U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: Program Guidance Letter 91-6

Date: 22 APR 1991

Reply to Attn. of:

From: Manager, Grants-in-Aid Division, APP-500

To: PGL Distribution List

91-6. Value Engineering (VE) - Mark Beisse (267-8826).

Value analysis, or VE, is the systematic application of recognized techniques which identify the function of a project or service and provide the best function reliably at lowest overall cost. An audit by the Inspector General was recently completed based on provisions in 49 CFR 18.36 encouraging VE, and a revision of the DOT order is in process.

Several forms of technical analysis are an appropriate substitute for VE in most airport grant projects. Alternatives analysis is frequently completed in project plans or system planning for major projects. Likewise, cost-benefit studies or present worth analysis are commonly used in capital improvement programming. However, use of a formal VE task team during construction design and planning may be considered appropriate for new airports and similar unusually complex or large projects. The attachment contains a report which describes the potential applicability of VE to the AIP. The conclusions and recommendations of the report are provided for information purposes, rather than as program guidance.

Specific concurrence on the scope of work by the FAA is required prior to the use of VE by local or State agencies in AIP projects. The cost of work performed on VE will not be allowed unless incurred after the date of the specific FAA concurrence on the scope. Other questions about VE procedures should be directed to AAS-200 pending completion of an advisory circular.

for Lowell H. Johnson

Attachment

U.S. Department
of Transportation

**Federal Aviation
Administration**

A Recommendation Report for Value Engineering

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Report to the Federal Aviation Administration Pursuant to Department of Transportation Order 1395.1 for the implementation of Value Engineering within the Airport Improvement Program.

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PREFACE

This Recommendation Report is designed to provide insight on the work efforts performed by various Governmental agencies in the field of Value Engineering (VE). Of specific interest are the structure of different VE programs and the amount of savings that have been accomplished for projects that have undertaken VE studies. Analysis of these achievements provides the basis for issuing recommendations to the Federal Aviation Administration (FAA) to initiate a Value Engineering program for the Airport Improvement Program (AIP) grant process.

Special consideration should be given to the following individuals who provided assistance necessary to complete this document:

Gary Henderson - VE Coordinator, Federal Highway Administration
Dale Daucher - Arthur Beard Engineers, Inc.
Tom King - Society of American Value Engineers.

I. Introduction:

a) Background:

This study is in response to a requirement by the Federal Aviation Administration (FAA) Office of Airport Safety and Standards for a review and analysis of literature in the field of Value Engineering (VE) to determine whether the concept and principles of VE are applicable to the airport grant-in-aid programs; and if it is feasible to suggest methods to implement the techniques into the airport construction programs.

This requirement is established through DOT Order 1395.1, which directed all agencies of the Department of Transportation (DOT) to establish policies and assign responsibilities for the use of VE within the direct construction and grant programs. Furthermore, it is the policy of DOT to obtain the maximum benefits for Federally-supported construction projects. Therefore, VE criteria will be established by directive of the Operating Administrations and approved by the Assistant Secretary of Administration for application in the planning design and/or construction phases of a project. VE criteria needs to consider the overall complexity of the project, its estimated cost and other relevant design and/or construction factors. A VE study should be conducted if there is an assumed potential for a significant ratio of savings to cost of the VE. This use of VE can also apply to design standards, construction procedures and VE incentive clauses in construction contracts, as deemed reasonable and appropriate by the Operating Administrations.

b) Value Engineering Applications:

Value Engineering is an organized effort directed at analyzing the function of systems, equipment, facilities, services and supplies for the purpose of achieving the essential functions at the lowest overall cost consistent with required performance, reliability, maintainability, quality, and safety.

stage that VE studies are implemented, the less beneficial the proposed changes will be.

Value Engineering is a technique used during construction planning to lower costs while maintaining the quality of the product, or project design. The VE procedure involves an organized, systematic approach to evaluate the function and cost of each project element, without sacrificing performance requirements.

The objective is to make sure each design element serves a necessary function, thus contributing value. The VE approach also determines how to produce, or acquire, this function at the least total cost. Total cost includes the initial cost and the life-cycle cost. Life-cycle cost alternatives involve analyzing all expenditures relating to design, construction, maintenance, operation, and future replacement over a specified period of time. These are considered in conjunction with an appropriate degree of beautification measures, or aesthetics, and are converted into dollar values with respect to the time period originally specified.

Value Engineering principles are applied by following a standard set of steps, or phases, that provide the basis for a VE change proposal and the justification for that change proposal to be accepted and implemented in the project design. These procedural steps, collectively known as the job plan, are the main focus for the VE study and are addressed as follows:

Preparation phase - development of the VE team.

Information phase - data collection on the project scope and size and establishment of constraints for function and cost evaluation, in order to isolate the items of major cost.

Evaluation phase - determination of the essential functions and their costs.

Speculation phase - development of alternate systems or methods.

predated this time frame. The information search included a review of literature that consisted of magazine articles, textbooks and other Federal agency handbooks and guidelines for the application of VE, and VE reports completed by other Agencies. Interviews were conducted by phone to individuals involved with value engineering studies. Included were representatives from the Urban Mass Transportation Administration (UMTA), the Federal Highway Administration (FHWA), the Society of American Value Engineers (SAVE), the American Association of State Highway Officials (AASHTO), and industry. Information gathered was reviewed in light of VE programs and how they are structured, relate to the contractor, and provide benefits. Programs were also analyzed for determination of when a VE study needs to be conducted, especially in other grant programs, and how those Agencies follow through with a VE study. Based on these findings, recommendations were made to the FAA on how to establish a VE program for the AIP Program, and an outline was formed for the development of an Advisory Circular on Value Engineering.

Program reviews were focused on three Agencies in particular that have successfully established VE policies and the results of their efforts can be applied to establish a similar program for the FAA. The three Agencies are the Urban Mass Transportation Administration (UMTA), the Federal Highway Administration (FHWA), and the Department of Defense (DoD). The UMTA provides grant funds and concentrates VE efforts on construction projects for transit facilities. The FHWA also provides grant funds and has developed a VE program to evaluate construction projects, of which a large percentage are involved with pavements. The DoD does not utilize a grant program, however, their extensive use in value engineering can provide essential information for the establishment of a VE program, particularly with their detailed contractual arrangements for VE programs and incentives.

The steadfast, continuing interest that the GAO maintains in the use of value engineering led to urgent recommendations to the UMTA to establish a VE program as a better means of cost control for transportation construction projects than the peer review program. The GAO briefed the UMTA on the successes of value engineering within other agencies. UMTA officials, and industry representatives familiar with UMTA projects, were convinced that a value engineering program could provide required functions at the lowest cost consistent with performability, reliability, and maintainability. They also realized that applying VE can achieve substantial savings if it is performed early in the design stage, and if the resulting recommendations are implemented so as not to cause undue delays.

Value Engineering, according to the UMTA, is a systematic cost control technique that applies function analysis, creative thinking, and cost modeling. UMTA's position on its application is to encourage VE techniques to all construction projects and require its use on major capital projects, i.e. construction projects exceeding $2 million. Value engineering on a project in the $150 million range must be performed around the 30 percent design phase. If larger, more complex projects are proposed, a second VE analysis must be conducted at the 60 to 75 percent level of completion.

Construction projects that fall under UMTA's grant program include stations, guideway structures, and maintenance and other transit facilities. In order to properly perform a VE study, details of a project design must be coordinated to portray a functional balance between cost, required performance, schedule constraints, and desired levels of reliability. This can become very complicated in large projects. As a result, the UMTA regards value engineering as a management tool that complements rather than replaces other cost-reduction and/or cost-control techniques. The UMTA relies on the supportive relationship it has among the sponsoring agencies to

Potential benefits can be provided for both the UMTA and the contractor, however, the contractor needs the appropriate incentive to produce those cost savings. The UMTA VE program contains provisions for the sharing of cost and savings of value engineering in proportion to its participation in project costs. These shared provisions only apply if the Value Engineering proposal requires a modification in the job plan, specifications or other requirements of the contract that would result in savings to the Government. Acceptance of changes presented in the VE proposal is at the sole discretion of the UMTA, at which time the UMTA adopts the changes for general use on other contracts that could benefit from the findings.

Compensation is awarded only if there is a Value Engineering special provision in the original contract. The contractor is paid as a Lump Sum Item in the amount of one half of the difference between the life-cycle cost of the original contract work and the life-cycle cost of the new work as authorized in the change order. The Lump Sum Value Engineering payment is made to the contractor in two equal installments. The first half is awarded when the UMTA receives the approved change order. The remaining half is awarded upon completion of all items of work included as part of the change order.

Application of VE in the Federal Highway Administration:

A majority of the work performed by FHWA is funded by a federal grant-in-aid program, supported by tax money delegated from Congress, and dispersed amongst the States. Each State submits their own projections for the need of federal funds, therefore, the number of projects usually exceeds the amount of money the FHWA has to award. This shortage of funds forces States to compete for a share of federal support. In order to be systematic, the States prioritize their projects, using guidelines developed by the FHWA. These guidelines define the position the FHWA holds on the

In response to the request from the Secretary of Transportation to establish a VE program, the FHWA has set aside an organizational unit within its Agency to develop an active VE program and recognize the benefits achieved from its implementation within each State highway or transportation agency. The FHWA has also delegated to the American Association of State Highway and Transportation Officials (AASHTO) the authority to provide guidelines for States to voluntarily establish their own VE programs. AASHTO's guidelines are designed to recognize the need for flexibility to adapt to individual needs within the States, while optimizing the allocation of limited funds. AASHTO takes the position that with cooperation, understanding, and application of VE principles and practices, the challenges of rising costs and diminishing resources can be met.

Not every project requires a VE study. There is a point of diminishing returns that can be met if the cost to perform a VE study will not outweigh the overall life cycle costs. It is important to determine certain project characteristics that would demand a VE study to be performed. AASHTO supports value engineering as an effective tool for product improvement and design enhancement in project development, construction, traffic operations, and maintenance. AASHTO requires a State VE program to develop a policy directive describing where, when, how, and to what specific areas of work the VE effort should be directed. VE programs within the State organizations should be closely monitored, evaluated, and modified to assure the program's effectiveness. It is therefore essential that VE training or program familiarization is provided at every level within the State organization. AASHTO strongly urges States to appoint a VE coordinator to oversee contract management, ensure accepted recommendations are implemented, and to reward contractors for their ideas. The VE coordinator is responsible for protecting Federal procurement integrity, but does not get involved with day to day project management. The VE coordinator must trust the

Value engineering provides another benefit that States have realized. Instead of State organizations competing with one another for funds, they have begun to voluntarily work together to conduct VE studies. The States are realizing a cost savings when they pool all of their expertise together to study highway problems as opposed to contracting out for the same information. This also reduces the total cost of a VE study for each State. This is quite a contrast from the UMTA VE projects that we reviewed, where each State conducted its own VE study. In effect, the FHWA is allowing States to assimilate practices used in the private sector to achieve the same results as using the private sector for the study. The benefit in doing in-house VE is that the government does not have to share the savings; the disadvantage is that they lose the benefit of specialized knowledge, and they require additional staffing to perform these tasks.

The State highway officials have the tough responsibility of deciding which highway problems need to conduct a VE study. The voices of the public about highway transportation are usually the first things that grab their attention. However, it is difficult, if not near to impossible, to establish a regulation for every type of problem. To give the states a hand in deciding what projects could benefit from using VE techniques, the FHWA contracted the Transportation Research Board (TRB). From their analysis, the TRB recommended that VE should concentrate on research in highway maintenance to optimize the expenditure of resources. This topic was ideal for VE. Shortly after the conclusion of this study, the FHWA began promoting the use of VE among the States by sponsoring studies in maintenance research so that the States could see the benefits of using value engineering, and begin to utilize cooperative studies.

The following examples demonstrate how inter-State VE efforts on large scale highway concerns can solve unilateral problems, and provide cost savings to each participating State. In 1984, the

passed on to DoD contractors, cost-effectiveness and efficiency have become the focus of contractual agreements.

DoD contractors must follow military specifications in order to comply with contract requirements. Military specifications state the necessary levels of performance, reliability, quality, and maintainability needed to complete any type of contractual project. As a result, contractors strive for consistency with these specific requirements and overlook the opportunities that deviate from standard procedures to produce the same functions at a lower cost.

In the past, contracting methods had not encouraged contractors to submit cost reduction proposals that would affect their contractual agreements. As a matter of fact, such a reduction in contract price generally committed the contractor to a comparable reduction in their fee or expected profit. With today's demand for frugal spending, the military recognized the need to provide positive incentives to the contractor, in order to expect cooperation in these efforts. In the military today, value engineering is accepted as the technique that provides such contractor incentives, while significantly contributing toward a better economy.

Value engineering, as defined in the Department of Defense, is used as as management tool to analyze the functional requirements of DoD systems, equipment, facilities, procedures, and supplies. As a management discipline, VE incorporates utilization of total resources with available technologies into a specific procedure. This presents VE as an approach for increasing the 'return on investment,' which, for the DoD, can result from lower costs for acquisition, logistics, or operation while continuing to provide the necessary level of performance. This approach can also result from more useable defense capability for the same total dollar expenditure.

involves a change in the contract, spcifications, purchase description, statement of work, etc.

The benefits from value engineering studies are shared by both the Government and the contractor. DoD policy, as stated in the Armed Services Procurement Regulation (ASPR), provides the contractor with substantial financial incentives that must include the following principal elements. First, if savings are accrued due to an accepted contractor change proposal, the Government is responsible for awarding a reasonable proportion of those savings to the contractor. Second, it must be clearly defined to the contractor that this proportion will be applied to a substantial base. And third, the contractor should be convinced that an objective evaluation and expeditious review process were performed on the change proposal.

Such elements of financial reward are specified in the contract under a VE Contract Clause. These clauses should not be confused with reward for efficient performance according to stated terms of the contract. VE Contract Clauses only reward accepted proposal changes to the contract documents, which will result in better but lower-cost defense products. These provisions enable the DoD to motivate a contractor to identify and successfully challenge unrealistic Government requirements and specifications.

Depending on the project priority and complexity, DoD contracts utilize two different types of VE Contract Clauses which clarify the responsibility of the contractor in performing a VE study. The two types of clauses are VE incentive clauses and VE program requirement clauses. The VE incentive clause allows the contractor to make the decision to perform a value engineering study. Any proposal submitted that has the potential for feasibly upgrading the contract specifications, purchase description, or statement of work may be rewarded. Therefore, no formal VE effort is required, but the contractor has the opportunity to share in any real savings

payments based on actual future procurements, if requirements are uncertain. The percentage of the contractor share for a future acquisition savings is usually between twenty and forty percent.

Collateral savings provide contractors with a share in Government furnished property, operations, logistics support, or any other areas which accrue to the Government as a result of accepting a VECP. The determination of the amount of collateral savings, if any, is made solely by the Government. Usually, an accepted amount is about ten percent for a typical year.

Benefits achieved from military value engineering are not limited to economic improvements. Contractors who have performed successful VE studies develop a more favorable competitive position with the military. A successful VE history can influence a contractor's rating in the DoD contract performance evaluation program. Highly regarded VE performance in the past may also contribute to improved negotiated fee or profit on new contracts.

Potential Application of VE in the Federal Aviation Administration: The Federal Aviation Administration (FAA) has been directed to implement a value engineering program to its Airport grant-in-aid program by the Department of Transportation to take advantage of this cost savings technique. This grant program was initiated to promote the development of a system of airports to meet the overall needs of the Nation, and is currently known as the Airport Improvement Program (AIP). It was established by the Airport and Airway Improvement Act of 1982, and was later amended by the Airport and Airway Safety and Capacity Expansion Act of 1987.

AIP projects are funded through September 30, 1992 by the Airport and Airway Trust Fund. Taxes or user fees are collected from the various segments of the aviation community and placed in the Aviation Trust Fund. These charges are placed on operations such as airline tickets, freight waybills, international departure fees,

to perform a VE analysis. Complex projects exceeding $150 million are encouraged to perform two VE studies, one at the 30 percent mark and one at the 60 to 75 percent mark of the design effort. The savings the UMTA has realized from implementing such a VE program has far outweighed the savings they accomplished through the sole utilization of their informal peer reviews. The FAA grants program could benefit from a similar VE arrangement, since construction of airport facilities required for safety and operations are eligible for Federal funds.

The FHWA also provides grant funding, and has developed a VE program to evaluate construction projects being considered for aid. The FHWA does not require VE studies for every project, and has delegated the decision to the individual state organizations. The FHWA offers assistance for states who utilize VE programs, and encourages the others by initiating awareness sessions. The FHWA requires VE analyses on major capital expenditures, i.e. projects exceeding $2 million, and honors the judgement of State organizations for standard construction projects. These standard construction projects include maintenance and repair, therefore a point of diminishing returns must be considered in the decision of whether or not a VE study should be conducted. Although the FAA grants program does not include routine maintenance and repair as eligible projects, construction, alteration, and extensive repair of runways, taxiways, aprons, and roads within airport boundaries are considered as development projects and could benefit from the achievements the FHWA has received due to the establishment of their VE program.

The DoD does not utilize a grant program, however, their extensive use in value engineering can provide essential information to the establishment of an FAA VE program. DoD contractors must follow military specifications in order to correctly adhere to contract requirements. In response to developing better cost-effectiveness, the military has incorporated VE Contract Clauses in defense

$1 million and $5 million should be strongly encouraged to perform a VE study, with the accessibility of a certified value engineer. These projects would require a 40-hour VE analysis at or before the 30 percent design completion point, based on the discretion of the FAA Regional office submitting the grant proposal. The contracotr for projects under $1 million should be made aware of value engineering as an option he could partake on his own, with a contract incentive clause that would benefit any positive changes discovered.

2. Value engineering should be initiated in the pre-grant stage of the grant process. The proper value incentives and change proposal requirements should be discussed in the preliminary project meeting. Information on deadline dates should be established for submission as part of the preapplication filed through the state agency. The sponsor should have a clear understanding at this point as to the type of VE arrangement and procurement sharing the VE study will produce, provided the Value Engineering Change Proposal is accepted by the Government. Any changes that are accepted by the Government become the property of the Government, to be used in other suitable contracts.

3. As part of the establishment of a VE program, it is also recommended that formal training of value engineering principles and methodologies be implemented. A clear understanding of the contractual agreements and incentives that will be available should also be provided at the Regional level. Top management positions should have a working awareness of the VE policies adopted, in order to assure successful results in the VE program.

4. Guidance material in the form of an Advisory Circular needs to be developed and disseminated. This document should provide the information necessary to initiate and perform a VE study. A clear understanding of the FAA's position on value engineering should be stated, including types of contractual agreements, formal methods

BIBLIOGRAPHY

1. A Mandate for Value Engineering. James Minges and John Graumann, American City & County, October 1986, pg. 60.
2. Accounting. Charles T. Horngren, Walter T. Harrison, Jr., Prentice Hall, 1989.
3. Airport System Development. Congress of the U.S., Office of Technology Assessment, Washington, D.C., 1984.
4. Becoming Competitive with Value Engineering/Value Analysis. Dr. Vincent G. Reuter, Journal of Systems Management, Vol:36, Issue 10, October 1985, pg 24-31.
5. "Build it Yourself" for Less: look to value engineering as the method, in-house expertise as the means. Andrew V. Rushing, American School & University, September 1983, Vol:56, pg. 42a.
6. Case Commentary: VECP Priorities. Robert D. White, Contract Management, November 1990, pg. 39,40.
7. Cost Management Models for Design Application. Garvin T. Dreger, AACE Transactions, 1988, pg. J.4.1-J.4.6.
8. Department of Defense Value Engineering Program Needs Top Management Support. Report to the Congress by the Comptroller General of the United States, Report No. PSAD-78-5, November 16, 1977.
9. Financial Management: Value engineering trims new construction costs. H. Donald Ulrich, American City & County, Vol:99, pg. 144(2).
10. How to Save a Delayed Project. Wesley R. Querns, AACE Transactions, 1986, pg. A.6.1-A.6.6.
11. Military Standard - Value Engineering Program Requirements (MIL-STD-1771) U.S. Department of Defense, Washington, D.C., December 30, 1981.
12. Moving America: New Directions, New Opportunities A Statement of National Transportation Policy Strategies for Action. U.S. Department of Transportation, February 1990, Washington, D.C.

24. Value Engineering Study: Cross Street Bus Maintenance and Storage Facility - Final Report November 1985. Richard J. Reynolds and Stephen M. Mitchell for the Greater Bridgeport Transit District, Bridgeport, CT.

25. Value Engineering Study of Crack and Joint Sealing: Final Report, December, 1984. Ernest J. Blais, U.S. Department of Transportation, Federal Highway Administration, Office of Implementation, Washington, D.C., Report No. FHWA-TS-87-226.

26. Value Engineering Study of Drainage Maintenance, November 1982. Charles W. Niessner, U.S. Department of Transportation, Federal Highway Administration, Office of Research, Development, and Technology, Washington, D.C., Report No. FHWA-TS-82-223.

27. Value Engineering Study of Guardrail and Impact Attenuator Repair: Summary Report, June 1987. Deborah Longhi Allen, U.S. Department of Transportation, Federal Highway Administration, Office of Implementation, Washington, D.C., Report No. FHWA-TS-87-226.

28. Value Engineering Study: Springfield Metrobus Garage Facility - Final Report, November 1985. Smith, Hinchman, & Grylls for the Urban Mass Transportation Administration, Springfield, Va, National Technical Information Service. Final Report No. UMTA-DC-06-0461-85-1.

29. What Good Are Value Analysis Programs? Dr. Vincent G. Reuter, Business Horizons, March-April 1986, pg.73,74.