

Function Worth promotes Mind Tuning
by
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Biography

Don joined SAVE in 1967 when he became the value engineer for the Chesapeake Division of NAVFAC and completed his 28 year career for the Federal Government as the Director, Value Management for the General Services Administration, Public Buildings Service.

For the past 30 years he has been in the private sector as an independent Building Consultant performing value engineering, developing project business plans, and serving as a cost engineer for many large projects.

His cost expertise extends to authorship of a book titled *Parametric Cost Modeling for Buildings, 2014, Routledge publications*. It is with this extensive knowledge of cost that he was compelled to draft this paper on function worth which is at the heart of value engineering.



Abstract

This paper provides a case history in facilitation using of one of SAVE's Technology Templates (Value Index – Highway Function). It was the contributing and leading cause of the success of a VE Workshop on a 4.3 mile highway project. Technology Templates also exist for Manufacturing and Construction work and the same methodology as described in this paper applies to those areas as well.

Introduction

The workshop began on a very negative tone. The participants were from local, State and Federal Government. All were experts in highway design and construction. This author had no expertise in highway construction and everyone in the room knew that! In addition most everyone attending the workshop were told and appointed to be there – no one volunteered to value engineer a project that had no apparent opportunity for change or savings. Most thought that to be there was a waste of time and time was being wasted only to meet a Government requirement to do VE.

Larry Miles, the originator of Value Analysis and Engineering Technology knew the importance of beginning a value study on the right foot. His book¹ stressed the human factors of the team in performing value engineering. Everyone must “feel” what we are trying to do is vital. He felt that “mind tuning” was an essential step for a good value study.

His first edition of the book in 1961 and subsequent editions never used the term “worth.” Instead he tabulated² two terms side-by-side: Estimated present cost and Value. In later years he agreed that the better term used in that context would be “worth.” And, of course, he meant comparing function cost with function worth side-by-side.

One of the keys to changing attitude is to get the team members to realize that there is opportunity and room for cost improvement in what they are being asked to study for a week. The “buy in” must come from the team. So, armed with the detailed cost estimate, the author facilitated this by using the

Technology Template for calculating value indices for highway projects. Use of the template is a 4-step process described below.

Step 1 – Prepare the Cost Model

The first 3 columns of the template is really a cost model for the present cost of the project. Using the designer's detailed cost estimate prior to the workshop, the author identified and listed the major components of the project. The team then was asked to determine the basic overall function of each component as shown in Figure 1.

For the highway study we discovered that the cost was slightly more than \$5 million per mile. The team was asked what they thought of that unit cost. Most thought that it was acceptable and nothing could be done. A few thought it was on the high side but really didn't know what to challenge.

Cost Model

PROJECT: Highway

Designed paved area 224,162 square yards

COMPONENT	FUNCTION	COST
Roadway	Direct traffic	3,484,557
Erosion Control	Protect environment	1,136,246
Drainage	Remove water	2,767,490
Pavement	Support traffic	7,916,503
Water Works	Distribute water	205,302
Sanitary Sewer	Remove sewage	34,209
Lighting	Create contract	22,078
Traffic Control	Direct traffic	183,797
Signalization	Control traffic	253,761
Demolition	Clear path	33,000
Structures <20'	Span opening	121,569
Bridge No 1	Span opening	893,396
Bridge No 2	Span opening	250,219
Maintenance of Traffic	Continue flow	1,215,797
Administrative		1,318,000
Contingency		1,686,054
Totals		\$ 21,521,978
	4.3 MILES	\$ 5,005,111

Figure 1 – Cost Model

Step 2 – Define the Parameters

The next thing to do is to use the cost model to begin to create a value model (Figure 2). This is achieved by completing the parameter quantity column and the parameter unit of measure. Then calculate the parameter cost of each component.

Now the team members brightened up and began to judge the efficacy of the unit parameter cost for each highway component function. Several now saw opportunity to save some money when beforehand it seemed “mission impossible.”

Value Model

PROJECT: Highway

Designed paved area 224,162 square yards

COMPONENT	FUNCTION	COST	QTY PARA	COST \$/PARA
Roadway	Direct traffic	3,484,557	224,162 SY	15.54
Erosion Control	Protect environment	1,136,246	157,628 SY	7.21
Drainage	Remove water	2,767,490	36,670 FT	75.47
Pavement	Support traffic	7,916,503	4.3 MILE	1,841,047.21
Water Works	Distribute water	205,302	1,828 FT	112.31
Sanitary Sewer	Remove sewage	34,209	427 FT	80.11
Lighting	Create contract	22,078	33 EA	669.03
Traffic Control	Direct traffic	183,797	4.3 MILE	42,743.49
Signalization	Control traffic	253,761	41 EA	6,189.29
Demolition	Clear path	33,000	1 LS	33,000.00
Structures <20'	Span opening	121,569	1 LS	121,569.00
Bridge No 1	Span opening	893,396	92.3 LF	9,679.26
Bridge No 2	Span opening	250,219	22 LF	11,373.59
Maintenance of Traffic	Continue flow	1,215,797	22,757 LF	53.43
Administrative		1,318,000	24 MO	54,916.67
Contingency		1,686,054	1 LS	1,686,054.00
Totals		21,521,978	4.3 MILES \$	5,005,111

Figure 2 – Beginning of the Value Model

Step 3 – Analyze impact of Target Function

The next task is to step back and take an overview look of the entire project, its components and their contribution to the required project function. For a building one should challenge the designed gross square feet against the net to gross space efficiency to see the potential for reducing gross square feet.

For a highway, we looked at the designed paved area against the function of the highway and found paved areas that did not contribute to the basic function. It seems that paving a crossroad got into the project and the team thought that could be deleted without impacting the function of the highway. They thus established a new target for the paved area as shown below in the modified value model. It is important to note that the team, not the facilitator contributed this revised target area in Figure 3.

Value Model		PROJECT: Highway							Paving a crossroad not basic function of the project	
		Designed paved area			224,162	square yards	Target paved area			222,000
COMPONENT	FUNCTION	COST	QTY	PARA	COST \$/PARA	TARGET SAVINGS AREA	POTENTIAL SAVINGS			
Roadway	Direct traffic	3,484,557	224,162	SY	\$ 15.54	100%	\$ 33,608			
Erosion Control	Protect environment	1,136,246	157,628	SY	\$ 7.21	100%	\$ 10,959			
Drainage	Remove water	2,767,490	36,670	FT	\$ 75.47	100%	\$ 26,692			
Pavement	Support traffic	7,916,503	4.3	MILE	\$ 1,841,047	100%	\$ 76,353			
Water Works	Distribute water	205,302	1,828	FT	\$ 112.31	0%	\$ -	Amount of piping is not effected		
Sanitary Sewer	Remove sewage	34,209	427	FT	\$ 80.11	0%	\$ -	Amount of sewer is not effected		
Lighting	Create contract	22,078	33	EA	\$ 669.03	0%	\$ -	Reduction in pavement width will not reduce this cost		
Traffic Control	Direct traffic	183,797	4.3	MILE	\$ 42,743.49	0%	\$ -	This cost is a function of distance		
Signalization	Control traffic	253,761	41	EA	\$ 6,189.29	0%	\$ -	This cost is a function of the number of intersections		
Demolition	Clear path	33,000	1	LS	\$ 33,000.00	0%	\$ -	This cost is a function of the number of structures to be torn down		
Structures <20'	Span opening	121,569	1	LS	\$ 121,569.00	0%	\$ -	No structures are effected by a change in road width		
Bridge No 1	Span opening	893,396	92.3	LF	\$ 9,679.26	0%	\$ -	No bridges are effected		
Bridge No 2	Span opening	250,219	22	LF	\$ 11,373.59	0%	\$ -	No bridges are effected		
Maintenance of Traffic	Continue flow	1,215,797	22,757	LF	\$ 53.43	100%	\$ 11,726			
Administrative		1,318,000	24	MO	\$ 54,916.67	100%	\$ 12,712			
Contingency		1,686,054	1	LS	\$ 1,686,054.00	0%	\$ -	To be conservative we leave this alone		
Totals		21,521,978	4.3	MILES	\$ 5,005,111		\$ 172,050			

Figure 3 – Value Model Target

Step 4 – Judge the Worth of each Function

Next, the team superimposed potential system changes for each component as shown below. This is done quickly by setting a target percentage reduction based upon their quick ideas or experience to achieve each function's parameter. The rationale used for each is shown in the column on the right (Figure 4). Once again, the worth input is a product of the team.

The team can then quickly select the most fruitful two areas to focus their value study, 1) the highest dollar potential savings and, 2) the largest value indices.

Value Index Model		PROJECT: Highway								
Designed paved area		224,162 SY								
Target paved area		222,000 SY								
COMPONENT	FUNCTION	QTY	PARA	COST \$/PARA	TARGET AREA	SAVINGS PARA	WORTH \$/PARA	POTENTIAL SAVINGS	VALUE INDEX	
Roadway	Direct traffic	224,162	SY	\$ 15.54	100%	10%	\$ 13.99	\$ 382,064	1.12	Make cutouts in center lane
Erosion Control	Protect environment	157,628	SY	\$ 7.21	100%	44%	\$ 4.04	\$ 510,907	1.82	Cost of function is too high by experience
Drainage	Remove water	36,670	FT	\$ 75.47	100%	0%	\$ 75.47	\$ 26,692	1.01	
Pavement	Support traffic	4.3	MILE	\$ 1,841,047	100%	13%	\$ 1,601,711	\$ 1,105,499	1.16	Reduce material thickness
Water Works	Distribute water	1,828	FT	\$ 112.31	0%	0%	\$ 112.31	\$ -	1.00	
Sanitary Sewer	Remove sewage	427	FT	\$ 80.11	0%	0%	\$ 80.11	\$ -	1.00	
Lighting	Create contract	33	EA	\$ 669.03	0%	0%	\$ 669.03	\$ -	1.00	
Traffic Control	Direct traffic	4.3	MILE	\$ 42,743.49	0%	11%	\$ 38,041.70	\$ 20,218	1.12	Reduce length of project
Signalization	Control traffic	41	EA	\$ 6,189.29	0%	0%	\$ 6,189.29	\$ -	1.00	
Demolition	Clear path	1	LS	\$ 33,000.00	0%	0%	\$ 33,000.00	\$ -	1.00	
Structures <20'	Span opening	1	LS	\$ 121,569.00	0%	0%	\$ 121,569.00	\$ -	1.00	
Bridge No 1	Span opening	92.3	LF	\$ 9,679.26	0%	12%	\$ 8,517.75	\$ 107,208	1.14	Keep one span of bridge
Bridge No 2	Span opening	22	LF	\$ 11,373.59	0%	99%	\$ 113.74	\$ 247,717	100.00	Keep entire bridge
Maintenance of Traffic	Continue flow	22,757	LF	\$ 53.43	100%	15%	\$ 45.41	\$ 194,096	1.19	Expand North side of road first rather than South side
Administrative		24	MO	\$ 54,916.67	100%	9%	\$ 49,974	\$ 131,332	1.11	Reduce project time
Contingency		1	LS	\$ 1,686,054	0%	0%	\$ 1,686,054	\$ -	1.00	
Totals		4.3	MILES	\$ 5,005,111				\$ 2,725,731	1.15	

Figure 4 – Value Index Model

By the time the value indices were calculated the entire team was motivated because they could now see the opportunity to improve value by reducing project cost.

In fact the team calculated that on a \$21.5 million project there was potential to save \$2.7 million or 15%. When the study began they saw no potential.

And the major study topics they picked included Erosion Control (High index), Pavement (High savings potential), Maintenance of Traffic (High Index), and Administrative cost to reduce the scheduled length of time for the project.

“Mind Tuning” had occurred. In their mind they had isolated areas of the design that they could see could be improved and value increased. Even if they recommended saving only ½ of the items they uncovered, the time the team spent that week was well worth more than their salaries. And they were eager to explore the topics they uncovered, brainstorm ways to improve them, prepared detailed design proposals and report to their management what they achieved and recommended to be changed in the design.

Reflecting on the worth of an estimated expenditure for a function using whatever historical data or experience reference that is in the mind of the team member is the key to motivate that person to study the item further. Just think, if you were asked to spend \$25 for an ounce of cheese wouldn't you figure it worth your time to explore alternative ways to obtain protein?

Function – Cost – Worth is the key to successful performance of value engineering.

References

¹ Lawrence D. Miles, 1989, *Techniques of Value Analysis and Engineering 3rd Edition*, pages 53, 71-73, Lawrence D. Miles Value Foundation, Washington, D.C.

² *ibid*, page 74