Case Study

Value engineering reviews are required on Federal-aid highway projects that are on the National Highway System that exceed $50 million and bridge projects that exceed $40 million in total design and construction costs. (23 CFR 627.5) Since 2014, design-build construction projects have been excluded from this requirement. (23 CFR 627.3(e))

Value engineering is the practice of engaging an independent, multidisciplinary team of experts to review design and implementation plans of a highway project. As defined by Federal law, the team's objective is to confirm the project provides the needed functions, while considering community and environmental commitments, safety, reliability, efficiency, and overall life-cycle cost. (23 U.S.C. 106(f)(2))

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Value Engineering Enhances Quality and Savings in Florida and Virginia Highway Construction

This case study discusses benefits and challenges of incorporating value engineering into Florida and Virginia Department of Transportation projects.

Introduction

The Florida and Virginia Departments of Transportation (FDOT and VDOT) have woven value engineering (VE) reviews into the planning of major highway construction and maintenance projects for at least three decades. Today, both State DOTs have active VE programs to review planned projects.

In Florida, VE teams in 2022 and 2023 provided recommendations in several areas, including adjustments to roadway shoulder widths, reconfiguration of alignments and designs to avoid right-of-way acquisitions, and modifications to MSE wall aesthetics, said Bobby Bull, P.E., FDOT State Value Engineer. These changes were estimated to save millions of dollars on the final project costs, though some quality adjustments that add value—like improving soundwall aesthetics—may add to project expenses.

In Virginia, VE studies in 2022 and 2023 identified opportunities to reduce environmental footprints, improve bicycle and pedestrian access, and adjust traffic signal locations to expedite traffic, said Sarah Towell, VDOT VE Program Coordinator.

A key benefit of VE is the objective evaluation by outside experts on the details of complex and expensive projects, according to the two State DOTs. "It always helps to have someone who's not familiar with the project look at the plans and provide feedback and ideas. The Value Engineering process provides an opportunity to do that," Towell said.

Applying Value Engineering in Florida

FDOT has a robust transportation construction program with numerous projects that meet the State DOT's VE cost threshold, said Bull, State Value Engineer for FDOT.

Projects that FDOT selects for VE exceed $25 million in engineering, construction, and right-of-way costs. Other projects may also have complexities that warrant a study, even if those projects do not meet the cost threshold. In July 2023, FDOT raised the VE study thresholds to match the Federal requirements of $50 million for roadway projects and $40 million for bridge projects.

"The feedback from our management and the districts is positive." Bull said.

In FY 2022, for example, FDOT conducted 16 VE studies, producing 33 approved recommendations. These led to a total savings achieved of $50.1 million. (See Table 1.)

FDOT's eight districts, including Florida's Turnpike Enterprise, are responsible for project selection, team selection, the value engineering study, and recommendation resolution. An outside consultant is typically brought in to coordinate the VE workshop, which is held in-person, as a hybrid (in-person and virtual attendees), or online for all participants. An FDOT VE team consists of FDOT staff, the FDOT General Engineering Consultant (GEC) staff, and subject matter experts. FDOT uses internal staff prior to using GEC or consultant staff as VE team members.

FDOT conducts project VE studies either in the planning phase, Project Development and Environment (PD&E) phase, or design phase. Design phase VE studies usually occur when plans are at 60 percent (Phase 2 plans) to allow for accepted recommendations to be incorporated in the plans without impacting the overall project schedule.

"Project plans are provided to team members ahead of the workshop, ideally a couple of weeks in advance of the study," Bull said. Workshops can take 4 to 5 days, though less complex projects may take less time. Workshops include a six-step VE process, presentations of the project by the design team, a site visit when possible, a facilitated discussion of ideas for project implementation, and presentation to district management.

Purpose of Value Engineering

In a value engineering (VE) analysis, a project is reviewed and assessed by a multidisciplinary team not directly involved in the planning and development phases of a specific project. 23 CFR 627.1(b) requires all State departments of transportation to establish and sustain a VE program. Information about the types of projects for which a VE analysis is required can be found at 23 CFR 627.5(b)(1)-(5).

The VE analysis' purpose is to provide recommendations for:

- Providing the needed functions, considering community and environmental commitments, safety, reliability, efficiency, and overall life-cycle cost (as defined in 23 U.S.C. 106(f)(2));
- Optimizing the value and quality of the project; and
- Reducing the time to develop and deliver the project.

VE is not a design review, nor is it intended to reduce project costs by sacrificing quality, reliability, or performance.

Example Project: I-10 from West of Gadsden County Line to West of SR 263 Capital Circle

Figure 1. Map showing the Interstate 10 project in Leon County, Florida. Image source: FDOT, Value Engineering Study Report (2022)

FDOT provided details on a VE study in June 2022 that FDOT conducted for a capacity project planned in District 3, on Interstate 10 (I-10) from the Gadsden County line to west of State Road (SR) 263 (Capital Circle Northwest) in Leon County, approximately 1.25 miles. Improvements called for widening I-10 from four to six lanes. Improvements were also considered at the Leon County Rest Area ramps.

Widening and possibly replacement were considered at all bridge locations depending on the condition of the existing structures. The segment of I-10 is functionally classified as an urban principal arterial-interstate. I-10 is the main east-west corridor across northern Florida and connects the greater Pensacola area to the west with Tallahassee and Jacksonville to the east, ultimately traversing the entire United States. I-10 is part of the FDOT Strategic Intermodal System (SIS), Florida's high priority network of transportation facilities important to the State's economy and mobility.

According to FDOT, the VE study produced these proposals and recommendations for adjustments to the project that were accepted by District 3 management:

- That the contractor bid the option for using Mechanically Stabilized Earth (MSE) walls or soldier piles and lagging for the construction phase. Many contractors have the steel H piles and wood lagging readily available, which saves cost and time acquiring MSE panels. Potential savings: $422,128.
- Utilize graded aggregate base in place of lime-rock base and subgrade, to eliminate the chances of issues related to encountering unsuitable materials during construction. This proposal would not result in cost savings but would result in time savings. Additional costs incurred will be made up by the time savings.
- Shift the westbound bridge 6 feet to the median to avoid constructing a bridge with an additional 6 feet of width for the entire length of the bridge. This was the designer's original recommendation but had not

been selected by FDOT due to a slight shift in the final alignment by 6 feet. However, other bridges along I-10 on the same corridor have approved alignments shifting more than 6 feet (example Yellow River Bridge on I-10). Potential savings: $2.25 million.

As of mid-2024 the project was still finishing the design phase (at 90 percent) with no scheduled letting and construction dates yet posted, Bull said.

Table 1. FDOT Reports to FHWA Value Engineering Survey, 2020-2023

FY	Total # of VE Studies	Total # of Proposed VE Recommendations	Total # of Approved VE Recommendations	Value of Approved VE Recommendations	# of Approved VE Change Proposals (VECP)	Value of Approved VE Change Proposals
2020	19	130	66	$ 1,147,000,000	34	$ 4,741,800
2021	11	81	36	$ 24,513,393	36	$14,333,117
2022	16	85	33	$ 36,680,000	27	$13,460,000
2023	16	158	66	$ 943,690,127	27	$31,894,860

Applying Value Engineering in Virginia

Projects that VDOT selects for VE exceed $15 million in estimated construction costs, under a Commonwealth of Virginia adaptation of the Federal threshold for when VE is applied on bridge and highway construction projects (Virginia Code, Section 33.2-261). This mandate does not apply to design-build construction. VE also may be waived for Virginia emergency projects to keep the process moving or for routine maintenance, such as mill-and-fill pavement jobs, unless the Federal cost threshold applies.

Towell's role as VDOT VE Program Coordinator is to make sure the studies are held, reports are documented, and recommendations that are approved through the central office in Richmond are incorporated into the plan.

VDOT aims to hold VE reviews at 30 percent of a project's planning stage, late enough to see a complete plan but early enough to make meaningful changes. Towell looks for VE-eligible projects from the agency's 6-year transportation plan and project advertisement spreadsheets.

The overall VE process can then take 4 to 5 weeks, from development of the team and producing a report to when recommendations are approved. Those recommendations then go through more approvals from agency leadership.

On an eligible project, the project manager assembles a VE team of engineers and other experts and stakeholders. The VE team may come from elsewhere in the agency or outside the DOT, such as from cities, counties, and permitting agencies related to the project.

The team typically receives the project's plans in advance of a VE workshop, which generally occurs online. For a 2023 2-day workshop, the agenda had included a project presentation from the design team, along with discussions of these topics:

- Major project features and the rationale behind them
- Alternatives considered
- Adjacent facilities
- Adjacent projects, if any, including future projects
- Project challenges

Example Project: Air Terminal Interchange (ATI) Eastern and Western Intersections, Norfolk, VA

VDOT conducted a VE assessment in April 2023 that produced two recommendations and $2.2 million in estimated savings for a project to improve the Air Terminal Interchange (ATI) Eastern and Western Intersections in Norfolk, Virginia, according to information provided by VDOT.

The plan for the $109 million project includes a new interchange at the eastern side of the I-564 Intermodal Connector. The objective is to improve access to and from the Naval Station Norfolk base, and provide traffic relief to surrounding roadways. The project includes a new bi-directional bridge spanning the eastbound lanes and rail tracks, and also extends and widens the existing Ingersol Avenue.

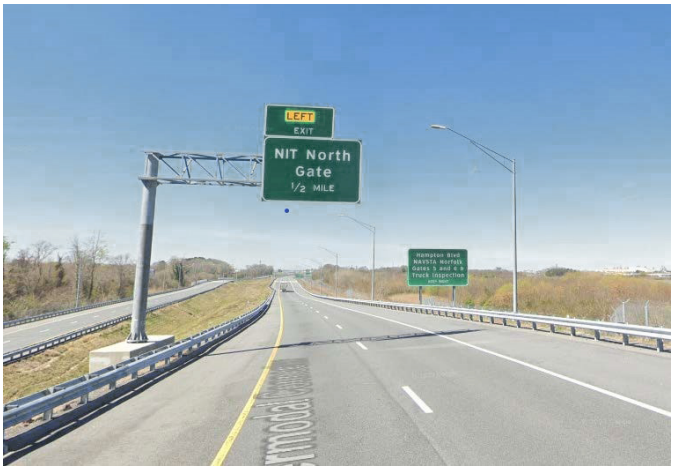

Figure 2. I-564 leading to the interchange. Photo source: VDOT

A six- to eight-member VE team from within VDOT was assembled, meeting online over 2 days in a facilitated workshop. Members represented these disciplines: construction, environmental, hydraulics, IT systems, materials, right-of-way, roadway design, structure and bridge, traffic, and utilities.

During the evaluation, the VE team produced eight recommendations, including two that were accepted by the District engineer. These were (1) to reduce the new bridge from three lanes to two in both directions and provide a shared turn lane, for an estimated cost savings of $1 million, and (2) to reuse asphalt materials that would avoid costs and disruption of replacing existing paving. Together, these were estimated at $2.2 million costs saved by bridge and paving reduction. A separate adjustment would reuse existing stormwater management facilities instead of building new ones. Costs were not calculated, but the design team agreed the benefit would be value added by avoiding disruption.

The idea to narrow the bridge came after the VE team questioned whether the traffic counts justified such a wide, secondary bridge. While the traffic volume was high, it was typically heavy in one direction in the morning (toward the base) and then just as congested in the other direction late in the afternoon (away from it), the VE team noticed.

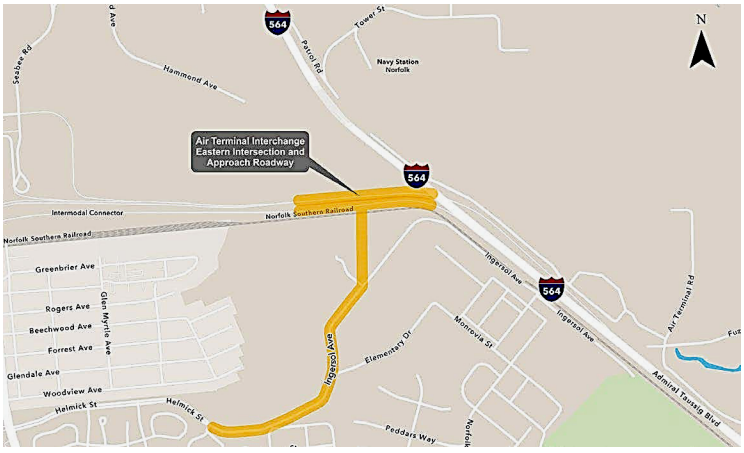

Figure 3. Project graphic from VDOT brochure ahead of a public hearing after the VE study. Image source: VDOT

Table 2. VDOT Reports to FHWA Value Engineering Survey, 2020-2022

FY	Total # of VE Studies	Total # of Proposed VE Recommendations	Total # of Approved VE Recommendations	Total Value of Approved VE Recommendations	# of Approved VE Change Proposals (VECPs)	Value of Approved VE Change Proposals	Total Savings*
2020	4	14	9	$ 8,134,000	7	$ 240,158	$8,374,158
2021	5	12	12	$ 5,351,000	0	$ NA	$5,351,000
2022	7	26	17	$ 3,920,910	5	$ 73,435	$3,994,345

* Total Savings Achieved = Value of Approved Recommendations + Value of Approved VE Change Proposals
Source: FHWA, https://www.fhwa.dot.gov/ve/vereport.cfm

Summary of Benefits and Challenges

FDOT and VDOT identified these advantages to applying VE to projects:

- Fresh eyes on project designs, which can lead to the implementation of VE team recommendations.
- Opportunity for feedback on details.
- Cost savings or non-material enhancements for non-roadway elements such as for bicycle and pedestrian paths or adding sound barriers.

FDOT and VDOT shared these challenges:

- Finding and scheduling staff to take time from other work to participate in the workshops. VDOT planned to offer more training to encourage staff engagement, as well as to revise and update VE manuals to make them clearer and more user-friendly, Towell said.
- Potential of a heavier VE workload as construction is more expensive due to rising material and labor costs. FDOT is exploring ways to streamline VE management, especially on more straightforward projects, such as resurfacing, restoration, and rehabilitation (RRR).

Suggestions for Other Agencies

VDOT said conducting the VE studies online has worked well, helping to increase participation and saving money in travel and hotel costs. Extra non-workshop days can be built in after the first day, which gives time for the design team to evaluate the recommendations. FDOT saw advantages to in-person or hybrid sessions.

FDOT said having a good procedure in place helps ensure that district managers are familiar with the VE process and that the method is applied consistently within each district.

Both VE coordinators encouraged keeping communication channels open about upcoming projects between the central VE office and district project managers. That way, when a project triggers a VE study, the VE manager can help.

Contacts and Sources

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- FHWA, Value Engineering Frequently Asked Questions, https://www.fhwa.dot.gov/ve/vefaq.cfm
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- Virginia DOT, Value Engineering Program, https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/construction/value-engineering

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