# THE APPLICATION OF VALUE PROFILING ON PUBLIC PROJECTS: AN EXAMINATION OF THE CALIFORNIA DEPARTMENT OF TRANSPORTATION'S PERFORMANCE MEASURES PROCESS


## Robert B. Stewart, CVS-Life, PMP & Chili Cilch, AVS



## *Abstract*

The California Department of Transportation (Caltrans) Value Analysis (VA) program has been using the Performance Measures Process since 2000. Over this period, this process has been applied to over 150 VA Studies. During this time, Caltrans has been delivering a true value improvement program that has established a system to measure the impact of its VA Studies relative to cost, performance and value.

This paper will explore the role that the Performance Measures Process has played in raising the level of consciousness of project stakeholders involved in VA Studies. Of particular interest to the authors, is how this process has increased the benefits to the general public relative to the tax revenues required to fund public projects. The objective of this paper is to demonstrate how the Performance Measures Process is working toward maximizing the value of public projects.


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Rob Stewart is a Certified Value Specialist and Project Management Professional who has been practicing Value Methodology for over 15 years. During this time, he has led over 150 value studies for clients in both the private and public sectors on a wide range of products, services and facilities from forklifts to multi-billion dollar transportation projects. He has taught courses in Value Methodology at Portland State University and the University of California, Berkeley. Mr. Stewart was responsible for developing Value Metrics, a value measurement system that compliments traditional Value Methodology. This system of techniques is now used by a number of public agencies as a means to evaluate the relationship of project cost and performance to value improvement. In 2001, he was awarded the Federal Highway Administration's award for "Most Outstanding Value Engineering Study" for his efforts on the I-215 Improvement Project in San Bernardino, California. Most recently, he was awarded an "Honorable Mention" by AASHTO for a VE / Constructability Review Study he led for the Seismic Retrofit of the San Francisco-Oakland Bay Bridge in 2002.

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Ms. Cilch began her VA career in 1994 as the first full-time District Value Analysis Coordinator (DVAC) in the state. In 2000, she was promoted as a senior-level program manager. Under her direction, District 11's VA program has grown from three or four studies a year to ten on average, many of which she has facilitated in-house. She was also recently the acting Program Manager for Caltrans' statewide Value Analysis (VA) Program between November 2004 and November 2005. During this time she worked to streamline business practices and to expand VA awareness within the department. During her tenure at Caltrans, Chili helped to champion the use of Value Analysis as a Caltrans process improvement tool and has received extensive training in Total Quality Management. She has served as a Certified Examiner for two California Quality Awards, the state version of the Malcolm Baldridge National Quality Award. Chili is actively involved in SAVE International, the professional society of Value Practitioners.

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## Introduction

Value Methodology (VM), as it is now referred to by SAVE International, has been an ever expanding body of knowledge since its initial inception by Lawrence Delos Miles in 1942. As originally conceived by Miles, a purchasing engineer with General Electric, VM was aimed primarily at industrial applications. If one reads his book on the subject, "The Techniques of Value Analysis and Engineering," first published in 1957, Miles identifies the concept of "function," specifically "basic function," which describes what a manufactured item must do in order to fulfill its intended purpose.[1] In doing this, he establishes a new vernacular that is specifically relevant in the discussion of value. This is summed up neatly with the statement, "All cost is for function.[2] Within this context, the notion of value is dominated by the cost of production as the fundamental criterion in achieving a desired function. Several references are made in his book to "performance," however; it seems that Miles largely assumes that "required performance" is manifest in the delivery of the basic function. If we consider that the vast majority of manufactured goods essentially perform "work functions," which by definition infers a measurable output or end result, then to a large extent Miles is correct in this assumption. He does elaborate on the idea of customer requirements, which he refers to as "required secondary functions.[3]" These are intended to describe dimensions of performance that must also be considered in fulfilling the basic function. From Miles' perspective within the context of industrial design, these initial steps in codifying the language of function, and consequently value, were by and large adequate.

Today, the application of Value Methodology has grown to include virtually every aspect of human industry, including design and construction as well a wide range of processes and services. Of particular interest is the application of VM to the design and construction of public facilities, specifically transportation projects. This is a radically different shift from the environment where Miles formulated his original methodology, for a variety of reasons to be enumerated.

Firstly, Miles' was employed by a major private corporation, General Electric (GE), whose sole function is to generate profit. The function of government, on the other hand, is to serve the public good. Thus, the basic functions of private corporations and public agencies are result in completely different paradigms.

Secondly, the products that GE produced at that time were purchased by a wide array of private companies, public organizations and, of course, individual consumers. The facilities developed by public agencies are intended to serve the public, which are in turn funded through the levy of taxes upon the public. Therefore, the concept of "customer" varies greatly for public and private entities. From the perspective of a company like GE, customers make explicit and independent buying decisions based on the fulfillment of a specific desired function. Conversely, from the perspective of a public agency, customers (or perhaps more appropriately stated, "users") do not exclusively make explicit buying decisions. Rather, they are just as likely to make implicit buying decisions through the act of paying taxes (which we are all compelled to do, regardless of our desire to do so). Furthermore, it is likely that the users may never even utilize the facilities that government provides. Indeed, the delivery of the facilities may result in more harm than good, depending upon the unique perspective of the individual.

Lastly, it is typically a straightforward process to identify customer requirements (i.e., performance) if one is delivering products that have been specifically designed to address a specific purpose for a specific type of customer. Such is the case for a company like GE that produces goods directed to a specific market sector that is actively seeking to acquire them. This is not the case for public agencies where the

functions to be delivered through the development of a specific project may or may not meet the wants and needs of a diverse population of potential users, which constitutes the public at large. This is perhaps the most important distinction to be made for this comparison, for it is the customer or user that must ultimately determine value.

This analysis thus begs the question, “How do we assess the value of functions when they are directed at the public good?” Again, we must consider that the “user” represents a broad constituency, the members of which will possess varying degrees of interest in the functions proffered via publicly funded facilities.

## *The Dynamics of Improving Value on Public Projects*

A brief comparison of the key differences between delivering projects within the public and private sectors was presented in the opening paragraphs of this paper. The context within which public projects are delivered involve the following factors: 1) sponsoring agencies whose focus is ostensibly on serving the public good; 2) a cross-section of users possessing varying degrees of interest ranging from open acceptance to complete hostility towards such projects; and finally, 3) users that possess widely divergent viewpoints on the essential attributes of project performance. These factors play a crucial role in how value is perceived and subsequently measured. In addition to these factors, there are several others the merit attention.

Most public projects are advanced by a sponsoring agency that is responsible for managing their development and construction. Furthermore, due to the broad-ranging nature of most projects today, there are typically many additional stakeholders representing other public agencies as well as community groups, individuals and private organizations. Frequently these entities will not be in agreement as to the need and purpose of the project, much less its performance requirements. In situations such as these, it is not uncommon for the viewpoint of the sponsoring agency to dominate the discourse between the stakeholders. Oftentimes, this phenomenon results in the alienation of these stakeholders which results in projects that ultimately do not meet the needs of the majority; are delayed due to political infighting; and bear witness to cost overruns.

Projects within the public sector, especially those enjoying high visibility such as transportation projects, are by nature unique and particularly context sensitive. As such, despite the fact that similar projects may share similar features, their real and perceived impacts can vary tremendously. This requires a completely new assessment of performance expectations and requirements for each project which further complicates the task of developing optimal solutions that are tailored to meet the specific needs of the locality in which they are developed.

Public projects, regardless of the government agency that sponsors them, must compete with other like projects for increasingly limited public funding. Because of this, public projects are the coin of politics. Politicians stand to reap significant benefits if the projects they support are successfully completed. They also stand to lose a great deal if they fail. The delivery of projects is one of the most visible and substantive ways in which the public can measure the success of their political representatives. Politicians, of course, are keenly aware of these facts and, unfortunately, often press to complete projects in support of their own political agendas, which do not always coincide with what is in general public’s best interests. Two common examples of this phenomenon are “pork barrel” projects, which typically involve the expenditure of large sums of money for an inordinate degree of benefits, and the “sunk cost” effect, which describes the tendency of politicians to continue to pump more money into failing projects that should otherwise be terminated. In situations such as these, political expediency generally trumps logic and good sense, much to the chagrin of us all.

The benefits of public projects can often be challenging to quantify. Methods, such as cost-benefit analysis, are widely regarded today as inadequate in trying to capture both the positive and negative impacts to the public good by expressing them in monetary terms. While such economic analysis can be useful for planning purposes, it must be acknowledged that it is exceedingly difficult to place a monetary value on such things as the environment and human lives. For example, the value placed on human life

by one such cost-benefit analysis is a little over $3 million, while the health costs carbon dioxide emitted through vehicle exhaust is $115 per ton.[4] While there may be indeed hard actuarial and scientific data to support such calculations, they fail miserably in expressing the qualitative impacts of the loss of human life and the degradation of our health and the environment. No high-ranking government official or politician would be foolish enough to publicize that such analysis formed the primary basis in their decision-making process. Clearly, different analytical tools are needed.

## *An Examination of the Caltrans Performance Measures Process*

The California Department of Transportation (Caltrans) has maintained a vigorous VM program (which it refers to as Value Analysis in order to better describe the wide variety of products, processes and projects to which VM is applied) since the mid-1980s. In 2000, significant changes were made to the application of VM with Caltrans to in order to better measure value improvement. The Performance Measures Process (alternately referred to as Value Metrics) was developed to better assess the impacts VM studies were having on the qualitative aspects of the performance of the facilities Caltrans delivers.

This value profiling system was initially developed in response to concerns expressed by the then Deputy Director of Program Project Management, Jack Boda, about the Caltrans VA program. He was generally impressed with the cost savings identified through the VA process; however, he wondered what was happening to project performance. He explicitly stated that the VA program needed to develop "performance measures" in order to ensure that project performance objectives were adequately met. Mr. Stewart, with the permission and support of George Hunter, the Caltrans VA Program Manager at the time, developed the Performance Measures Process (PMP) toward this end.

The PMP utilizes a system of the following four techniques: 1) identify and define critical performance attributes and requirements; 2) determine the relative importance of the performance attributes in meeting a project's need and purpose; 3) develop measurement scales to quantify (or qualify) performance levels; and, 4) compare performance to cost ratios (i.e., value) of alternative design concepts. As the intent of this paper is to focus upon the results of this system rather than the application, the reader may refer to previous articles and publications prepared by the authors for further information on the techniques employed.[4]

Value is fundamentally determined from the unique perspective of the customer or user and the function he or she is seeking to accomplish. Therefore, for public works projects, the degree of value can differ greatly for each stakeholder impacted by a project. A community member that relishes the undisturbed habitat from their backyard vista might see no value to a project that threatens to jeopardize their view. Virtually all public works projects must seek to satisfy competing interests while accommodating, to the highest extent possible, perceived adverse impacts. When developing a project, the pubic works professional must always be mindful of the assessed potential to satisfy the public need within the context of what is fiscally and lawfully "reasonable and feasible."

The challenge for transportation projects is balancing the needs of multiple customers. The performance expectations of peak-hour commuters, movers of goods, and emergency service providers might differ, but their need for reliable and timely mobility is a common objective. The complexity of identifying key performance drivers is magnified when the needs and wants of the impacted non-user stakeholders are equitably addressed.

In order to evaluate the performance of PMP to the Caltrans VA Program, key program statistics were compared using historical data that is submitted annually to the Federal Highway Administration (FHWA). In the period immediately preceding the implementation of PMP which included Fiscal Year (FY) 1998 to 1999, the results of the Caltrans VA program are provided in Table 1. FY 2000 was omitted from this analysis as this was the transition year where PMP was implemented, so some studies were conducted using PMP while others were not. During this two-year period, approximately 50 VA studies were conducted.

| Summary of Results<br>July 1998 to June 2000 | |
|---|---|
| No. of VA Studies Completed | 50 |
| Total Project Costs | $3.8 billion |
| Accepted NPV Savings | $272 million |
| Conditionally Accepted NPV Savings | (included above) |
| Acceptance Rate of Alternatives | 31% |
| Total % Cost Savings | 7% |
| VA Study Costs | $2.1 million |
| Return on Investment | 130:1 |
| Average Performance Improvement | N/A |
| Average Value Improvement | N/A |

*Table 1*

Over the past five years (FY 2001 to 2005), the firm of Value Management Strategies, Inc. has performed over 125 VA Studies for Caltrans. Of these, approximately 75 have been carried through the implementation process. Table 2 provides a summary of the results of these projects.

| Summary of Results<br>July 2001 to June 2006 | |
|---|---|
| No. of VA Studies Completed | 75 |
| Total Project Costs | $8.8 billion |
| Accepted NPV Savings | $537 million |
| Conditionally Accepted NPV Savings | $146 million |
| Acceptance Rate of Alternatives | 57% |
| Total % Cost Savings | 8% |
| VA Study Costs | $4.5 million |
| Return on Investment | 150:1 |
| Average Performance Improvement | 17% |
| Average Value Improvement | 28% |

*Table 2*

An examination of these two tables reveals a minor increase in the total cost savings (~1%) but a significant improvement in the acceptance rate of value alternatives which amounts to a 26% increase – nearly double the previous period's results. The authors would attribute this increase in acceptance to the focus of the PMP on project performance. Our experience has been that the VA teams are doing a much better job of vetting the value alternatives relative to performance and eliminating those that cut cost at the expense of performance before they reach the project decision makers. Furthermore, the number of value alternatives that are ultimately proposed has decreased, thereby improving the efficiency of the review and implementation process.

The cost to conduct VA studies using PMP has increased by about 30% than those that did not. This reflects the increase in time that has been allowed to conduct the studies which have expanded from a five-day format to a six-day format and additional time for study preparation and implementation. Despite this additional cost and effort, the average return on investment has increased from 130:1 to 150:1, which is clear indication that the additional funds spent to implement PMP have been worthwhile.

What is greater interest to the authors; however, are the last two indicators on Table 2 which denote an average performance improvement of 17% and value improvement of 28% per project. These two indicators far exceed cost savings which only represent 8% if both accepted and conditionally accepted alternatives are considered. It should be noted, however, that these cost savings were reduced by approximately $141 million due to value alternatives that led to increased project costs. This data is significant when we consider that the improvement in performance relative to cost savings is more than double, which provides a strong affirmation that the Performance Measures Process is shifting the focus of the Caltrans VA Program from cost reduction to total value improvement.

## *Additional Benefits of the Performance Measures Process*

A number of important benefits have been observed through the application of PMP on VM Studies. It should be noted that many of these benefits cannot be quantified, but have contributed significantly to the general improvement of value that the PMP has helped Caltrans achieve on its projects. These benefits include:

- Maintaining Focus on Purpose and Need
- Minimization of Stakeholder Bias
- Emphasis on Value Improvement over Cost Reduction

### Maintaining Focus on Purpose and Need

In the United States, most publicly funded projects are defined through a “Purpose and Need” statement which establishes the primary justification for all funding and permitting approvals. The “Need” defines the current conditions and deficiencies, and the “Purpose” defines the intended results to address the need. For example, a project is sponsored to correct a sight distance problem in order to reduce accidents. The need is to reduce accidents at a specific location; the purpose is to improve sight distance. Occasionally a debate regarding a project’s Purpose and Need continues into the advanced stages of project development. This results in costly delays, largely due to postponing critical decisions to move the project forward. Once the basic function (“Purpose”) and the higher-order function (“Need”) are agreed upon, the other performance objectives can be better understood and classified.

By design, the PMP forces all participants in the VM process to maintain their focus on “Purpose and Need.” During the initial stages of a VM study, project stakeholders are asked to identify those performance attributes and requirements that best describe the project’s “Purpose and Need.” These attributes and requirements essentially define the scope of the project which is then used to identify stakeholder preferences for performance relative to satisfying “Need and Purpose.” Through the application of the PMP, both the stakeholders and VM team members develop a much stronger sense of what is important in achieving a successful project and are forced to see beyond the narrow framework of specific personal or organizational agendas. This broader perspective helps project stakeholders better understand the positions of others, maintain focus on “Purpose and Need,” and fosters consensus.

This focus on “Purpose and Need” is reinforced throughout the VM study through the application of the PMP process, including function analysis, the speculation of new ideas, the evaluation of these ideas, the development of alternative concepts and, finally, the decision-making process utilized to select those alternative concepts that will best improve project value. Each step of the VM job-plan is anchored by the project’s “Purpose and Need” statement, thereby ensuring the fundamental goals and objectives of the project are kept at the forefront of all team dialogue and interaction.

## Minimization of Stakeholder Bias

One of the problems that are endemic with the delivery of public projects is that of stakeholder bias. As mentioned in the previous paragraphs, most project stakeholders will possess agendas and viewpoints that differ not only those of their peers, but also of the project's stated "Purpose and Need." As a result, there will be a number of organizational, professional and personal biases at play that can severely hinder the development of alternative concepts leading to improve value. Of particular concern is the tendency for personnel representing the sponsoring and/or funding agency to dominate projects and steer them in directions that may result in less than optimal value relative to the public good.

The PMP is structured in such a way that it requires a conscientious assessment of project performance. This feature forces stakeholders to provide justifications for what they do and do not prefer relative to the established project performance attributes and requirement. This aspect of PMP requires stakeholders to provide substantive rationale that speaks to "Purpose and Need" and is surprisingly effective at exposing opinions, misinformation and hidden agendas for what they are. Furthermore, PMP utilizes a variety of commonly used techniques, such as paired comparisons, that make stakeholder manipulation difficult. When properly applied by a conscientious facilitator, stakeholder bias can be minimized and the focus on improving project value can be maintained.

## Emphasis on Value Improvement over Cost Reduction

Traditional VM has traditionally focused primarily on cost reduction. This fixation on cost has led to the perception that VM is essentially a cost cutting methodology rather than one that focuses on true value improvement. Cost reduction tends to infer a reduction in project scope and/or performance. True value improvement requires that cost and performance are given equal consideration.

Value, in relation to function, must ask this question: *"how well is the need or want (i.e., function) being fulfilled relative to the cost to do so?"* To answer this question, one must first ascertain the performance expectations of the function. PMP seeks to establish a numerical expression of project performance through measurement scales and eliciting preferences for key performance attributes from the stakeholders. Once this is achieved, an expression of project value can be achieved by dividing the project's performance by its cost. This numerical expression of value for the original design concept serves as the value baseline (referred to as the value index). It is subsequently used to compare the value indices of other alternative concepts. From this, comparison, stakeholders can make better informed decisions relevant to improving total value.

Since the implementation of PMP as part of the Caltrans VA study process, there has been a marked change in the perception of the program, especially by project managers. This is especially important since project managers are essentially the VM program's "customers." This shift away from cost reduction toward value improvement coupled with the fact that the value alternatives generated by the VM process are better balanced and are more considerate of performance, has lead to improved participation and strengthened relations with external stakeholders. In some cases, external stakeholders that control project funding have utilized the VM process as a means of developing consensus, improving project communications and increasing project value.

# *Summary and Conclusion*

Improving the value of public projects requires a more nuanced and balanced approach because of the infinitely diverse perception of the customer. The application of PMP to the Caltrans VA process has provided the means to achieve this end. It has resulted in marked improvements both in terms of results and the perceptions of stakeholders, and should serve as an example to other public agencies how VM can be transformed through value profiling techniques.

## *References*


[1] Miles, Lawrence D. (1972) Techniques of Value Analysis and Engineering – 2nd Edition, McGraw Hill, New York

[2] Ibid

[3] Ibid

[4] California Life-Cycle Benefit/Cost Analysis Model (2004), California Department of Transportation.

[5] Stewart, Robert B. (2005) Fundamentals of Value Methodology, Xlibris, Philadelphia