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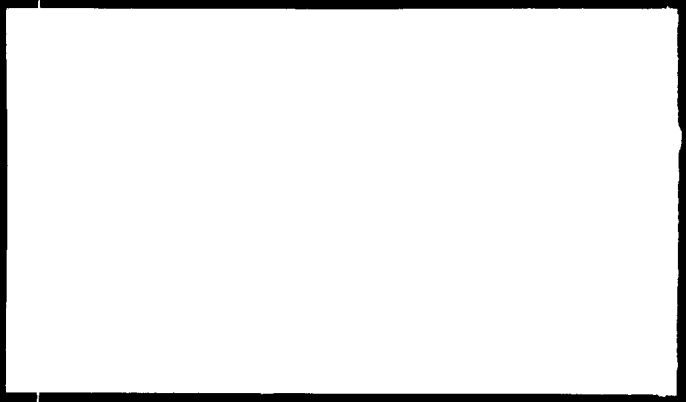

Federal Construction Council

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Technical Report

No. 92

Elements of an Effective Value Engineering Program

Federal Construction Council
Consulting Committee on Value Engineering

NATIONAL ACADEMY PRESS
Washington, DC
1990

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INTRODUCTION

The value engineering concept was developed about 45 years ago as a means of saving money without sacrificing quality or performance. It was first applied to construction about 25 years ago.

Most federal agencies currently define value engineering as an "organized effort directed at analyzing the function of construction operations, systems, equipment, facilities, procedures, methods, and supplies for the purpose of achieving the required function at lowest total cost consistent with the requirements for performance, reliability, quality, safety, and maintainability." (Federal Construction Council Consulting Committee on Planning and Design Technology, 1988).

Over the years, value engineering has been implemented in two ways by federal agencies:

1. Federal contracts for the procurement of many products and services (including construction) contain a "value engineering incentive" clause that encourages the contractor to propose cost-saving changes in the specifications for the products or services to be supplied, provided the proposed changes do not sacrifice any of the central features or attributes desired by the government. If a contractor's "value engineering change proposal" is accepted, the government shares the savings realized with the contractor.

2. Special value engineering studies are conducted during the design phase by a study team other than the design group. The studies are expected to identify design changes that will reduce costs without sacrificing quality or performance. The composition and functioning of typical value engineering study teams are described in Appendix A.

This report is concerned only with the second application of the value engineering concept; that is, through value engineering studies conducted during design.

WHY THE STUDY WAS INITIATED

Value engineering is a controversial subject in federal construction agencies. Some agency officials are opposed to the concept on the grounds that (a) architects and engineers are paid to develop optimum designs, and the government should not have to pay for additional value engineering studies to improve on their work; and (b) design changes made as a result of value engineering studies seldom provide the same level of quality or performance as the original design.

Conversely, many other agency officials enthusiastically endorse value engineering. They believe that value engineering studies can help agencies get facilities that fully meet their needs at significantly lower costs.[1] The Corps of Engineers' whole hearted commitment to value engineering, for example, is reflected in the description of the Corps' program presented in Appendix B.

Value engineering also has been endorsed by people in the private sector. Donald Trump, for example, credits value engineering with saving many thousands of dollars in

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[1] The money saved by the government through value engineering is ordinarily used for other construction projects. Thus, the benefits of value engineering generally come in the form of more construction for the dollar, and not reduced expenditures.

the construction of his casino in Atlantic City, New Jersey. (See Trump, 1989)

Actually, there have been disagreements about the benefits of value engineering almost from the time the concept was first introduced. For example, such disagreements prompted the Federal Construction Council to sponsor a symposium on the subject more than 20 years ago (Federal Construction Council, 1969), and the debate has continued to the present. The divergence of views on the subject is also demonstrated by the fact that whereas some agencies have had formal value engineering programs for many years, other agencies have almost totally ignored the concept.

However, the question became moot in January, 1988, when the Office of Management and Budget (OMB) issued Circular No. A-131 directing heads of federal agencies "to establish and improve their use of value engineering programs." OMB indicated that it had issued the directive because recent reports of the General Accounting Office and of many inspector generals in federal agencies had "consistently concluded that greater use of value engineering would result in substantial savings to the government."[2]

The Federal Construction Council Program Committee concluded that agencies developing value engineering programs for the first time might benefit from the experiences of the agencies that have had programs for many years. The Program Committee agreed, therefore, to form a consulting committee on value engineering to assemble information on the subject.

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[2] Congress also has shown an interest in value engineering as evidenced by a bill introduced in October 1989 by Representative Cardiss Collins. The bill, among other things, would require the head of each agency to establish a value engineering office in his agency. The bill also stipulates the composition and duties of the value engineering staff. (U.S. Congress, House, 1989)

HOW THE STUDY WAS CONDUCTED

The Consulting Committee on Value Engineering met four times in the course of the study. Early in its deliberations the committee identified ten important factors relating to value engineering programs:

1. An effective organization.
2. A clear statement of policies.
3. Well defined procedures.
4. Specific goals and objectives.
5. Proper staffing.
6. An effective training and education program.
7. High level management support.
8. Stable and adequate funding.
9. An effective crossfeed/lessons-learned program.
10. Credible records of saving.

Information on the current policies, practices, and views of the federal agencies represented on the committee regarding these factors was provided by the committee members. This information was reviewed and discussed at the committee meetings and a composite picture of the range of agency policies and practices was developed. That composite picture is presented in the three chapters that follow. The chapters cover the three main elements of a successful program: organization and staffing, policies and procedures, and continuity of support.

It should be noted that this report does not discuss the history or philosophy of value engineering or detailed procedures used in conducting value engineering studies since such matters have been covered in depth in numerous other publications. A comprehensive list of books, reports, conference proceedings, and video tapes on value engineering can be obtained from the Society of American Value Engineers (SAVE), 600 S. Federal Street, Chicago, IL 60605.

ORGANIZATION AND STAFFING

As with most human endeavors, the success of a value engineering program depends more than anything else on two factors: a sound and appropriate organization and an effective staff. The views and experiences of the agencies on these vital factors are summarize below.

ORGANIZATION

The experience of the agencies is that a value engineering organization is most effective if it mirrors the organization of the agency of which it is a part. Since federal agencies have a variety of organizations, it is impossible to describe an ideal value engineering organization. However, Figure 1 shows an effective value engineering organization in a large agency like the Army Corps of Engineers or the Naval Facilities Engineering Command with a number of divisions and regional offices. The key feature of the hypothetical organization shown is that there are value engineering slots at every level in the organization. Thus, value engineering permeates the entire structure.

It will also be noted that value engineering is shown as a primary staff function at each level. This reflects the experiences of the agencies that, to be effective, a value engineering coordinator needs ready access to the head of the office in which he or she works.

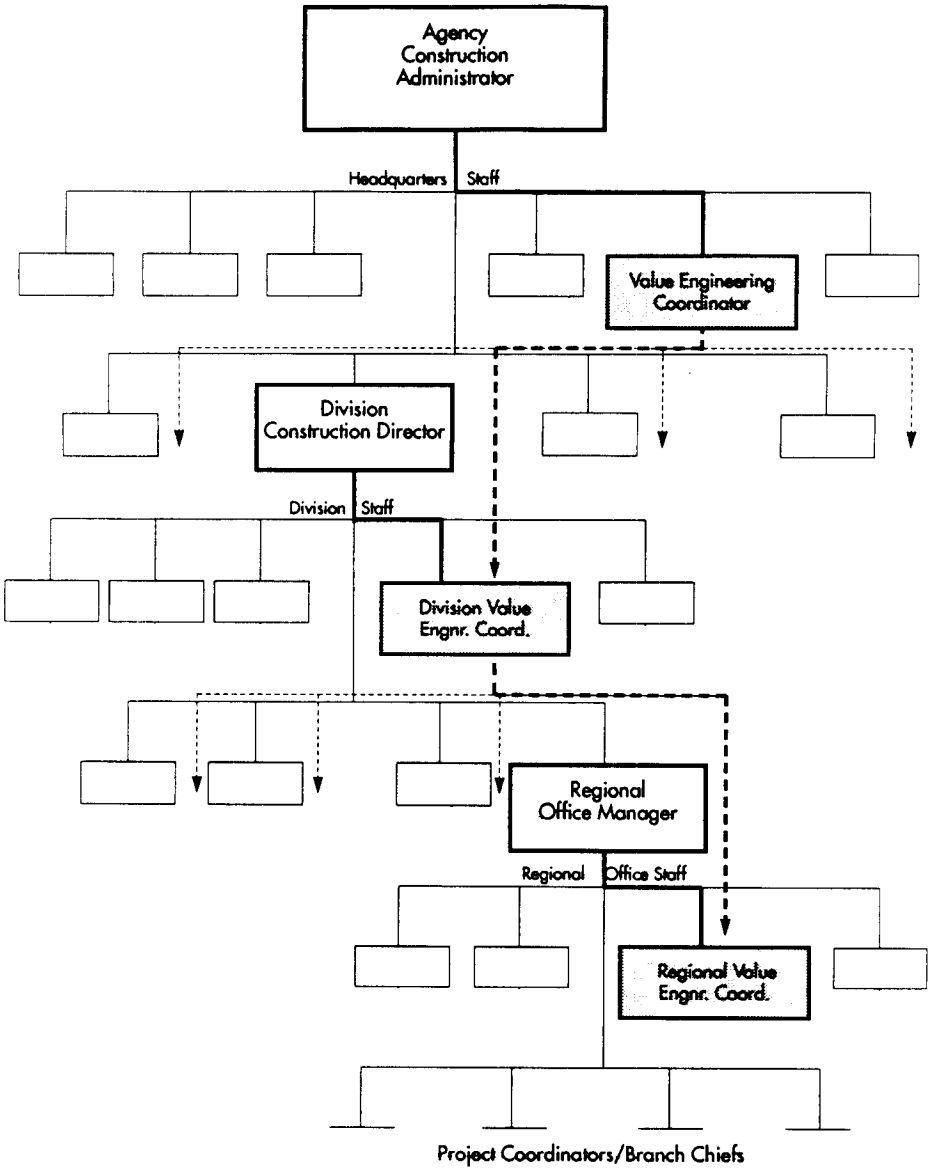

Figure 1. Hypothetical Value Engineering Organization in a Large Agency

Of course, putting value engineering on an organization chart does not ensure the success of a value engineering program. Agencies have learned that in order to be successful, value engineering coordinators must have authority that is commensurate with their responsibilities, and that the authority they need most is the authority to demand cooperation between designers and value engineering analysts. Such authority is vital because some designers, especially when they are first exposed to value engineering, become very defensive and negative. They view questions about their designs as attacks on their competence and they react accordingly. Good value engineering coordinators always try initially to overcome such reactions through diplomacy and persuasion. If, however, cajolery does not work, a coordinator must have the authority to insist on the cooperation of designers.

STAFFING

Agencies with successful value engineering programs have found that, regardless of how good a value engineering organization looks on paper, it will not succeed unless it is staffed properly. The committee found that the agencies were in general agreement on the following matters relating to value engineering staffing:

1. Value engineering must be the primary responsibility of value engineering coordinators; it cannot be just an extra duty.
2. In order to ensure that value engineering coordinators command the respect of the designers and managers with whom they must deal, they need to be experienced professional engineers or architects and have a government service rating comparable to their

counterparts in design.[3] (An adequate rating is also needed in order to attract qualified people to serve as value engineering coordinators.)

3. To preclude over-staffing or under-staffing a value engineering organization, agencies need to adopt staffing guidelines; one agency, for example, tries to have approximately one value engineering coordinator per 500 employees.

4. Care must be taken when forming value engineering study teams. Agencies, have determined, for example, that the leader of a study team should have at least 10 years of professional experience and that all of the other members must have demonstrated their expertise in some field of engineering. Most agencies also insist that all members of a value engineering team be trained in value engineering analysis. The makeup of a value engineering team will, of course, depend on the nature of the project being reviewed.

The agencies are also in agreement on the need for some type of formal value engineering training program. The specific views of the agencies on training are discussed in the next chapter.

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[3] Some agencies believe the value engineer coordinators need to be registered engineers or architects; other agencies believe registration is unimportant.

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POLICIES AND PROCEDURES

Agencies have found that a successful value engineering program requires a clear statement of policies -- so that the program can survive the possible opposition of local supervisors -- and well-defined procedures, to ensure that value engineering studies are performed properly. The experiences of the agencies on what constitutes good policies and procedures are summarized below.

GENERAL VALUE ENGINEERING POLICIES

Several agencies have developed policy statements on value engineering -- including the Office of Foreign Buildings Operations of the U.S. Department of State (1984), the Office of Projects and Facilities Management of the U.S. Department of Energy (1989), and the Naval Facilities Engineering Command (1983). Among the items that the agencies have included in their statements of policies are the following:

1. A delineation of the general objectives of the program, with emphasis on the fact that the goal is to reduce long term costs, and not merely to obtain short term savings.

2. A requirement that those involved in value engineering analyses be as accurate as possible and scrupulously objective when preparing cost estimates.

3. A requirement that records be kept of all major decisions and the reasons for those decisions.

4. A reference to the Office of Management and Budget Circular (No. A-131) on Value Engineering (Office of Management and Budget, 1988).

5. Guidelines on selecting projects for value engineering studies. (The guidelines might indicate, for example, the minimum size project, in terms of estimated cost, that is to be value engineered.)

6. The anticipated savings-to-cost ratio expected from value engineering studies (e.g., 10 to 1).

7. A requirement that -- whenever possible -- value engineering studies be conducted in the early stages of the design process; i.e., at or prior to the end of the "design development phase", which is roughly equivalent to the 35 percent design point. (If value engineering is performed when a design is almost complete, the implementation of suggested changes may require considerable redesign work, which designers dislike and often oppose, and cause the project to be delayed. In addition, value engineering performed on an almost completed design is frequently viewed as merely cost cutting. To avoid such problems, the military agencies generally do not refer to cost reduction efforts undertaken after the 35 percent design point as value engineering.)

8. An indication of whose signatures are required on value engineering studies in order to make them official; e.g., the members of the value engineering study committee and/or the responsible value engineering coordinator.

VALUE ENGINEERING PROCEDURES

Most agencies with value engineering programs have issued statements or directives concerning the procedures to be followed in their programs. Among the topics covered in such directives are:

1. Procedures to be followed in conducting value engineering studies.
2. Methods of calculating value engineering savings.
3. Methods of disseminating the results of value engineering studies.
4. Methods of setting annual value engineering goals.
5. Value engineering training procedures.

Conducting Value Engineering Studies

One agency, the Department of Energy, does not issue detailed procedures on conducting value engineering studies. DoE leaves it to its operating elements to develop their own procedures. All of the other agencies, however, have issued or are developing procedures, and in general such procedures cover the following matters with regard to the conduct of value engineering studies:

- How value engineering teams are assembled.
- The qualifications of members of value engineering study teams.
- When in the design process the team is assembled.
- How the team functions.
- The need to give valid reasons for the rejection of value engineering suggestions.
- Who is responsible for ensuring that approved value engineering suggestions are implemented.

The policies and practices of the Naval Facilities Engineering Command on these matters are presented in Appendix A.

Calculating Value Engineering Savings

Inasmuch as the purpose of value engineering is to reduce unnecessary costs, value engineering programs are judged on the basis of the "bottom line." Value engineering programs cost money, and unless agency managers are convinced that the savings realized are

substantially in excess of the required investment, they are reluctant to continue investing scarce money and talent in value engineering programs.

Managers of value engineering programs have been aware of the need to document savings from their work for many years. However, their efforts to convince others of the savings being generated by their programs are hampered by the fact that in construction savings from value engineering are hypothetical since it is seldom possible to prove that a particular value engineering change made during design has actually resulted in lower bids.[4]

In order to help ensure the creditability of claimed value engineering savings and the benefits of value engineering programs, most agencies have established procedures regarding the calculation of savings from proposed changes. In general, most agencies direct value engineering teams to be ultra-conservative when making assumptions about potential savings and to be scrupulously careful to make economic analyses in accordance with accepted principles. In addition, most agencies require value engineering coordinators to verify that all changes for which savings are claimed have, in fact, been made.

Disseminating the Result of Value Engineering Studies

All of the agencies that have had value engineering programs for some period of time have come to realize that the benefits of value engineering studies can be magnified if procedures are developed to permit the lessons learned and insights gained from one study to be applied elsewhere -- such as to modify the basic design criteria and/or

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[4]These comments apply to value engineering studies performed during design. They do not apply to value engineering proposals submitted by construction contractors.

specifications of an agency, or for use in other value engineering studies of similar buildings.

While the benefits of disseminating the lessons learned from individual value engineering studies would appear to be self evident, the agencies have learned it is not accomplished automatically. To facilitate the dissemination and widespread use of such information, some agencies have developed standard formats for the presentation of the results of value engineering studies. Similarly, some agencies have developed a key word method of finding passages and recommendations on a particular subject in value engineering reports. For example, as discussed in Appendix B, the Army Corps of Engineers has developed a value engineering data base called "VE-Trieval" in which value engineering changes that have been accepted by various Corps' offices are stored on a computer. Ideas on particular topics can be identified through a key-word search procedure. It is expected that the Army data base, along with similar data bases from the Navy and Air Force, will soon be available on compact disks through the National Institute of Building Sciences.

Setting Annual Goals

Several agencies have found that it is useful to develop and issue annual value engineering program goals to supplement the general objectives that are outlined in value engineering policy statements. Such annual goals, these agencies believe, help to stimulate everyone in the agency to pursue value engineering vigorously. However, not all agencies are convinced of the value of annual goals. The Department of Energy and the Department of the Interior, for example, believe that goals can be dangerous because they promote the adoption of changes of questionable value and the inflation of claimed savings.

The agencies express their goals in various ways. Three of the most common methods of setting annual value engineering goals are the following:

- As a return on an agency's investment in value engineering; i.e., the amount of documented savings from value engineering studies is expected to equal or exceed some multiple of the money spent on value engineering studies.
- As a percentage of an agency's total construction expenditures; i.e., the dollar amount of certified savings from value engineering studies divided by the total estimated cost of either the overall construction program of the agency or the total estimated cost of the projects on which value engineering studies are made is expected to equal or exceed a certain amount, expressed as a percentage. (The current value engineering savings goal of both the Army Corps of Engineers and the Naval Facilities Engineering Command, for example, is 6 percent of their annual military construction budget.)
- As a certain number of value engineering studies undertaken. (Alternatively, an agency could establish as an objective the percentage of projects on which value engineering studies will be performed.)

All of the agencies agree that it is a waste of time to establish annual value engineering goals unless they are stated in such a way that a particular individual is held accountable for meeting the goals, and unless someone reviews the performance of the various value engineering offices in the agency to compare the results achieved with the goals.

Value Engineering Training

The committee found that the agencies are in general agreement that two types of value engineering training are needed: the training of value engineering practitioners, and the training of managers in the purposes and benefits of value engineering.

With regard to the training of managers, the agencies have found that managers can become well informed about the purposes and benefits of value engineering through briefings lasting between one and four hours. However,

such briefings do not guarantee that a manager will be a supporter of value engineering. Many managers are skeptical of value engineering, and their skepticism can be overcome only by demonstrated results. Until they have seen for themselves that value engineering produces results, they generally retain their skepticism. The briefings of managers serve only to educate them about the nature of the value engineering program, how it functions, what it is intended to do, and how value engineering studies are performed. Two agencies -- the Army and the Navy -- have prepared videos to be used in such training.

With regard to the training of value engineering practitioners, the agencies generally agree that an experienced engineer can learn to apply value engineering techniques by attending a forty-hour value engineering course. As a rule, such courses include approximately twenty hours of lectures and twenty hours of value engineering analysis of a specific project.

Several of the agencies reported that they are making a concerted effort to train all of their engineering and architectural personnel in value engineering. Toward that end, they are training approximately 15 percent of their staff annually. Because of staff turnover, they expect such training efforts to continue indefinitely. At least one agency, the Naval Facilities Engineering Command, permits employees of private architect-engineering firms under contract to the Navy to attend their value engineering course.

Some agencies insist that private architect-engineer firms seeking design contracts have at least some people on their staffs who have successfully completed an approved course in value engineering.

4

ENSURING CONTINUITY OF SUPPORT

The committee found that all of the agencies are in agreement that value engineering programs are most effective when they are a regular and continuing element of the design process. Ad hoc efforts and start-stop programs are not conducive to effective value engineering. Consequently, most agencies strive for continuity in their value engineering programs, and most have found that two factors in particular contribute to continuity: high level management support for value engineering and stable and adequate funding.

ENSURING MANAGEMENT SUPPORT

Ensuring continuing high level management support for value engineering programs can be a challenge in some agencies because of rapid turnover in top management positions. In some agencies, managers may stay only two or three years and each new management team has its own views on such things as value engineering. To minimize the chance of an effective value engineering program being terminated, most agencies make a concerted effort to get and keep the support of their high level management for value engineering programs. Among the steps agencies taken to ensure such support are:

- Periodic, well-structured briefings on the nature and benefits of value engineering.
- Regular reports to management of the successes achieved through value engineering.
- Providing opportunities for managers to get publicity for savings realized through value engineering.
- Having a firm, well-written policy relating to the need for and role of value engineering.

It should be recognized, however, that a successful value engineering program can sometimes be detrimental to the performance rating of a construction manager. This is because one of the factors commonly used to evaluate federal construction managers is whether or not his or her construction funds are being expended at the rate anticipated or prescribed by agency headquarters. Agencies establish expenditure schedules to help ensure that needed projects are undertaken without delay and that all of the funds authorized by Congress are used. While managers generally are in favor of saving money, they may not welcome value engineering changes that adversely affect their expenditure rate, particularly if the funds saved cannot be used for other purposes. When a manager's staff size is related to expenditures, unexpected savings from value engineering may have the additional undesired effect of causing a loss of staff positions. Although the committee members are unaware of any instance of an agency discouraging the use of value engineering because of these factors, the members have learned that proof of monetary savings alone is not enough to ensure the support of agency managers for value engineering.

ENSURING STABLE AND ADEQUATE FUNDING

All of the agencies were in agreement on the need for stable and adequate funding for value engineering programs, and of the fact that having a line item in the agency budget ear-marked for value engineering is the most effective way of ensuring stable funding. Most of the agencies (and the Office of Management and Budget) feel

that the funding for value engineering should represent some fixed percentage of the overall construction budget (e.g., one half of one percent).

The agencies were virtually unanimous in their belief that value engineering programs are in jeopardy if they are included in a general appropriation for design. Since design is in some respects an open-ended activity, funding for design is almost always less than managers of design work feel is needed. If value engineering is included in the design appropriation, design managers may be tempted to eliminate value engineering efforts in order to fund more design work.

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APPENDIX A

COMPOSITION AND FUNCTIONING OF VALUE ENGINEERING STUDY TEAMS IN THE NAVAL FACILITIES ENGINEERING COMMAND

Value engineering studies in most federal agencies are conducted by special study teams, which may be composed of either in-house personnel or engineers and architects employed by private consulting firms under contract to the government. Regardless of which type of personnel are used, the composition and functioning of value engineering study teams are essentially the same.

The policies and procedures of the Naval Facilities Engineering Command -- which are typical of the policies and procedures of most agencies -- are described in the following excerpt from a model "open-end" contract for value engineering services.

SCOPE OF WORK FOR OPEN-END CONTRACT
FOR VALUE ENGINEERING SERVICES

1. SCOPE OF WORK. The Value Engineering Management Services (hereinafter referred to as VETS) will be conducted immediately following completion of the 35% design and shall consist of one 40 hour team study by a multi-discipline team of six professionals meeting on five consecutive work days. The study group will follow the five step job plan as recognized by the Society of American Value Engineers (SAVE). The VE report (15 copies) shall encompass the recommendations of the VE study group with detailed cost estimates, life cycle analysis and sketches, as necessary.

VE services shall be performed in a timely manner concurrently with the normal design procedure and without delay in the design schedule set forth in the A&E scope.

2. ESTABLISHMENT AND APPROVAL OF VE TEAM. VE services shall be performed by a second team of designers, separate and completely independent from the original designers which prepare the 35% plans and specification. The VE services shall be performed by a qualified firm or persons having Certified Value Specialist (CVS) credentials that qualify them to perform such services.

All members of the team shall be professionally registered and completely knowledgeable of VE methodology by attending a certified forty hour workshop. Team Leader will be a CVS, certified by the Society of American Value Engineers and have had a minimum of eight years combined college education and practical on-the-job VE experience. Practical experience is considered to have been gained by being actively engaged as a consultant in VE activities.

A list of team members and their respective resumes representing the various disciplines to be covered minimum of six together with the certified (CVS) team leader's qualifications and discipline shall be submitted for approval at the time of negotiations. Changes to or substitutions to the approved VE team configuration shall be submitted in writing to the Contracting Officer for approval.

3. TYPICAL VALUE ENGINEERING TEAM CONFIGURATION *

a.	VE Team Leader	80 Hrs. **
b.	Architect	40 Hrs.
c.	Structural Engineer	40 Hrs.
d.	Mechanical Engineer	40 Hrs.
e.	Electrical Engineer	40 Hrs.
f.	Civil Engineer	40 Hrs.
g.	Typing	60 Hrs.
		340 MH

* The V.E. Team Study will be conducted in the town where the A/E of record resides. The VETS Team (typically) will comprise of three locally hired team members and three from the CVS firm.

** The principle person responsible for prestudy work assembling, editting and reproducing the recommendations generated by the Value Engineering Team Study. C.V.S. must edit and sign the final report.

4. STUDY GROUP REQUIREMENTS AND ENVIRONMENT

Prior to commencing a VE study LANTNAVFACENGCOM will forward the following information to the VETS Team:

(a) Two sets of 35% drawings (full size)
(b) Two sets half size drawings
(c) Specifications (2 copies)
(d) Detailed Cost Estimate (6 copies)
(e) Basis of design (6 copies)
(f) Design Calculation (Mech, Elec, etc.)
(g) Boring logs and soil reports
(h) PED (4 copies)
(i) Photographs of job site
(j) Design & Criteria Manuals (Navy) shall be available for reference

The VETS Team shall be assembled and isolated away from their normal work station in order to avoid the normal daily interruption such as: phone calls, quick questions and brief meetings which come up and tend to be very disruptive to studies of this type.

5. CERTIFIED VALUE SPECIALISTS (CVS) RESPONSIBILITIES 80 Hours effort

a. Pre Study
   (1) Review complete design package and identify high cost areas.
   (2) Prepare cost model (actual vs. historical).
   (3) Prepare bar graphs of all sub systems.
   (4) Prepare preliminary cost worth ratios.

b. 40 Hour Study
   (1) Team leader and coordinator.
   (2) Team recorder.

c. Post Study
   (1) Write and assemble report.
   (2) Proof all VE recommendations, especially the cost estimate and life cycle analysis.
   (3) Calculate redesign effort for each recommendation in man hours.
   (4) Sign and submit final report: express mail 10 copies to LANTDIV and 5 copies to A&E of record.

6. VE REPORTS AND DOCUMENTATION REQUIREMENTS. The results of each VE study performed on the project shall be documented as follows:

(a) Contents page.
(b) Brief description of total project and project requirements with a copy of DD 1391.
(c) Brief summary of VE recommendations.
(d) One site plan, floor plan and elevation on 8-1/2" x 11" or fold out.
(e) Summary sheet (only) of 35% cost estimate.
(f) VE cost model of project.

(g) Each VE recommendation will be described "Before and After VE" and will be accompanied with a detailed cost estimate of savings, life cycle cost analysis, and sketches as necessary.
(h) Complete 5 step job plan (worksheets) of all work will be submitted as a glossary for reference.

7. VE REPORT FORMAT. All reports must be systematically assembled and must be short and concise, yet informative enough for decision making. VE Reports shall be prepared and submitted on 8-1/2" x 11" bond paper and bound under hardback cover appropriately identified. The report shall be prepared and bound under hardback cover and appropriately identified as a summary report. Sketches may be 8-1/2" x 11" or fold-out. Pages must be sequentially numbered in the lower right hand corner to facilitate assembly. Tabs should be used for quick reference of important sections of report.

8. CHECK LIST FOR VE WORKSHOP.

a. Room size 250 SF - isolated away from normal work station environment.
b. Adequate lighting for prolonged reading, writing and studying (70FC).
c. Five large tables with a minimum of 10 chairs.
d. Proximity and access to telephones and duplicating machine (Xerox).
e. Blackboard and/or flip chart.
f. Current estimating books (least three different sources).
g. Access to Sweet's Catalog and Navy Design Manuals.

9. GUIDANCE AND CONSULTATION.

a. Value Engineering Team Studies will be conducted in the city where the A/E of record resides unless otherwise directed.

b. When preparing the fee for VE services the VE contractor is required to hire three of the six team members from the local A/E community where the A/E of record resides. No member of the A/E's firm may be a member of the VETS Team.

Additional guidance for the VE job plan is contained in enclosure (1). Consultation for the preparation of VE Reports is available by contacting the VE Officer, Code 048, telephone area code 804, 444-9797 of the Atlantic Division, Naval Facilities Engineering Command.

APPENDIX B

Value Engineering in the US Army Corps of Engineers...

A Commitment to Quality

Eugene A. Degenhardt, P.E, CVS
Value Engineering Officer
US Army Corps of Engineers, St. Louis District

In the Beginning

The value engineering methodology was conceived in 1947 by Mr. Lawrence Miles, an engineer with General Electric, who believed that an intentional effort should be developed to improve a product's value by substituting other materials to perform the same function of more expensive (and scarce) items.

From this beginning, the Navy Bureau of Ships initiated a formal Value Analysis program in 1954. In 1964, the Corps of Engineers initiated their own program by having a private consulting firm conduct a series of seminars for its employees. Over 4,000 persons were introduced to the VE Job Plan in five months. In the same year, a contract containing a VE incentive clause was advertised for bids. Realizing that the Value Engineering methodology was a viable mechanism by which to improve a product's value, full time VE positions were created in the Corps in 1966.

The Corps VE program has now grown into a "family" of over 60 VE officers at the various District and Division offices and laboratories. A VE officers guide is available which provides general guidance as to how a VE program is to be conducted. It is a flexible document which permits a reasonable degree of interpretation by the VE officer due to the different types of projects encountered. Most of the Corps VE officers have full time, staff level positions.

To emphasize the importance of Value Engineering program, the Chief of Engineers, in conjunction with the Assistant Secretary of Defense, has developed a set of initiatives. Some of the major ones are:

- o VE will be an integral part of the design cycle and applied early in the design phase of a project.
- o VE will be applied, when cost effective, to each project with a current working estimate exceeding $2 million.
- o The Corps-wide VE Study Team, (OVEST) will be utilized by Commanders whenever possible.
- o Training will be an integral part of the VE program.

Goals and Accomplishments

To date, the Corps VE program has produced over $2 billion in savings to the taxpayer. Recently, the savings have averaged over $175 million per year. As can be seen in the accompanying graphs, the savings are increasing at an accelerating rate. From just a few years ago, when the VE officers goal was only 2 percent of a project's cost, this figure has risen to 6 percent due to the emphasis being given to achieve a balanced budget.

Organizational Structure

The Chief of Value Engineering is located in the Office of the Chief of Engineers in Washington, D.C. From this point, thirteen Division offices have jurisdiction over 38 District offices. These offices are configured along watershed boundaries for civil works functions.

The Division offices are primarily responsible for performing special functional tasks for the Chief of Engineers, assigning goals and monitoring the activities of their respective Districts, and suggesting new areas of study. The District offices are field operating activity centers where the work is initiated.

In addition, the following laboratories and support centers have VE officers assigned to them:

Construction Engineering Research Laboratory
Cold Regions Research and Engineering Laboratory
Engineer Topographic Laboratories
Engineering and Housing Support Center
Waterways Experiment Station

How the Corps Implements Value Engineering

The heart of the Corps VE effort is in the formulation of in-house VE study teams which are generally comprised of about 5 to 7 people from a wide variety of backgrounds. A diverse group is desired so that new thoughts can be surfaced and investigated. Studies may last anywhere from just two days to a week, or be performed intermittently over a period of weeks or months. The Corps VE officer generally solicits the team members, initiates the study, and provides assistance on an as-needed basis. If possible, the team leader is a person who has recently taken the Corps 40-hour, SAVE-approved workshop. A formal report and presentation is the result of such an effort. In addition, outside architect-engineer firms are sometimes utilized to perform VE studies when a heavy workload exists and/or a high degree of "outside" brainstorming is desired.

Another important aspect of the Corps VE program is contractor submission of VE proposals through the formal Value Engineering Change Proposal (VECP) process, whereby they receive 55 percent of savings resulting from approved proposals. The success of the VECP program lies in the resident engineers and VE officers ability to create enthusiasm among the various contractors. It is also important that contractors be given an opportunity to participate in a 40-hour workshop and feel comfortable with the VE Job Plan.

Individual employees are also encouraged to submit VE proposals on their own and are rewarded through the Corps suggestion program. A great deal of "people persuasion" and

sincere effort is needed to arrive at a point whereby employees tend to "think VE" as part of their daily activities -- it works!

Other Activities

The heart of a successful and continuing Corps VE program lies in the numerous 40-hour VE workshops that are offered on a periodic basis by full-time Corps VE officers. Unlike other training programs, these five-day classes pay for themselves many times over. A typical class of 35 professionals is divided into about 6 or 7 study teams which perform a VE study on an on-going Corps project as they are guided through the VE Job Plan. A report is prepared and a presentation is given by each team. Because of the unique techniques that are utilized to put people in a creative mood, the classes are both fun and a learning experience. Fellow professionals from outside the Corps are invited to attend these unique and productive workshops.

Another important part of the Corps VE program is the purposeful interaction between the VE officers on a world-wide basis. A Corps-wide meeting is held each year immediately after the Society of American Value Engineers' (SAVE) International Conference. Besides encouraging their participation in SAVE, the Corps conference gives VE officers a chance to share ideas through organized small group exchange/feedback sessions and distinguished invited speakers.

Although seemingly simple, one of the most effective techniques to promote enthusiasm within a Corps office is by the "internalization" of the VE program. Rather than just another "add on" technique for the professional to contend with, VE is made an integral part of the on-going design refinement/review process. In many offices, the design team leader for a project must show their supervisor a list of design objectives before they initiate their study -- VE **must** be one of them which is elaborated upon. Using this philosophy, the designer feels that they "own" part of the VE process and can be recognized for their contributions to it.

A computerized data base, called **VE-trieval**, was developed by the Corps in 1983 to enable a person to search for money-saving ideas that could be utilized on their particular project. Accepted VE ideas from Corps offices were put into a central data base which could then be queried by a key word search technique. Much interest has been expressed in its expansion and it will be soon be put on a CD-ROM optical disk format for others to use. The successful design/construction-oriented VE ideas from the Corps, Navy, Air Force and others will be contained on a single disk. In addition, there will be a direct crossfeed link between the successful VE proposals and the offices responsible for updating the guide specifications and technical manuals. The potential for future savings from such an activity is significant.

O V E S T -- The Corps-wide Value Engineering Study Team

The Chief of Engineers established OVEST in 1984 for the purpose of enhancing the Corps VE program in the study of large or complex projects. Located in Savannah, Georgia, OVEST is comprised of eight senior level designers with extensive technical, construction and project management experience. Their high level of expertise has resulted in the performance of over 85 major VE studies to date with a gross construction cost savings of over $80 million. Their payback ratio is over $35 for every dollar spent.

CrEAtiViTy and FUNCTION -- the heart of the Corps VE Job Plan

The Corps VE Job Plan is similar to most other VE Job Plans in terms of its sequence; i.e., Information, Speculation, Analysis, Development and Presentation phases. What makes the Corps effort unique is that a great deal of emphasis is placed on functional creativity -- "what else could satisfy the required function?" Employees are encouraged to venture out of their comfort zone to look for a second right answer -- there usually is one. The freedom is given to question regulations that often appear to be a constraint in this era of rapidly changing technology.

PEOPLE -- The heart of the Corps VE success

Although seemingly simple, the generation of enthusiasm by the Corps VE officers is THE secret of a successful program. To assist the VE officer in this task, the genuine support of TOP management is imperative. Without this boost, a lip service scenario will result. The rest is easy to imagine.

The bottom line -- if you want an effective Value Engineering program in your agency, one MUST jump into the effort with a 100 percent commitment.

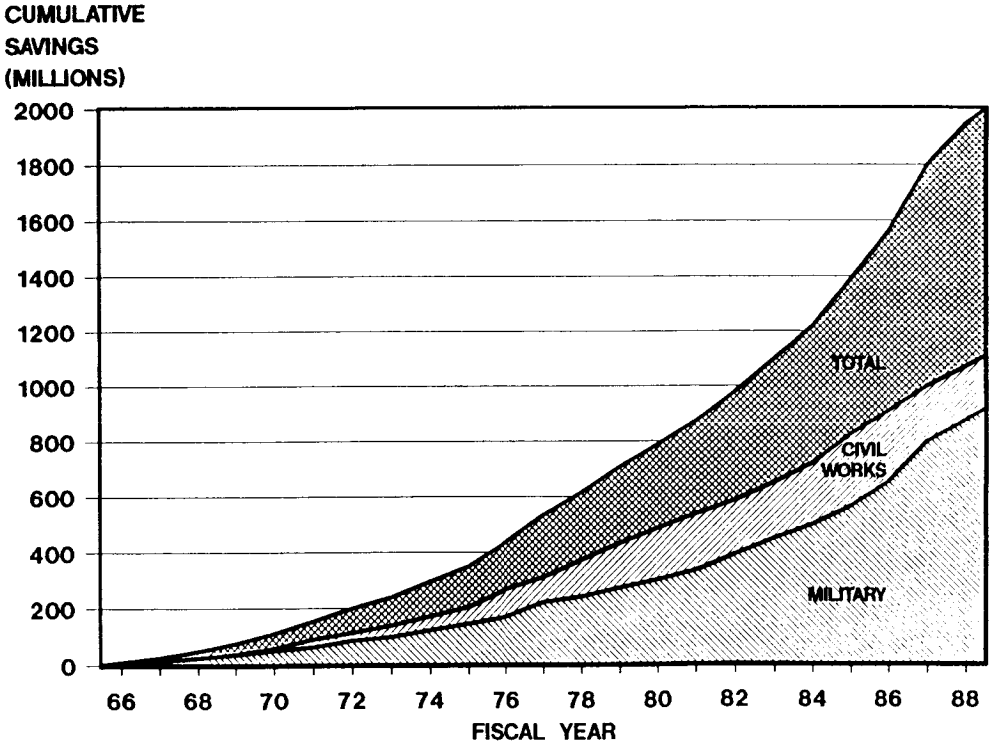
Examples from the Corps -- VE really works!

The figures at the end of this paper illustrate just a few of the thousands of Corps VE ideas that have been implemented. As can be seen, quite a few of them did not involve complex solutions, but merely an open mind and creative atmosphere between a team of interdisciplinary professionals.

If you don't look for the second right answer,
you won't find it!

TOTAL VE SAVINGS

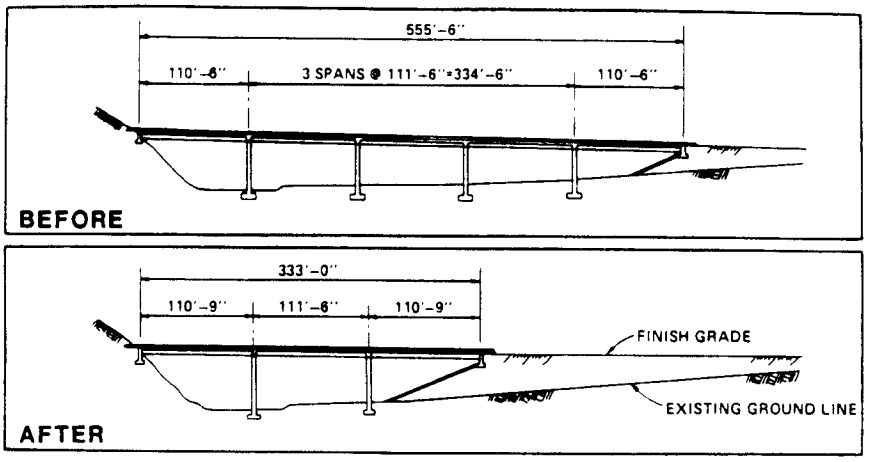
IN-HOUSE AND CONTRACTOR-SUBMITTED



VALUE ENGINEERING

BLUE MARSH LAKE

L.R. 06048 HIGHWAY BRIDGE



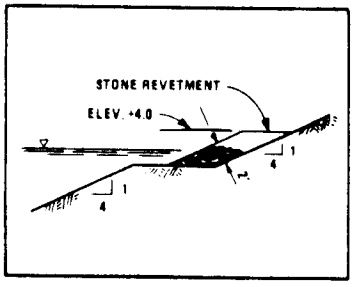
SOURCE – PHILA. DIST.
U.S.A. C OF E

INSTANT CONTRACT SAVINGS $289,000.00

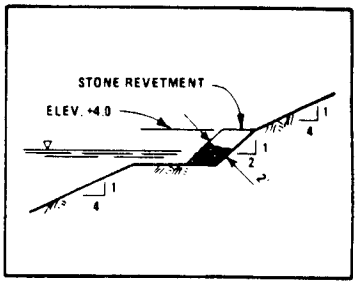
SAVINGS – CONCRETE, PIERS, PRE-STRESSED GIRDERS, GUARDRAIL

STONE REVETMENT

U.S. NAVY TRIDENT PROJECT, CANAVERAL HARBOR, FLA.



BEFORE: STONE 90,000 TONS
@ $ 22.70 = $ 2,043,000



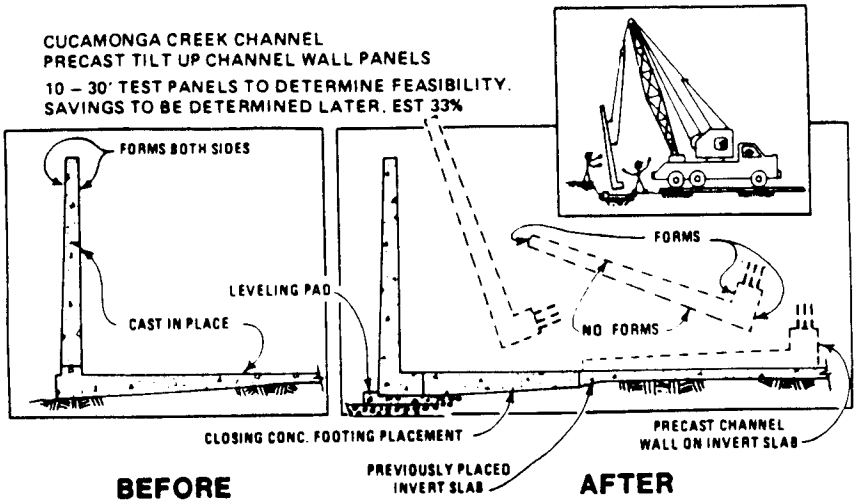
AFTER: STONE 72,000 TONS
@ $ 24.98 = $ 1,798,560

TOTAL SAVINGS – $ 244,440

SOURCE: JACKSONVILLE DIST.
U.S. ARMY CORPS OF ENGINEERS

SAVINGS: STONE QUANTITIES

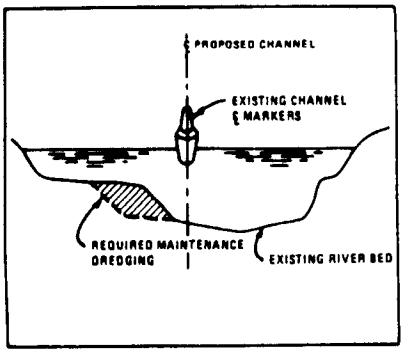
CUCAMONGA CREEK CHANNEL
PRECAST TILT UP CHANNEL WALL PANELS
10 – 30' TEST PANELS TO DETERMINE FEASIBILITY.
SAVINGS TO BE DETERMINED LATER. EST 33%



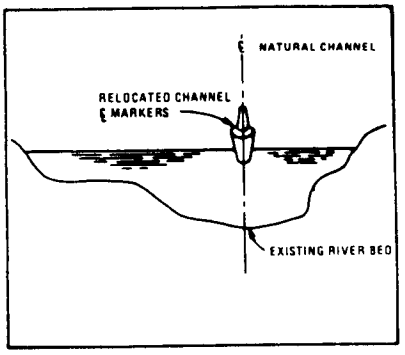
SOURCE: LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

SAVINGS: PRICE PER CUBIC YARD OF CONCRETE, TIME, LABOR, MATERIALS AND REDUCES SAFETY HAZARDS

DREDGING



BEFORE: CONTRACT REQUIREMENTS INCLUDED MAINTENANCE OF CHANNEL AS MARKED BY EXISTING CENTER LINE MARKERS.



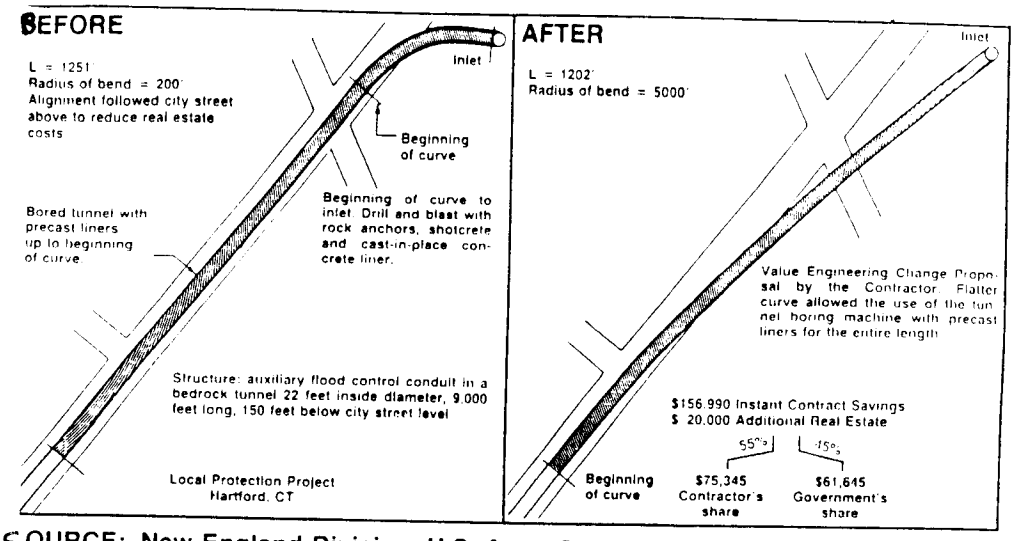
AFTER: EXISTING CENTERLINE CHANNEL MARKERS RELOCATED FOR NATURAL CHANNEL ELIMINATING 120,000 C.Y. REMOVAL REQUIREMENT.

1 YEAR SAVINGS $232,000

SOURCE: SAVANNAH DISTRICT
U.S. ARMY CORPS OF ENGINEERS

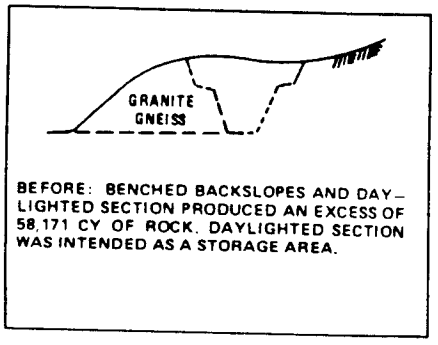
SAVINGS AND ENVIRONMENT

Tunnel Realignment

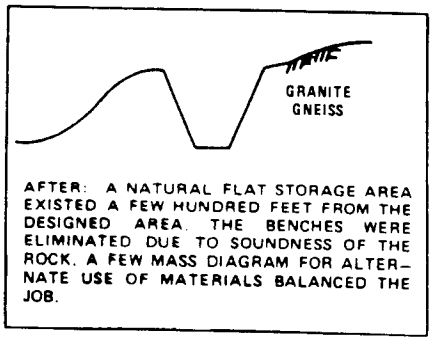


SOURCE: New England Division, U.S. Army Corps of Engineers
SAVINGS: First Year – $61,645

MATERIALS UTILIZATION



BEFORE: BENCHED BACKSLOPES AND DAYLIGHTED SECTION PRODUCED AN EXCESS OF 58,171 CY OF ROCK. DAYLIGHTED SECTION WAS INTENDED AS A STORAGE AREA.



AFTER: A NATURAL FLAT STORAGE AREA EXISTED A FEW HUNDRED FEET FROM THE DESIGNED AREA. THE BENCHES WERE ELIMINATED DUE TO SOUNDNESS OF THE ROCK. A FEW MASS DIAGRAM FOR ALTERNATE USE OF MATERIALS BALANCED THE JOB.

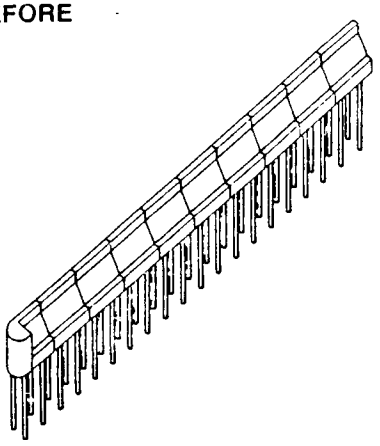
FIRST YEAR SAVING $ 334,000

SOURCE: WALLA WALLA DISTRICT
U.S. ARMY CORPS OF ENGINEERS

SAVINGS: FUEL, TIME, LABOR, WASTING OF MATERIALS, ENVIRONMENTAL SCARS.

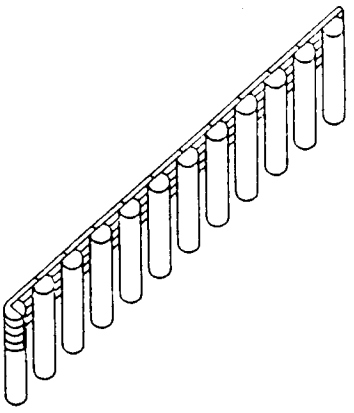
Construction of Downstream Lock Guide Wall in the Wet Lock and Dam No. 26 (Replacement), Mississippi River

BEFORE



Conventional caisson-founded guide wall design utilizing coffer-dam/dewatering procedures.

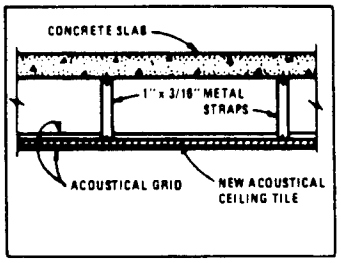
AFTER



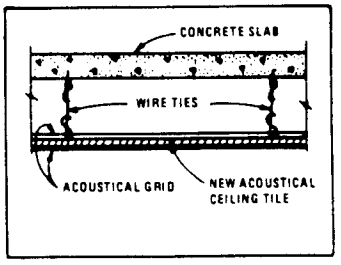
Utilization of precast concrete beams on concrete-filled sheet pile cells (avoid dewatering costs).

SOURCE: St. Louis District, U.S. Army Corps of Engineers
SAVINGS: $10,000,000 Tentative

ACOUSTICAL CEILING



BEFORE: STANDARD SPECIFICATIONS REQUIRED ZINC COATED CARBON STEEL STRAPS FOR ACOUSTICAL CEILING GRID IN VICINITY OF FORT STEWART, SAVANNAH, GA. AND WILMINGTON, NC.



AFTER: REGULAR WIRE WAS USED FOR SUSPENSION OF ACOUSTICAL CEILING GRID. STANDARD SPECIFICATIONS ARE NOW MODIFIED TO ELIMINATE METAL STRAPS.

SAVINGS – FORT STEWART ONLY

1 YEAR – $130,000
3 YEAR – $370,000

SOURCE: SAVANNAH DISTRICT
U.S. ARMY CORPS OF ENGINEERS

SAVINGS AND DECREASED CONSTRUCTION TIME