make it impossible to set the forms to the prescribed dimensions. Specifications require the use of tremies but the largest size tremie feasible would be about the size of a soda fountain straw.

When faced with placing concrete around heavy reinforcement, the contractor is likely to be advised to "use a small vibrator." The advice may be no more productive than asking a major league baseball homerun king to reproduce his record using a sawed-off broomstick for a bat.


Bring in the missing professional

The concrete construction industry has a problem. It is practically devoid of people who have the professional expertise to evaluate the concrete process that involves all steps in the transformation of raw materials into the hard structural material which meets the characteristics and qualities prescribed by the

architects and structural engineers. We do not have people who can develop the needed construction practice standards. Neither do we have people who can analyze the concreting process to verify that what is proposed is feasible.

The concrete construction industry must get the cooperation of universities to introduce a program geared to produce concrete process professionals (the equivalent of

process metallurgists in the steel industry). Progress in concrete construction technology will be slow as long as there are no professionals who concern themselves with making the concrete construction process work. With the help of the concrete process professional, contractors will be able to improve their profits, accelerate construction and build better structures without concern for how their con-

crete will behave. When professionally developed, the results of the concrete construction process are predictable. 

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