MULTIPLE VE STUDIES FURTHER ENHANCE QUALITY AND COST EFFECTIVENESS OF FACILITIES

This document was presented at the 1993 International Conference of the Society of American Value Engineers (SAVE) at Fort Lauderdale, Florida by Khaled A. Obeid, Ph.D., PE, CVS, SH&G, Detroit. It was published in the SAVE Annual Proceedings and is copyrighted (SAVE, 1993). Permission to upload this document to CompuServe has been given by SAVE.

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ABSTRACT

This paper illustrates that integrating the VE approach in project design will result in significant quality enhancement and achieve cost effectiveness. Two VE studies were conducted on the University of Cincinnati Science and Engineering building at two different design stages of the project using the function approach and following the VE job plan.

INTRODUCTION

In construction projects, normally a VE study is conducted once on the project. This paper addresses a case study in which two VE workshops were conducted at two different design stages of the University of Cincinnati Science and Engineering Research building. The new facility is to bring research centers together from many engineering departments and science colleges to promote research interaction and a cross fertilization of ideas and techniques that are not easily shared in a traditional departmental building organization.

The team of Michael Graves Associates, KZF Associates, Inc. and Smith, Hinchman & Grylls Associates, Inc. (SH&G) were responsible for the complete design and engineering of this project. I was evolved as the structural team leader in the two separate VE studies conducted for this project at the schematic and at the design development stages.

At the schematic stage, the first VE study reduced the project cost from $37 million to $30 million approximately. During the design development the project exceeded the fixed limit of construction cost. Therefore, the second VE study was conducted at the design development stage to further enhance project quality and reduce total project cost to meet the fixed limit construction cost of $29.23 million without sacrificing any essential function of the project.

OBJECTIVES OF THESE VE STUDIES

The main objectives of these two VE studies could be summarized as:

- To illustrate that significant quality enhancement and cost effectiveness could be achieved by using the integrated approach of conducting multiple VE studies on a project at two different design stages.
- Insure high quality image of the research laboratory building.
- Reduce initial costs of the project to meet the fixed limit of construction.
- Minimize operation and maintenance costs.
- Optimize building layout and functional space effectiveness.
- Identify and resolve issues of value and constructibility prior to construction.

VE PROCEDURES

A description of the VE procedures that were followed for both VE studies is illustrated in Figure 1. This figure depicts the three different stages included in a VE workshop. Since the required functions of the project are the controlling elements in the overall VE approach, Figure 2 represents the function/logic (FAST) diagram for this project. The basic function is the most important action performed by the project while the secondary function is that supporting the basic function.

SH&G
Value Management Workshop Procedures

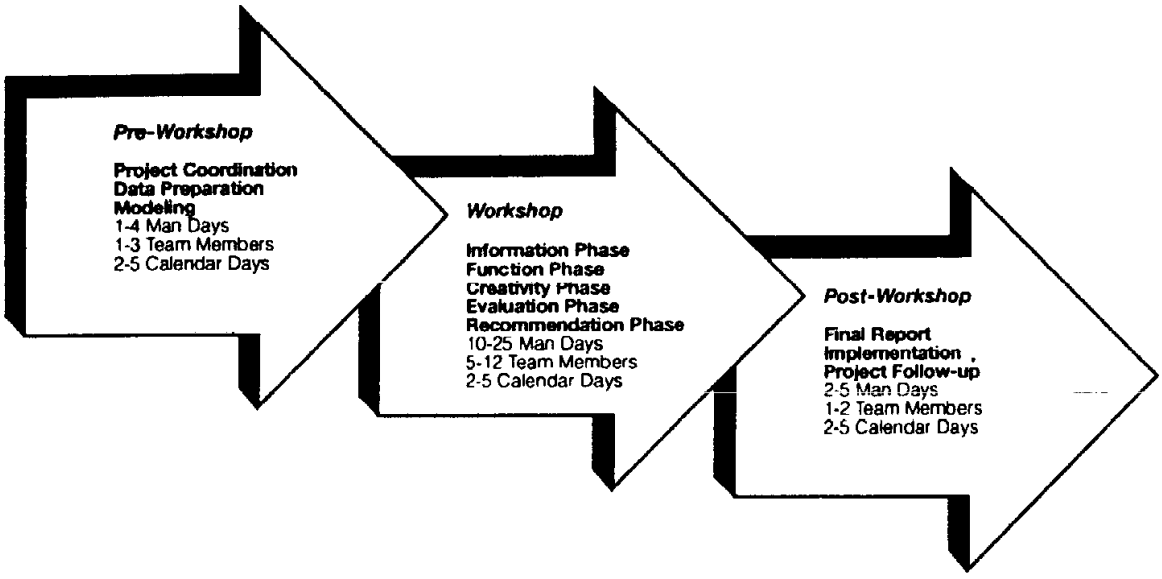


Figure 1

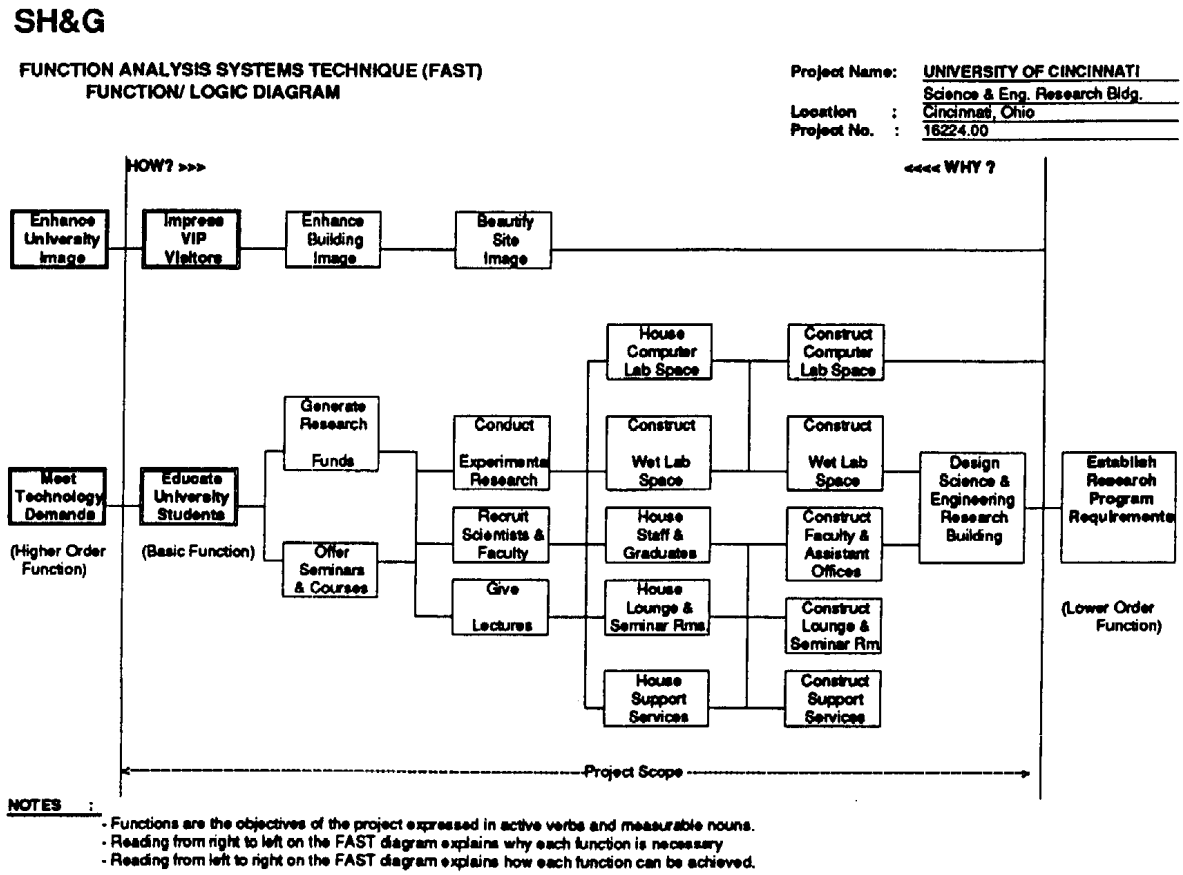


Figure 2

VE MODELS

VE modeling approach has been employed during these studies. The following VE models have been introduced and enhanced to assist the VE team to achieve the main objectives:

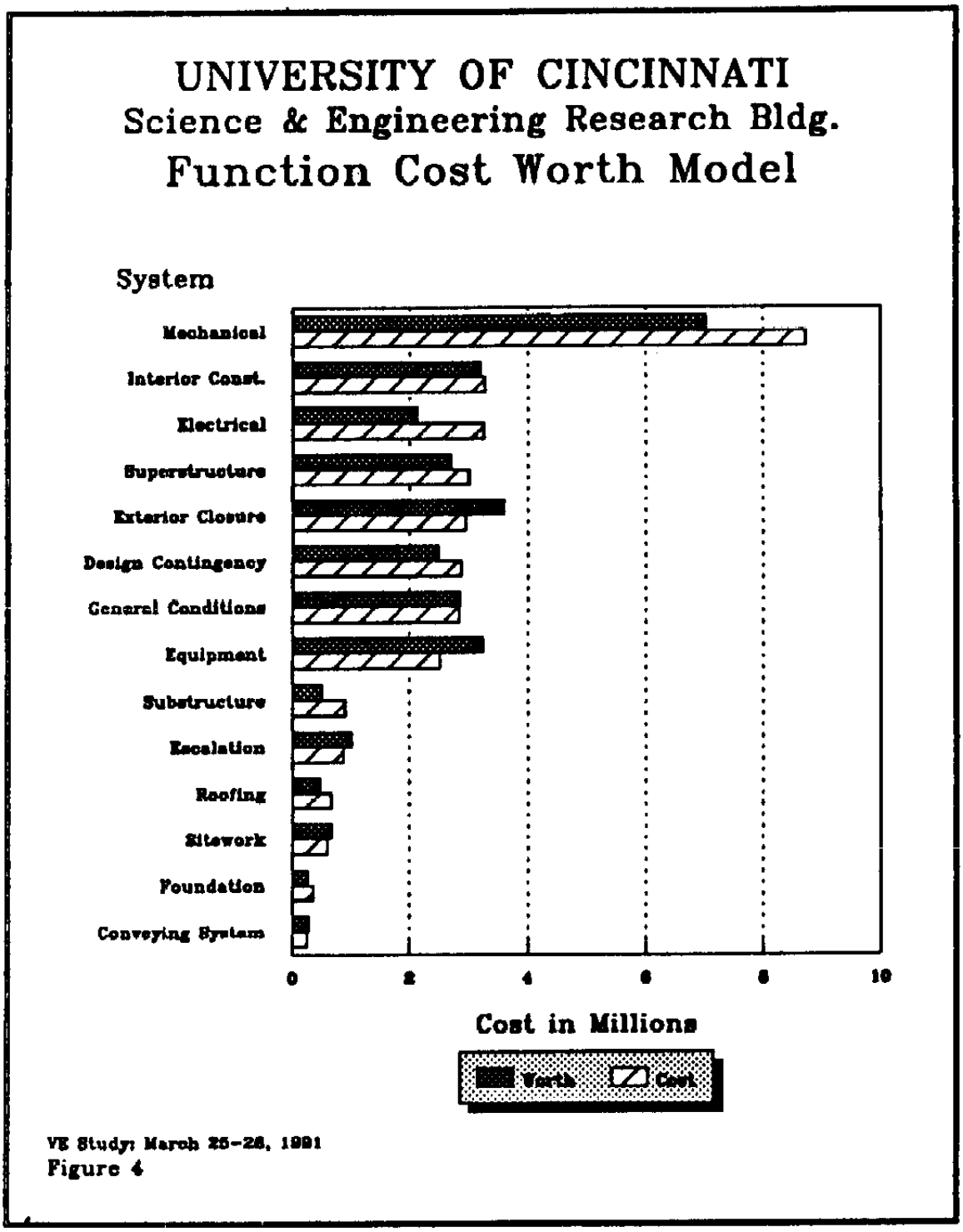
Quality Model

The quality model serves as the basis of the design process and generating criteria that follows. Attitudes and expectations once defined serves as the sensitive measure by which the VE team evaluate various design alternatives. The graphical quality model depicted in Figure 3 represents the relative "weighting" of importance between 12 major elements. This weighting was determined by first defining the issues of concern corresponding to each element and confirmed by the owner and the design team during the VE workshop.

Each of the University of Cincinnati representatives and design team at the workshop independently voted for the most significant and the least significant elements in the design of this project. Those with the most votes are shown with dots in the outer most part of the quality circle such as image, operational effectiveness and capital cost effectiveness. Those that were felt to be less significant are located towards the center of the quality circle such as schedule, community values and user comfort in this case.

Functional Cost Worth Model

The cost information used for both VE studieswere prepared by SH&G cost estimating team prior to each study. The function cost model was prepared using these information, then costs were distributed by functions based on uniformat cost systems as indicated by Figure 4. This will help identify high cost areas that could lead to potential VE savings. Due to the workshop time limitation the VE team followed Pareto's Law by concent-
rating on the high cost items that could be 20% of the project components but containing 80% of the project costs.



Space Model

A computerized space model as illustrated in Figure 5 was prepared for this project to identify major spaces within the facility by their corresponding function. The model helped the VE team focus their attention on selected spaces of high differences between the design and the corres-ponding program spaces. This generates ideas about combining spaces according to functional use and rearranging the space in more effective ways.

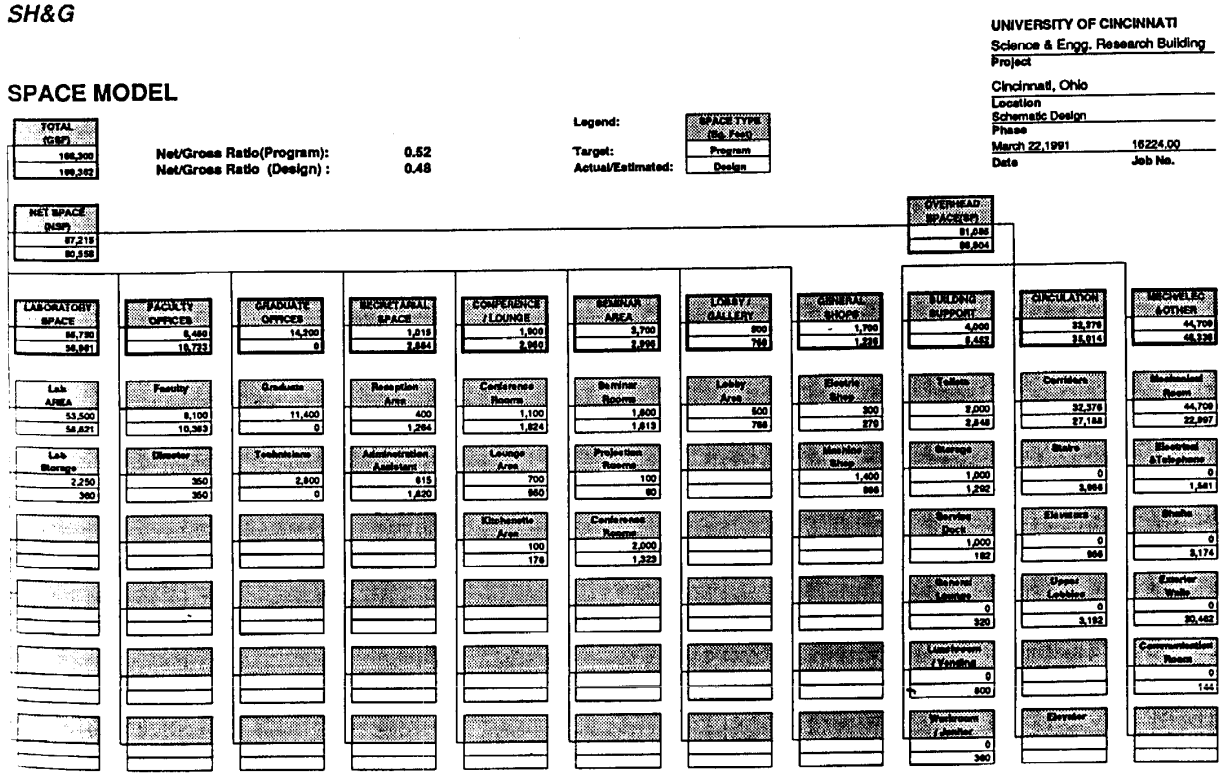


Figure 5

The total program space for the facility was 168,300 sf but the design development stage was 172,500 sf. The net to gross ratio was 0.48 at the schematic stage then was improved to 0.53 to exceed the net to gross ratio for the program space of 0.52 as indicated in Figure 5.

PROJECT WORKPLAN VE INTEGRATION

The VE approach has been integrated into the design project for this case study. Normally a workplan including a graphical project schedule that portray stages of design, discipline responsibilities, coordinating relationships and design products is prepared for each project. In this particular study the VE techniques have been applied at both schematic and design development stages. This resulted in improvements of team interaction and more economical implementation of VE recommendations. In addition, this integration approach allowed the VE team to manage and monitor the costs throughout the design project. This approach has minimum impact on the overall fee for designing a project, yet resulted in maximum effect on project value, quality and design production efficiency.

SUMMARY OF RESULTS

The VE potential savings resulted from the two VE studies conducted on this project were illustrated in Table 1. Potential savings of $6.982 million resulted from the VE study at schematic stage while $1.575 million potential savings resulted from the VE study conducted at the design develop-ment stage.

Table 1
VE Potential Savings

	VE Study at Schematic Design Stage		VE Study at Design Development Stage	
VE Category	No. of VE Proposals	VE Savings w/ 25% Markup	No. of VE Proposals	VE Savings w/ 19% Markup
Structural	4	$249,000	9	$193,000
Architectural	14	$3,675,000	17	$827,000
Mechanical	7	$1,000,000	10	$331,000
Electrical	8	$634,000	7	$224,000
Civil/ Site	1	$20,000		
Equipment	2	$58,000		
General	4	$1,346,000		
Total	40	$6,982,000	43	$1,575,000

The VE implemented savings for this project (total $7.44 million) was the result of applying the multiple VE studies approach and integrating VE into design process.

CONCLUSIONS

From the multiple VE studies that were applied at different design stages of this research laboratory facility the following results were observed:

- Applying the VE approach at multiple design stages of the project does not adversely affect the design completion schedule.

- Each of the two VE studies contributed in reducing the project costs to meet the fixed limit of construction cost.

- Both VE studies improved space efficiency by increasing the net to gross ratio.

- The second VE workshop isolated potential savings paid for the owner an increase in the overall area (gross square feet) of the project to meet additional owner requirements.

- The savings which resulted from the schematic VE study were substantially more than those from the design development VE study. Therefore, the earlier the project stage at which VE is applied the higher the potential savings that is to be expected.

- The number of VE proposals produced by each VE team remained about the same, whether at schematic or design development stage. However,the emphasis of the second VE study was focused on quality enhancement features rather than cost saving items.

- Multiple VE studies result in improving cost effectiveness and enhancing project quality throughout all project stages.

- As an added benefit, the involvement of owner, user, design groups and the VE team in a positive, decision making resulted in solving a variety of issues in real-time workshop setting.

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