VALUE ENGINEERING CONCEPT EXPLAINED BY EXPERT IN FIELD

HON. WILLIAM D. FORD

OF MICHIGAN

IN THE HOUSE OF REPRESENTATIVES

Thursday, June 24, 1971

Mr. WILLIAM D. FORD. Mr. Speaker, the concept of value analysis/engineering was introduced to the construction industry about 6 years ago, and tested and proved on the Federal Government level by the U.S. Postal Service in 1970.

The post office experience has since served as a pattern for value engineering studies by several other Government agencies. The Postal Service was so impressed, in fact, that it initiated a value analysis/management training course last year in its Postal Service Management Institute.

An excellent history and explanation of the value engineering concept was written recently by Mr. Louis C. Kingscott, Jr., president of Louis C. Kingscott

& Associates, of Kalamazoo, Mich. It was published in the May bulletin of the Michigan State Society of Architects.

Because of the tremendous potential of value engineering at the Federal Government level, I recommend it highly to my colleagues, and insert it at this point in the RECORD.

The report follows:

VALUE ANALYSIS—ENGINEERING IN THE CONSTRUCTION INDUSTRY

(By Louis C. Kingscott, Jr.)

"We do Value Analysis/Engineering as a part of our normal Architectural and Engineering Services" most A&E firms will tell you. I said that before 1965, but my experience since has shown that this is not true. Why?

It has been six years since the concept of Value Analysis/Engineering was introduced to the construction industry. Recently, a marked increase of activity has been noted which appears to be related to the recent upsurge in prices and accompanying budget restrictions. In an effort to combat this upsurge, the construction industry is becoming more receptive to the VA/E concept.

"We have been cutting costs for years, but we don't call it value engineering," is a typical reaction when one mentions VE in most consulting firms. This is understandable since all firms are concerned in some manner with cutting costs. A question asked by many firms is, "What is the difference, besides the name, from what is being done now?"

Actually, during more than five years of activity in the VA/E profession, our subsidiary Washington, D.C. firm has developed and refined VA/E specifically for the construction industry. As pioneers in this field, our VA/E approach has resulted in total cost reductions of at least five percent of total cost of ownership for many clients.

It was in recognition of our early activities in the VA/E field that prompted the United States Senate Committee on Public Works and the House of Representatives Post Office and Civil Service Subcommittee on Postal Facilities and Modernization to ask us along with others to testify before them about the potential of Value Analysis/Engineering in the construction industry. As a result of the Hearings, a number of government agencies have studied this potential and have adopted formal programs.

The present method of design for a facility involves principally the architect and/or engineer developing plans and specifications which take into consideration the design criteria of the owner.

The architects and engineers must determine which materials, equipment and methods are most suitable from the standpoint of aesthetics, economy, function and maintenance but within the standards and criteria set by the owner. Generally, the selection is done by an architect or engineer working on a particular aspect of the design. For example, the electrical engineer selects the generators and material for conductors, conduits, panel boxes, etc. The civil engineer selects the sewage and water systems, etc.

In some cases, economic studies are conducted, such as fuel selection, structural systems, and even site selections. However, in most instances, any selections or studies are made by an individual or at best, by a group of individuals within the same discipline. In some cases, a team is called together. But, normally no formal job plan is followed or full-time employees assigned to organize and coordinate activities to generate and follow through on new ideas.

In essence, what occurs is that each discipline ends up generating requirements, reviewing these requirements, establishing and modifying their particular criteria, based on the standards and criteria of the owner. This approach does not always lead to decisions which are most economical for the end function of the facility. Instead, this approach fosters or encourages economic decisions within each area with maximum safety factors deemed necessary by each discipline. Although this system is not totally without merit, it tends to sacrifice end system performance in maximizing sub-system performance. The result is that total cycle costs (total cost of ownership) are not adequately considered.

HOW DID VALUE ANALYSIS/ENGINEERING ORIGINATE?

During the last years of World War II and the early years of the war recovery era, General Electric in its manufacturing activities noticed that some of the substitute materials they were forced to use actually performed as well, or better; and at the same time, they cost the same, or less.

GE decided they needed to know why they didn't discover these substitutes for themselves in the first place without the war forcing them to it. After digging into their usual design practices, they realized that scarcities had forced them to perform a functional analysis approach to the design of their components. And, GE's accompanying cost analyses showed them that a relatively few parts of the design represented a great majority of the high cost items. This basic observation by GE is formalized by Pareto's Law of Distribution. Pareto (1848–1923) was an Italian economist and sociologist who found that in situations where a large number of diverse elements are involved in a single unit, about eighty percent of the costs are in about twenty percent of the elements.

WHAT IS VA/E?

Value Analysis/Engineering in construction is an objective, systematic method of optimizing total cost of a facility or system for a specific number of years. By total cost is meant the ultimate costs to construct, operate, maintain and replace a facility or system over a specific life cycle.

In simple terms, VA/E is a systematic, organized approach to obtain optimum value for every dollar spent. Through a system of investigation, unnecessary expenditures are avoided or removed, resulting in improved value and economy. The VA/E approach is a creative effort directed towards the analysis of functions. It is concerned with elimination or modification of anything that adds cost to an item but is not necessary to its needed requirements. During this process all expenditures relating to construction, maintenance, operation and replacement are considered. Through the use of creative techniques and the latest technical information regarding new materials and methods, alternate solutions are developed for each specific function. VA/E is not simple cost-cutting by making smaller quantities or using less or cheaper materials.

Lawrence Miles, while at GE, the now-recognized father of Value Analysis/Engineering by industry, and the National Society of American Value Engineers, (SAVE), formalized a management approach to develop a series of questions about certain important elements of design. This series of questions can be used in designing an electrical appliance, a building or even finding the best way to do house work. This series is called the "VA/E" Job Plan.

Thus the essential component of this organized effort is the Value Analysis/Engineering Job Plan. The Job Plan breaks down into four phases; i.e., information phase, speculative phase, analytical phase, and proposal phase.

Before the Job Plan can be utilized, the VA/E effort must seek out high cost areas having potential segments of unnecessary costs. This continuing effort should start as soon as valid design decisions have been made and end only when the client accepts the facility or product.

After a number of high cost areas are isolated and evaluated, the areas of greatest potential savings are selected for further VA/E study. Systems such as structural systems and mechanical systems are always investigated for unusually high costs. The study is conducted by a trained multi-disciplined team. This team approach has proven to be most productive.

THE INFORMATION PHASE

During this phase four principal questions must be answered.

What is the design?

What does it do?

What is the value of the function?

What does it cost?

The first step taken by the team is to gather all pertinent information such as existing criteria, present performance, and special problems. The next step in the information phase is most important—determining the primary and secondary functions of the design and relating these functions to cost. In simple terms, primary and secondary functions are those performance characteristics that a design possesses. The primary function is the basic purpose of design. It is the function that must remain to do the job. Conceivably, all other functions might be eliminated, but the primary cannot. Secondary functions are not required to achieve the basic purpose of the design—they only aid in achieving it. If the design can be changed, the need for secondary functions may be modified or even may disappear. For example, in a typical electrical wiring system, the wire itself performs the primary function—conduct current.

The insulation performs secondary functions—protect wire, identify wire, and insulate wire. Theoretically, we could eliminate the insulation and still perform the primary function—conduct current. Quite often we find that the secondary functions cost more than the primary function.

The next step is to determine the value or worth of the primary function. This is defined as the lowest cost achievable to perform the primary function in the most elementary manner feasible within the state of our present technology, with due consideration given to aesthetics. Normally, no value is assigned to secondary functions. This value or worth is used as a guage to indicate whether or not good value is apparent in the performance of a particular function. Extreme accuracy in determining this figure is not important since it is merely used for comparison.

The final step in the information phase is to determine what we are paying to perform this function. If this figure exceeds the estimated value of the function by many times, poor value and high costs are indicated.

THE SPECULATIVE PHASE

During this phase of the principal question to be answered is—what alternate ways can the necessary function be performed? This phase is designed to introduce new ideas to perform the basic function. Therefore, it is necessary to fully understand the problem, and, by using the problem solving or creative technique, to generate a number of possible solutions. The objective of this process is to generate a greater quantity of ideas, thereby enhancing chances of optimum solutions and higher savings.

The creativity process starts early in life for every individual and maximizes at 4–5 years of age. From then on, creative thinking is restricted due to parental and school controls, rules, regulations and social and legal requirements until many lose their inherent ability to be creative. In fact, one can become negative.

What can be done? For one thing, it must be recognized that the creative process requires an alert mental attitude and a responsiveness to change. Also, it must be recognized that regeneration of creativity can definitely be advanced through training.

This phenomenon is dictated by the loop on the curve. By training and practice, creative ability can be improved by learning to recognize and overcome barriers to creativity. As one aspect of training, it is very important that such emotional blocks as the fear of making a mistake or of appearing foolish be removed in order to maintain a positive approach to creativity.

The foremost approach in value analysis/engineering creativity is the "brainstorming" technique. Brainstorming is a problem-solving conference method, whereby each participant's thinking is stimulated by others in the group. The typical brainstorming session consists of a multi-disciplined group sitting around a table and spontaneously producing ideas that might perform the required function. During the session the group is encouraged to generate the maximum number of ideas. No idea is criticized! Judicial judgment and negative thinking are not permitted.

Experience has shown that engineers, and to a somewhat lesser extent, architects find it difficult to participate in a brainstorming session. It is necessary to continually point out that any evaluation or criticism must be held under a later phase. It is only after a number of sessions that "free wheeling" is achieved.

ANALYTICAL PHASE

In this phase, sometimes called the evaluation and investigation phase, alternates generated during the preceding phase are sifted, examined and developed into alternate solutions. The principal tasks to be accomplished are to evaluate, refine, and cost analyze the ideas and list them in order of the greatest savings.

The VA/E team must use all the sources of information available to determine if the ultimately selected alternate is truly lower cost, and perform required functions without impairing the essential quality, reliability or maintainability. An important aspect of the problem is determination of total costs. One solution might result in lower acquisition cost, but at the same time it might result in higher cost for the life of the system.

PROPOSAL PHASE

The proposal phase, sometimes called the program planning and reporting phase, is the final step in the VA/E Job Plan. During this phase, three things must be accomplished.

1. The group must thoroughly review all alternate solutions being proposed and document them completely to make sure that the best value is being presented and significant savings really are being offered.

2. The group must develop a sound proposal to management. In doing this, the group must consider not only to whom it must propose, but how to propose solutions most effectively.

3. Finally, the group must present a plan for implementing the proposal. This action is a critical one. If the proposal can't convince management to make the change, all the work goes for naught.

A most important fact is that the VA/E staff or team does not make the final decisions. It only recommends to the decision maker—designer, architect, engineer, or owner. Its effectiveness depends on its performance (which has been proven) and the attitude of management.

When is the best time to apply VA/E? The best time is in the early design cycle where VA/E can make its maximum impact on cost reduction. At this point, however, without accurate cost estimates, it is harder to document. But, major design decisions can be challenged and if changed, implemented wihout much extra work.

The most dramatic application of VA/E is when bids have exceeded the budget. This is the least productive stage but cost savings can be documented more easily. Major design changes are quite often prohibitive both from the implementation costs and the time schedule.

It is most important to note that when VA/E change proposals are accepted that the architect-engineer receive proper additional service fees for implementation.

What are some of the beneficial side effects of VA/E with our own office? Better internal communications between disciplines has resulted. It helps us to view a building as a total system as opposed to a collection of separate design solutions for architectural, mechanical, electrical, structural and civil engineering problems. It has inceased our internal efficiency. How much? By at least five percent. Many other benefits are developing continually.

Architects and Engineers, as the major decision makers, must investigate all new management tools that will provide their clients with better service. We must not be relutant to change and especially in the study and adoption of new management tools that will offer our clients the most value for their construction dollar. Value analysis/engineering is a tool.

REV. JOHN J. LONG—GREAT PRIEST, GREAT EDUCATOR, GREAT MAN

HON. JOSEPH M. McDADE

OF PENNSYLVANIA

IN THE HOUSE OF REPRESENTATIVES

Thursday, June 24, 1971

Mr. McDADE. Mr. Speaker, last Friday morning, the Reverend John J. Long of the Society of Jesus died in Mercy Hospital in Scranton, Pa., and in dying, left the community bereft of a truly great priest, a truly great educator, and a truly great man.

Father Long came to Scranton with one great mission before him. He took over the position of president of the University of Scranton with an absolute determinatcn to make a splendid university an even more distinguished one in the academic world. He brought together the people of our community in a manner we had not seen before. He gave each one of us a sense of participation in the life of that university and he gave every student in that university an enormous sense of participation in the life of the community.

Throughout the years when he was president of the university, and in the years afterward when others took on that burden, there was scarcely a project initiated by the good people of that region in which Father Long did not have a prominent part. He had a sense of dedication to the community that made the community realize that this was a unique man. He had a sense of dedication to each individual in the community that has made his loss a very, very personal loss to all of us who were fortunate enough to have him as a friend.

It is the end of most men to pass from this earth and to be forgotten quickly. Occasionally there comes along a man who leaves such an imprint on his time that he is remembered for generations to come. Father Long was such a man. In the death of Father Long, it is very difficult to extend sympathy to anyone. In his lifetime, he triumphed over death