



Value Management Office
Value Engineering Program



R-2527 Value Engineering Report

May 23, 2019

Date of VE Study

May 15, 2019

Right of Way Date

February 2019

Let Date

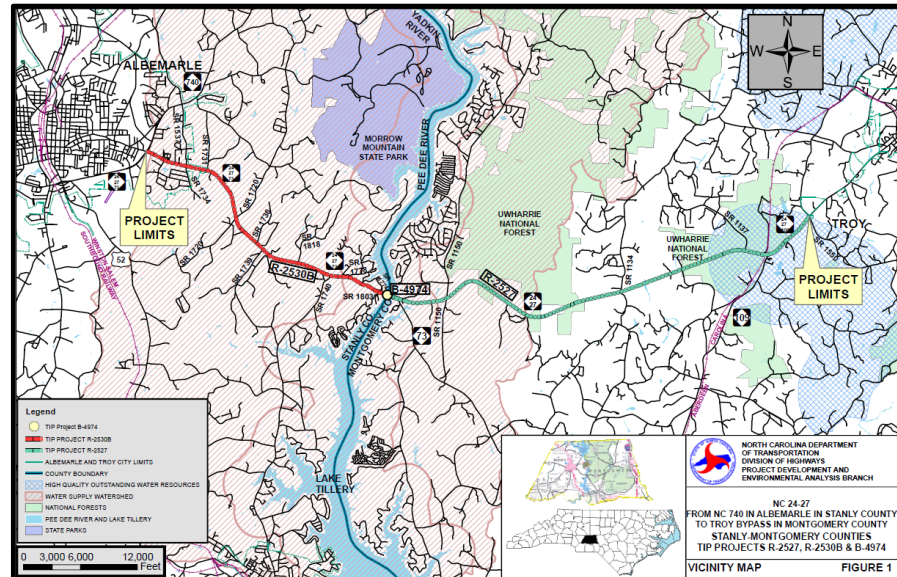
February 2021

County

Montgomery

Total Estimated Cost

\$55.6 Million



Project Description

The NCDOT proposes to widen NC 24-27 from east of NC 73 to the Troy Bypass to multi-lanes. The original project development study was completed in conjunction with the adjacent R-2530B and B-4974 projects. In addition to the roadway widening, the project includes replacement of the rail line and railroad bridge that crosses over NC 24-27.

EXECUTIVE SUMMARY

The North Carolina Department of Transportation (NCDOT) Value Management Office (VMO) selected project R-2527 to be reviewed as part of a Value Engineering (VE) study based on the FHWA requirements. The VE study was held on May 15, 2019 at the Dewberry office in Raleigh. Dewberry's VE study team, including representatives with diverse transportation expertise from SEPI Engineering and Planning Communities, reviewed the project materials to develop recommendations that would add value to the project. The VE study team was guided through each step of FHWA's Value Engineering process and ultimately identified 14 ideas, or Value Opportunities. After evaluating the ideas, the team decided to submit 6 ideas as formal recommendations; the team also submitted three Design Considerations for NCDOT review. Further information regarding all of the ideas developed and the final recommendations is included in this report.



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PROJECT SELECTION

The Value Management Office (VMO) evaluated the upcoming Letting Lists to identify projects that have a cost estimate exceeding \$20M and a portion of the project on the National Highway System. VMO then creates a schedule based on project let dates and communicates with Project Managers throughout the Department. This project is federally funded and located on the National Highway System. The initial construction cost estimate for this project is \$55.6 million.

TEAM MEMBERS

The VE study team is a multi-disciplined team formed based on the primary design and construction elements of the project and the expertise of the individual team candidates. The goal of the Value Management Office is to create a balanced team that allows the individuals to provide objectivity to the project from a given area of expertise while working with other team members to discern effective recommendations for the project. Below is the list of the VE study team members and their areas of expertise:

Value Engineering Team

Rekha Patel, PE	Roadway (Dewberry)
Mark Pearson, PE	Structures (Dewberry)
Cameron Long, PE	Hydraulics (Dewberry)
Todd Brooks, PE	Traffic (Dewberry)
Steve Scott, PE	Construction (SEPI)
Danny Gardner, PE	Roadway (SEPI)

Team Leads/Facilitators

Alyssa Randall	Planning Communities
Beth Smyre, PE	Dewberry

VALUE ENGINEERING PROCESS

After project selection, the Value Engineering study team was led by the meeting facilitators through FHWA's systematic process of VE Analysis, which allowed team members to learn about the project, discuss the project, determine recommendations, further develop these ideas, and present recommendations to management for review and possible incorporation into the project. The seven phases are: Information Phase, Function Analysis Phase, Creative Phase, Evaluation Phase, Development Phase, Presentation Phase, and Resolution Phase. A general overview of each of the seven phases in the value engineering analysis is included in the Appendix.



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INFORMATION PHASE

Copies of the current Right of Way plans (dated February 2019) were provided to the team for review, along with additional design and planning information. The NCDOT and consultant project managers joined the meeting briefly to respond to questions from the VE team. A brief summary of the project includes the following: Widening NC 24-27 from east of NC 73 to the Troy Bypass to multi-lanes. The original project development study was completed in conjunction with the adjacent R-2530B and B-4974 projects, which are currently in the construction phase. In addition to the roadway widening, the project includes replacement of the rail line and railroad bridge that crosses over NC 24-27.

FUNCTION ANALYSIS PHASE

During the function analysis phase of the VE Study, the team was instructed to use the details provided in the information phase and the materials available to outline the core functions of the project. After identifying each function, the team categorized them based on the purpose of the project. A higher order function meant that the function had to occur regardless of the project. A basic function met the purpose and need of the project. Lastly, a secondary function is a potentially beneficial function but is not required by basic or higher order. By identifying and ranking functions, each team member objectively thought about the purpose of the project as a whole and identified areas that could be studied in the creative phase. The VE study team identified the following as functions of the project:

Project	Verb	Noun	Higher Order	Basic	Secondary
R-2527	Provide	Connectivity (to adjacent projects)	x		
	Increase	Capacity		x	
	Improve	Safety		x	
	Accommodate	Bicycles			x
	Improve	Recreational access (lake, trails)			x
	Replace	Aged infrastructure		x	
	Manage	Property access		x	
	Maintain	Flood flow conveyance		x	
	Provide	Regional mobility	x		
	Increase	Resiliency			x
	Maintain	Rail operations		x	
	Minimize	Environmental impacts		x	

Function Analysis Summary



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CREATIVE PHASE

During the creative phase, the VE study team reviewed the available materials and generated 14 potential ideas to be incorporated into the project. They revisited the Function Analysis to insure that all the basic and higher order functions were being met, but also looked for alternative ways to deliver those functions. These ideas would add value to the project, whether that is a cost savings, time savings, reduction in risk, improved constructability, etc. All 14 Value Opportunities were documented in the VE study spreadsheet in the VE Opportunity/Description/Notes Column:

VE #	VE Opportunity / Description / Notes
1	Existing RR grade exceeds norm; proposed is the same as existing. Suggest extending limits in order to address the railroad grade.
2	Investigate shortening bridge to reduce cost. (Would require geotechnical evaluation.)
3	Update traffic control plans to be consistent with the current R/W plans.
4	Look at refining temporary Y-line tie-ins versus constructability.
5	Assess access road to basin (sheet 6).
6	Review opportunities for parking at trail head (sheet 11). (Currently parking within utility easement.)
7	Sheet 34- Review USFS access road- driveway not currently shown on plans.
8	Labelling of C/A breaks- symbols shown, but endpoints not labelled. Ex- Sheet 37 access at U-turn bulb unclear.
9	Sheet 37- missing driveway pipes. (Sta. 309) Overall, check consistency between roadway and drainage plans.
10	Reevaluate fill slopes to determine whether guardrail could be eliminated in areas.
11	Sheet 36- evaluate maintaining access to concrete plant driveway during construction.
12	Railroad x-sections (sta. 48+50)- unclear what is being shown. (Possibly stream crossing, maintenance road)
13	Consider whether weathering (rusty) steel should be used in place of galvanized steel in USFS areas.
14	Reduce design to collector, including 8' shoulder.

VE Opportunities Generated During the Creative Phase



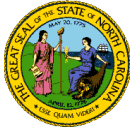
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EVALUATION PHASE

During the evaluation phase, the VE study team was instructed to discuss the advantages and disadvantages of each VE opportunity. Then, based on the advantages and disadvantages, the team decided whether to categorize the idea as a “1” and carry it forward as a formal recommendation or a “-1” and not develop the idea any further. At the conclusion of the evaluation phase, 6 of the ideas were carried forward into Development (with similar ideas being combined into a single recommendation):

VE #	VE Opportunity / Description / Notes	Advantages	Disadvantages	Rating	Rec #
1	Existing RR grade exceeds norm; proposed is the same as existing. Suggest extending limits in order to address the railroad grade.	Reduce the impact of the RR. Can be used as tradeoff option rather than raising grade (RR negotiations). Operational improvement for (and benefit to) the RR.	Increasing cost to NCDOT (additional track work, drainage). Only 100' R/W for RR; additional R/W needs would negate this option.	-1	
2	Investigate shortening bridge to reduce cost. (Would require geotechnical evaluation.)	The RR bridge is the costliest single item for project. If possible, could reduce cost.	Potential that higher quality material will be required for slope fill, slightly increasing cost of line item.	1	1
3	Update traffic control plans to be consistent with the current R/W plans.	<i>Categorized as design consideration.</i>			DC-1
4	Look at refining temporary Y-line tie-ins versus constructability.	Constructability, allowing traffic to be maintained by removing traffic from existing where possible, not having to piecemeal drainage.	Could impact R/W, potentially complicate drainage.	1	2
5	Assess access road to basin (sheet 6).	Safety improvement (due to location)- remove from L-line to Y-line.	Impacts to 54" pipe. Possible additional cost for lengthening pipe, additional R/W.	1	3
6	Review opportunities for parking at trail head (sheet 11). (Currently parking within utility easement.)	Provides additional recreational access (trail).	Potential utility conflicts. Could involve parking areas within NCDOT R/W. If parking option must be outside NCDOT R/W, will increase R/W cost.	-1	
7	Sheet 34- Review USFS access road- driveway not currently shown on plans.	USFS will need driveway access (unless otherwise specified).	Status of USFS position unknown.	1	4
8	Labelling of C/A breaks- symbols shown, but endpoints not labelled. Ex-Sheet 37 access at U-turn bulb unclear.	<i>Categorized as design consideration.</i>			DC-2
9	Sheet 37- missing driveway pipes. (Sta. 309) Overall, check consistency between roadway and drainage plans.	<i>Categorized as design consideration.</i>			DC-3



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VE #	VE Opportunity / Description / Notes	Advantages	Disadvantages	Rating	Rec #
10	Reevaluate fill slopes to determine whether guardrail could be eliminated in areas.	Eliminating guardrail, which is roadside obstacle.	Additional borrow material and earthwork cost. Potential additional environmental (wetland) impacts.	1	5
11	Sheet 36- evaluate maintaining access to concrete plant driveway during construction.	Potentially reduce cost of temporary shoring/ pavement (cost savings).	Possible increase in construction cost. May involve relocating box culvert (already relocated).	1	6
12	Railroad x-sections (sta. 48+50)- unclear what is being shown. (Possibly stream crossing, maintenance road)	<i>Eliminated after further discussion.</i>			
13	Consider whether weathering (rusty) steel should be used in place of galvanized steel in USFS areas.	Aesthetic considerations.	Likely higher cost, additional maintenance required. Availability may be an issue.	-1	
14	Reduce design to collector, including 8' shoulder.	Reduces R/W needed (at minimum, earthwork area). Reduces construction cost.	Possible safety concern for truck traffic. May not be consistent with other two projects on corridor.	-1	

Advantages, Disadvantages, and Ratings generated during Evaluation Phase

DEVELOPMENT PHASE

During the development phase, the VE opportunities categorized as a “1” were split among the Team members for further elaboration. Team members used all available materials, as well as their engineering background and experience, to justify the advantages of implementing each recommendation into the project. The team utilized development forms to organize their justifications. Development documentation is available in the Appendix.

PRESENTATION PHASE

The formal presentation of the VE study is this report. The report, along with the individual recommendation forms, will be sent to the project managers for evaluation. The individual recommendation forms will be marked with one of the following responses: accepted, accepted with modifications, or rejected and reasoning for the selection will be provided.

RESOLUTION PHASE

The resolution phase occurs during the Final Plans stage, just prior to let of the project. The project managers will provide evidence of plan sheets, cross sections, pavement schedules, structure drawings, etc. proving the incorporation of the accepted or accepted as modified recommendations into the project. During this phase, the total value will be assessed based on the recommendations that are implemented into the project design.



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APPENDIX

VALUE ENGINEERING ANALYSIS OVERVIEW

RECOMMENDATION AND DEVELOPMENT DOCUMENTATION



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VALUE ENGINEERING ANALYSIS OVERVIEW

(1) Information Phase: The VE study team gathers information about the present design and cost, then determines the needs, requirements, and constraints of the owners, users, and/or stakeholders, as well as the design criteria. Also, the project manager joins the team to provide additional project information, challenges, and answer any project related questions.

(2) Function Analysis Phase: The VE study team defines the project functions using measurable objectives consisting of an active verb and a descriptive noun. The VE study team analyzes these functions to determine which need improvement, elimination, or combination. Tools used during this phase include: random function identification, function listing, and value index.

(3) Creative Phase: The VE study team uses a variety of creative techniques, such as brainstorming, to generate alternative ideas to perform the project functions.

(4) Evaluation Phase: The VE study team refines and combines ideas, develops functional alternatives, and evaluates by comparison. Appropriate tools of comparison include advantage and disadvantage comparison and a rating of a 1, -1, or DC (Design Consideration). These designations are used after a discussion of each idea. A rating of 1 is the decision by the team to carry the opportunity forward to development. An idea which will not be carried forward for development will receive a -1 rating. The DC designation is used for ideas that have validity but cannot be developed by the team for various reasons. Those reasons may include, insufficient time, data, or project information; or perhaps they are straight forward and require no full development however should be considered before final design. By the end of the evaluation step in the VE process, all ideas will have a 1, -1, or DC rating. The opportunities given a 1 rating are now identified as recommendations.

(5) Development Phase: Based on the evaluation phase, the VE study team begins to develop in detail the recommendations carried forward. During this phase it is essential to establish costs and backup documentation needed to individually convey the alternative solutions. This can be done through written explanation, calculations, sketches or even use of other examples to list a few ways.

(6) Presentation Phase: The findings of the VE study are presented to management in the form of a written report. Each recommendation is documented on an individual recommendation form included in the report along with information documenting the rest of the VE study. The report is then sent to the appropriate business units to coordinate the final disposition. This phase may also include a verbal presentation.

As part of the presentation phase of the VE study process, each recommendation is evaluated by management and determined to be accepted, accepted with modifications, or rejected.



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Additionally, a written justification, based on sound engineering principles, is supplied with all recommendations. These decisions are then communicated back to VMO for tracking.

(7) Resolution Phase: As part of the final phase of the VE study process, all recommendations with an accepted or accepted with modifications status are incorporated into the project. The project manager will then provide documentation indicating implementation of the accepted and accepted with modification recommendations. The Value Management Office will then verify this information.