



# VALUE ENGINEERING GONE BAD:

## *A Refresher on How to Avoid Problems*

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**A**s a forensic engineer who investigates buildings that have problems, this author's experience is admittedly skewed to include examples of what not to do when it comes to construction projects. This experience has included numerous examples of processes that were reported to be "value engineering" (VE). However, upon further examination, the process that was followed did not comply with accepted principles of VE. When these principles are violated, the performance of the delivered product can be sufficiently compromised such that the project ends up in litigation. This article serves to provide a refresher about how the VE process is supposed to work, along with examples of VE gone bad.

### DEFINITION OF VE

In the simplest form, VE is intended to provide the owner with an alternative construction process, detail, or material that would result in a savings of time and/or money without compromising the performance of the delivered product. The Society of American Value Engineers (SAVE) International defines VE as "a systematic and structured approach for improving proj-

ects, products, and processes."<sup>1</sup>

It is the experience of the author that time and/or money savings are typically accomplished by the VE process; however, in many cases, the performance of the delivered product suffers. The performance problems typically include physical damage that requires repair, a reduction of the expected service life, increased maintenance costs, or a combination of these issues. Insurance data in the construction industry show "an increase in claims stemming from projects in which the design and construction were value engineered to bring the program within a budget that was likely too low in the first place."<sup>2</sup>

### THE PROPER VE PROCESS

In order for VE to be properly executed and have a positive result, the input of multiple parties is required. In addition to evaluating the potential time and/or cost savings, the impacts on project performance (both short- and long-term) should be carefully considered. If there is an expected impact on building performance, it should be clearly communicated and accepted by all parties. In some cases, the savings of time or initial cost may be sufficient to justify (at least to some) a reduced effective ser-

vice life and/or an increase in future maintenance/repair costs. In no case should time and/or cost savings justify a reduction in occupant safety.

The life cycle cost of the product (i.e., the constructed building) should be considered in any VE analysis.<sup>3</sup> BusinessDictionary.com defines life-cycle cost as the "sum of all recurring and one-time (non-recurring) costs over the full lifespan or a specified period of a good, service, structure, or system."

Ideally, the VE process should start at the project inception where the benefits can be most significant. However, once a contractor is selected, additional VE options may be presented. Regardless of the timing of the VE process, always make sure that the changes required to the contract do not affect the timescales or completion dates or incur additional costs that would outweigh the short-term savings provided. One key to successful VE evaluation is to remember the relationship between cost and value: value is function divided by cost. Therefore, value can be added by increasing function and/or decreasing cost. Concentration on the function of the project or product will help to avoid a simple cost-cutting exercise.

## VE DO'S AND DON'TS

The following lists of do's and don'ts are provided to assist with effectively incorporating the VE process into a project. The lists may seem basic; however, these are the principles that are typically violated when the VE process results in a problem.

### List of Do's

- Stick with good design and construction principles.
- Stick with products that have a proven track record.
- Engage the owner and design professional.
- Read and understand code evaluation reports.
- Understand and communicate risks/benefits.
- Communicate warranty and/or life expectancy consequences.
- Understand any resulting maintenance issues.

### List of Don'ts

- Change the design concept.
- Accept alternate products that are not acceptable to all parties.
- Violate accepted industry standards.
- Switch to untested products and/or assemblies.
- Accept code evaluation reports without proper review of performance testing standards.
- Rely on "silver bullet" products that promise more than they can deliver.
- Create unreasonable maintenance costs for future owners or tenants.

### EXAMPLES OF VE GONE BAD

The examples below describe when the VE process caused significant performance problems with the delivered product. While the intentions to save time and/or money may have been satisfied, the analysis of the VE proposal was insufficient to identify or understand the resulting consequences.

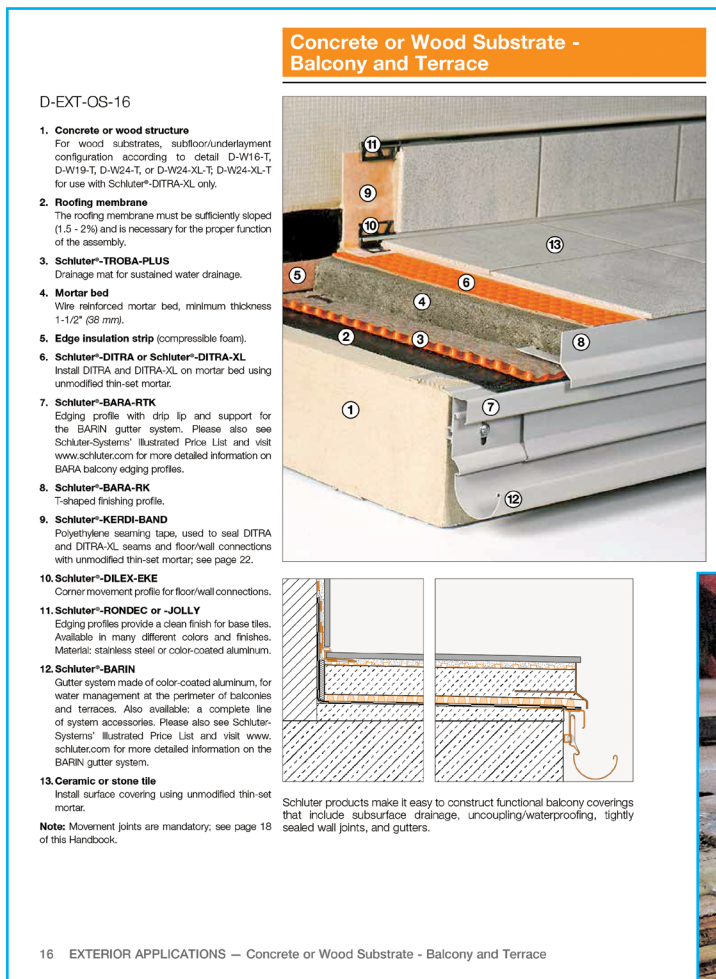


Figure 1 – As-designed balcony details.



Figure 2 – As-built balcony details.

exterior balconies. There are many quality products and systems that can be used for effective balcony waterproofing. As with most aspects of construction projects, better products typically cost more money and require more time to install. For this reason, balcony waterproofing systems are a common target for VE proposals.

On a condominium project constructed circa 2013, a well-known balcony waterproofing system was specified on the architectural plans (Figure 1). The system included a sloped waterproofing surface over a wood-framed balcony, perimeter flashings, a drainage mat, and an elevated tile walking surface. At some point during the construction project, an improper VE process replaced the specified waterproofing assembly with a low- to mid-grade liquid-applied waterproofing product applied over the plywood with no slope and a tile surface that was intended to have a 1/8-inch-per-foot slope on the walking surface (Figure 2). The resulting water damage became the subject of a construction defect claim. At the conclusion of litigation, a comprehensive and costly repair scope was funded by the insurance providers for the contractor and subcontractors who originally constructed the subject buildings.

### Inadequate Balcony Waterproofing

Exterior balconies are a common architectural feature on multifamily residential projects. Robust waterproofing details are critical for long-term performance of

Any time that a waterproofed surface is lacking slope, the chances of non-performance are drastically increased. Additionally, porous balcony surfaces (e.g., concrete, stone, and tile) will allow water to migrate to the waterproofed surface below. It is critical that the water be managed by providing slope that directs the water out of the balcony assembly. This basic design principle is important enough that it was eventually incorporated into the 2018

International Building Code.<sup>4</sup> Unfortunately, this code revision was made after hundreds of balconies were documented to experience water intrusion damages, requiring significant and costly repairs.

For the reasons described previously, any VE proposal for balcony waterproofing should be carefully scrutinized. While it is easy to save time or money using lesser-quality products, the risk in doing so can be substantial. Additionally, the expense of making repairs to damaged balconies on an occupied multifamily residential building greatly exceeds any cost savings that may be realized during the construction project.

The reasons that the VE process failed on this project included:

1. The design concept was changed.
2. An accepted industry standard (i.e., sloping the waterproofed surface) was violated.

### Paint-On Fire Resistance

The overall fire safety of a constructed building is accomplished by a combination of three elements: 1) physical separation of buildings, typically by the use of setbacks, 2) the safe ingress/egress provided to build-



Figure 3 – Traditional Type-X gypsum panel used for fire resistance.

ing occupants, and 3) fire resistance of the constructed assembly. In multifamily buildings, it is important to provide fire-rated assemblies to contain the extent of a fire.

Traditionally, it was common to provide fire resistance using non-combustible materials such as Type-X gypsum panels (Figure 3) or pressure-impregnated fire-retardant

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treatment (FRT) (Figure 4). There are now intumescent paints that are applied to the surface of combustible wood panels that claim to provide the same level of performance as traditional methods. However, at least in some instances, these claims have fallen short.

On a townhome project constructed circa 2008, an oriented strand board (OSB) roof deck with a thin film of intumescent paint was substituted for traditional methods of providing fire resistance. The use of the alternative product resulted in time and money savings during the initial construction of the project. The contractor relied on the claims made by the manufacturer regarding the adequacy of the product. The local authority having jurisdiction (AHJ) accepted a code evaluation report that appeared to support the claims made by the manufacturer. However, in a short period of time, the product experienced significant adhesion failure due to the heating of the wax content in the OSB roof deck (Figures 5 and 6).

During the investigation, it was determined that the product was never officially approved by the International Code Council (ICC). The code evaluation report associated with the product fell short of adequately evaluating the product for long-term performance and effectiveness. Research regarding the specific product revealed a troubled performance history marked with problems of durability. The repair scope proposed during the construction litigation process included the installation of Type-X gypsum board on the bottom of the OSB roof deck with the failing paint.

The reasons that the VE process failed on this project included:

1. A switch was made to an untested product and/or assembly.
2. The code evaluation report was not reviewed sufficiently to identify product performance shortcomings.

## DESIGN AND PRODUCT RELATIONSHIPS

Over the years, the author has investigated numerous construction products that



Figure 4 – Fire retardant-treated (FRT) plywood used for fire resistance.

were determined to be defective. Often, the products were simply not tested to replicate in-service conditions. While it is important to develop construction products that will improve long-term building performance, the products need to accommodate typical construction practices without being compromised.

Value  
is function  
divided by  
cost.

The investigation of product failures (often associated with a VE process) has revealed a relationship between building design and product performance. Obviously, good design works best with good building products, and poor design will fail when coupled with poor building products. The in-between scenarios are what require closer evaluation: 1) a good design may not be able to overcome a poorly performing building product, and 2) a high-performance building product may be able to tolerate a poor design.

In all cases, the VE process must consider both the robustness of the design and the fitness of the building products selected. While many “silver bullet” products may be adequate to meet short-term project objectives, the adequacy of the constructed



Figure 5 – Adhesion failure of fire-resistant paint.


assembly over the long term (typically 50+ years) should be carefully considered. After all, the durability of a building is dictated by the weakest link.



Figure 6 – Screen placed to catch fire-resistant paint shown falling from the OSB roof deck in Figure 5.



safe structure. If the process of increasing project value is to be undertaken, consider upgrading to products that are expected to provide longer service life at the same or slightly higher cost, where value is added by increased function, not just lower cost.

VE is an exercise that should involve the entire project team as the project develops. It should include a careful review of materials and processes to see if a more cost-effective solution exists that will achieve the same project objectives. In order to be successful, the VE process should focus on both short-term and long-term impacts. The examples described above illustrate VE that was primarily focused on immediate savings of time and/or money during construction, resulting in significant performance problems later. 

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#### HOW TO AVOID VE PROBLEMS

The best way to avoid VE problems is to eliminate the process altogether, trusting that the design professional has the best interest of the owner in mind with a set of plans and specifications that will result in a code-compliant, durable, and