# Value Assessment Report

## STIP BR-0021
## NC 48 Bridge over Roanoke River
## Northampton and Halifax Counties

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Prepared for:

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## VALUE ASSESSMENT STUDY

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## Introduction / Background

This report presents the results of a value assessment/value engineering (VA/VE) analysis conducted on the 25% plans for the NC 48 bridge over the Roanoke River between the cities of Roanoke Rapids and Gaston, NC. North Carolina Department of Transportation (NCDOT) Value Management selected this project to be reviewed as part of a VA analysis. Overall, in conducting this VA workshop, the VE process and methodology was followed. It is further described in the Appendix. In this report, the terms VA and VE used somewhat interchangeably.

**Date of VA Workshop:** May 26-27, 2021
**Right of Way Date:** January 2023
**Let Date:** January 2025
**County:** Northampton and Halifax
**Total Estimated Cost:** $33,600,000

## Results Obtained

The VA/VE team focused their efforts on the high cost and most impactful project elements. Using function analysis and brain storming techniques, the team generated 19 ideas with 14 identified for additional evaluation as possible recommendations and design considerations. The team developed 6 recommendations and 3 design considerations for the project team's potential implementation into the project. The table on the following page is a summary of the recommendations.

This report presents the team's recommendations and all back-up information for consideration by the decision-makers. This Executive Summary includes the results obtained, the recommendation summary, the VE study identification, the VE Process description and the back-up information developed during the study. The Appendix includes a discussion of the VE analysis overview. The VE Recommendation and Development forms for each recommendation were submitted as separate files to the NCDOT Value Management office. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VA/VE process.

# Recommendation Summary

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| IDEA No. | VE IDEA No. | RECOMMENDATION | APPROXIMATE INITIAL COST SAVINGS |
|---|---|---|---|
| 01 | 01 | Use roundabout at plant driveway | **$100,000** |
| 02 | 02 | Realign plant driveway using a reverse jughandle | **$100,000** |
| 03 | 05 & 06 | Revise profile and reduce bridge shoulder to 4 feet | **$1,570,000** |
| 04 | 08 | Use steel girders, increase spans | **$600,000** |
| 05 | 14 | Maintain existing bridge for utilities | **$1,200,000** |
| 06 | 16 | Shift cooling pond storage to east side of new bridge; shorten bridge | **$2,886,000** |
| **Design Considerations** | | | |
| | 03 | Realign VEPCO/plant driveways | **-----** |
| | 04 | Increase bridge shoulder cross-slope | **-----** |
| | 17 | Improve/realign area below north section of bridge at boat ramp area | **-----** |
| | | | |

## Study Identification

| | |
|---|---|
| **Project:** NC 48 Bridge over the Roanoke River<br>STIP BR-0021 | **Date:** May 26-27, 2021 |
| **Study Location:** Conducted remotely | |

## VE Team Participants

| Name: | Title/Discipline: | Organization: |
|---|---|---|
| George Obaranec | Team Facilitator | Michael Baker International |
| Maddy Barbian | Roadway/Geometric Design | Michael Baker International |
| Shanna Niswonger | Drainage/Hydraulics | Michael Baker International |
| Caroline Owings | Traffic / Work zone | Michael Baker International |
| George Karageorge | Traffic / Work zone | Michael Baker International |
| Brad Bell | Structures | Michael Baker International |
| Brandy Creech | Utilities | Michael Baker International |
| Terry Burhans | Environmental | Michael Baker International |

## Value Engineering Process

After project selection, each multi-disciplined VA/VE Study Team is led by a facilitator through a systematic process which allows the team members to learn about a project, discuss the project, determine recommendations, further develop these ideas, and present recommendations to the design team and management for further review and possible incorporation into the project.

## Information Phase:

### Project Description

This project is to replace the existing NC 48 1,500 foot long bridge over the Roanoke River. There are also some operational and safety improvements at each side of the bridge, along with some key project considerations. These include:

- At the north end, the boat access area and recreational parking and circulation
- At the south section, improved driveway and access points for the VEPCO facility and the paper plant. This includes improved circulation and access for the large number of trucks accessing the plant

- 
- Utility services and connections on the existing bridge that will need to be
- removed and relocated.
- At the south section, the presence of a cooling pond storage area that is required to be spanned along with several exposed and conflicting utilities

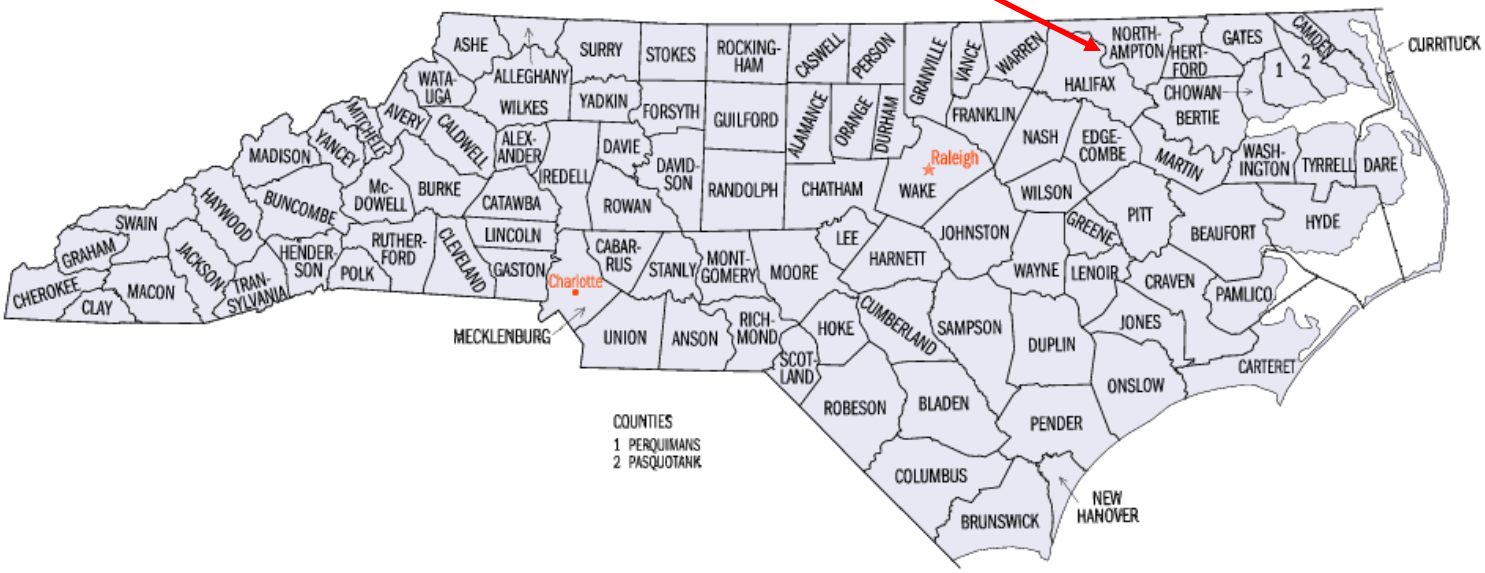
The proposed typical section will include one 12-foot lane and an 8-foot shoulder in each direction. A key concern of the project is the amount of logging trucks using travelling on the bridge and the associated added drainage maintenance problems on the bridge and their effect on the general traffic conditions at the plant driveway.

The current total project cost estimate is $33,600,000. The scheduled ROW certification date is January 2023 and the Division letting date is January 2025.

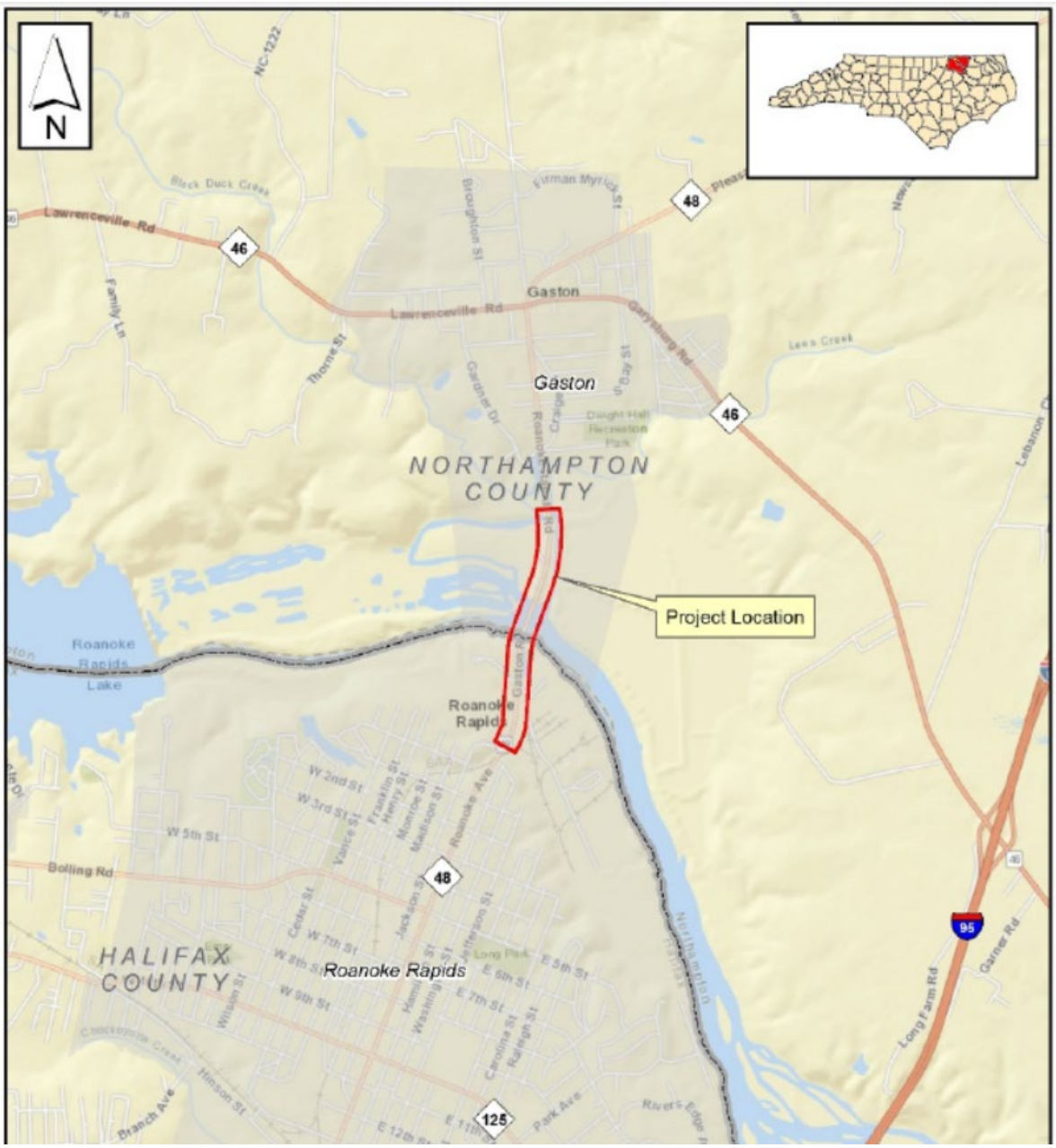
## Project Design Briefing

Kevin Fischer, the Division 4 Project Manager provided an initial, overall project information session and guidance on the first day of the VA/VE workshop.

**Project Location**




# Statewide Project Location Map




# Project Area Map

## Function Analysis Phase:

As part of the function analysis phase of the study, the team developed functions for both the major project elements as well as the overall project. Increase capacity was considered the basic project function. The tables and charts on the following pages represent the risk review, function analysis phase and Function Analysis Systems Technique (FAST) diagram.

| Verb | Noun | Higher Order | Basic | Secondary |
|---|---|---|---|---|
| improve<br>decrease | maintenance | × | --- | --- |
| replace | bridge | --- | × | --- |
| maintain<br>address | utilities | --- | --- | × |
| shift | alignment | --- | --- | × |
| modernize | section | --- | --- | × |

# Risk Review/Project Issues

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| No. | RISK IDENTIFICATION AREA | Probability | Project Impact | Risk Score (*) |
|---|---|---|---|---|
| 1 | Paper plant access intersection | 4 | 2 | 6 |
| 2 | Construction constraints for sturgeon moratorium | 4 | 4 | 8 |
| 3 | MOU with SHO for properties | 3 | 2 | 5 |
| 4 | Impacts and maintenance of boat dock and parking area | 3 | 3 | 6 |
| 5 | Providing/maintaining suitable bridge drainage | 3 | 3 | 6 |
| 6 | Vertical clearances to crossing transmission lines | 4 | 3 | 7 |
| 7 | Maintaining service for crossing and transmitting utilities | 4 | 3 | 7 |
| | | | | |

(*) A Risk Score of 7 or greater indicates a high priority concern with a high probability of occurrence and a major project impact. Refer to color chart on following page.

# RISK SCORING CHART

## Probability/Likelihood of Occurrence: 1 to 5

## Project/Relative Impacts: 1 to 5

| RELATIVE IMPORTANCE | | Project Impact | | | | |
|---|---|---|---|---|---|---|
| | | Negligible | Minor | Moderate | Significant | Extreme |
| **Likelihood of Occurrence** | **Probability** | 1 | 2 | 3 | 4 | 5 |
| NA | 0 | 1 | 2 | 3 | 4 | 5 |
| 1 | <10% | 2 | 3 | 4 | 5 | 6 |
| 2 | 10% - 35% | 3 | 4 | 5 | 6 | 7 |
| 3 | 35% - 65% | 4 | 5 | 6 | 7 | 8 |
| 4 | 65% - 90% | 5 | 6 | 7 | 8 | 9 |
| 5 | > 90% | 6 | 7 | 8 | 9 | 10 |

## Function Analysis

**Project:** Improvements
**Basic Function:** *verb / noun*

| ITEM No. | DESCRIPTION | FUNCTION | | INITIAL DOLLARS | | |
|---|---|---|---|---|---|---|
| | | Verb | Noun | Cost | % of Total | Worth /Save |
| **GEN** | **Overall Project** | replace | bridge | n/a | --- | yes |
| | | improve | drainage | | | |
| | | increase | LOS | | | |
| | | allow | trucks | | | |
| | | maintain | utilities<br>services | | | |
| | | | | | | |
| | **Bridge** | reduce | maintenance | n/a | --- | yes |
| | | span | river | | | |
| | | minimize | impacts | | | |
| | | modernize | bridge alignment<br>(typical section) | | | |
| | | connect | communities | | | |
| | | accommodate | trucks<br>logging | | | |
| | | drain | surface | | | |
| | | carry | utilities | | | |
| | | carrying | vehicles | | | |
| | | access | river | | | |
| | | maintain | history | | | |
| | | access | utilities<br>pump station | | | |
| | | | | | | |
| | **Retaining Walls** | reduce | impacts | n/a | --- | yes |
| | | control | cost | | | |
| | | accommodate | improvements | | | |
| | | retain | slope | | | |
| | | | | | | |
| | **Pavement** | support | loads | n/a | --- | yes |
| | | improve | approaches | | | |

## Function Analysis

**Project:** Improvements
**Basic Function:** *verb / noun*

| ITEM No. | DESCRIPTION | FUNCTION | | INITIAL DOLLARS | | |
|---|---|---|---|---|---|---|
| | | Verb | Noun | Cost | % of Total | Worth /Save |
| | | maintain | access | | | |
| | | improve | safety | | | |
| | | match | bridge | | | |
| | | add | storage | | | |
| | | eliminate | left turn | | | |
| | | reduce | maintenance | | | |
| | | | | | | |
| | **Drainage** | improve | bridge | | | |
| | | collect<br>treat | runoff | | | |
| | | discharge | on dry land | | | |
| | | | | | | |

## Creative Phase

During the Creative Phase, the VE Team reviewed the available material and generated 19 ideas to be further evaluated for potential incorporation into the project. They revisited the functions identified in the Function Analysis Phase to ensure that all the basic and higher order functions were being met and also looked for alternative ways to deliver those functions. These ideas would add value to the project whether through cost savings, time savings, risk reduction, improved constructability or other project benefit areas.

## Evaluation Phase

During the Evaluation Phase, the VE Team further identified and detailed the idea, explaining and discussing the advantages and issues of each VE idea and opportunity. They then rated the ideas either a “+”, carrying it forward to the Development Phase or a “–“, dropping it from further consideration. The table on the following pages represents the Creative and Evaluation Phases, Idea Listing.

## Development Phase

During the Development Phase, the VE Team members used the Recommendation and Development forms to provide more detail of the ideas rated as a "+". Team members used all available materials as well as their engineering background and experience to develop, detail and justify the benefits and advantages of the ideas and also to present and discuss any concerns or issues. The supporting documentation from the Development Phase including the Recommendation and Development forms are submitted separately.

## Presentation Phase

The formal presentation of the VA/VE Study is the report. The report, along with the individual recommendation forms will be sent to the project managing engineers 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 the project letting. The project managers will provide evidence of plan sheets, cross-sections, pavement schedules, structure drawings, etc. providing 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.

## Creative and Evaluation Phases; Idea Listing

| Idea No. | VA Idea No. | VE Opportunity Description/Notes | Benefits | Issues | Rating |
|---|---|---|---|---|---|
| 01 | 01 | Use roundabout at paper plant driveway | Eliminates signalized intersection, improved operations, eliminates sharp skewed alignment | Encroaches onto paper plant property, impacts some additional overhead utilities | + |
| 02 | 02 | Realign paper plant driveway with reverse jughandle | Improves interior truck circulation and general plant access | | + |
| | 03 | Improve, square-off alignment at VEPCO/power plant driveway | Improves intersection alignment | | DC |
| | 04 | Increase bridge shoulder slope to 3% | Could eliminate or reduce bridge scuppers | | DC |
| | 05 | Increase profile grade on bridge, shift high point to center of bridge; See No. 06 | Increase minimum bridge gradient of 0.5%; better stormwater distribution | Slightly increases bridge height, review transition constructability | + |
| 03 | 06 | Reduce bridge shoulders to 4 feet | Reduces bridge width | Impacts stormwater storage | + |
| | 07 | Investigate salvaging and reuse of substructure with new superstructure | Significant scope reduction, eliminate waterway work | As-built plan info not available, limited potential for 65 year old bridge, requires long-term closure | – |
| 04 | 08 | Increase bridge spans, use steel girders | Reduces waterway work, shortens project schedule | | + |
| | 09 | Shift alignment closer to existing, bridge over pump station | Minimal benefits | Aerial conflict could be more problematic condition, no other primary benefits | -- |
| | 10 | Reconstruct new bridge in same alignment | Reduces ROW/footprint | Impacts utility service/continuity, requires long-term full closure | -- |
| | 11 | Consider other alternates to historic preservation, maintain use of F rail | Reduced cost of F rail | Not a major cost driver; beneficial for the overall permit | --- |
| | 12 | Construct separate utility bridge | Less costly than underground crossings | Added waterway work, would require additional permitting | + |
| | 13 | Maintain existing bridge and utilities | Rehab for continued use | Without a new bridge, does not meet project needs | --- |

| | | | | | |
|---|---|---|---|---|---|
| 05 | 14 | Maintain existing bridge for utilities and ped/bikes; multi-use trail | Improves constructability, less reliance on utility coordination | Would require maintenance to existing bridge | **+** |
| | 15 | Review need and use of sidewalks and curb and gutters on side roads/driveways | Could eliminate unnecessary project element | Very limited areas, minimal impacts, already eliminated in some areas, does provide improved pavement edge definition | **---** |
| 06 | 16 | Reconstruct/shift cooling channel storage to east side of new bridge | Shortens bridge; consolidates pond, closer to plant | Could require added permits and surveys, intake review; requires pond expansion and regrading | **+** |
| | 17 | Provide improved/straightened alignment under bridge at boat ramp area | Adds space; improves access and circulation, increase parking area | | **DC** |
| | 18 | Shift proposed bridge alignment closer to existing at north end | Improve boat ramp area alignment | Minimal benefits of changing alignment | **---** |
| | 19 | Provide improved turning alignment for boat access driveway | Improves circulation and access; See No. 17 | | **DC** |
| | | | | | |

Legend:

XX – Numbered ideas are developed into recommendations included in this report

DC – Design Consideration, no cost implications at this time

**--** Ideas without a number or any other designation were not further advanced or developed; further explanations included under “Issues”

# APPENDIX

## Value Assessment / Engineering Analysis Overview

### Value Assessment / Engineering Process

After project selection, each multi-disciplined Value Engineering Study Team is led by a facilitator through a systematic process which allows the team members to learn about a project, discuss the project, determine recommendations, further develop these ideas, and present recommendations to the design team and management for further review and possible incorporation into the project.

#### VA/VE Phased Methodology

Value Assessment/Engineering (VA/VE) is a function-based, systematic approach of reviewing and analyzing a project, by an experienced, multi-disciplined team, led by a trained facilitator to develop and deliver recommendations for project improvements and best value. For this workshop, we followed the SAVE-International phased approach consisting of the following phases:

- Information
- Function Analysis
- Speculation
- Evaluation
- Development
- Presentation

It is important that each phase is thoroughly and rigorously presented and developed. A basic tenet of the phased approach is that each subsequent phase builds on the work completed in the previous phase. The phases are further described as follows:

#### Investigation Phase

The VE team begins the study by investigating the project. Prior to the actual start of the study, the team members should familiarize themselves with the available project documents. Good groundwork in the Investigation Phase is important to providing viable recommendations at the end of the study. The investigation process encourages team building and allows the team members to get to know each other and identify areas of expertise. Often, teams want to rush right into speculating solutions before they have taken the time to acquaint themselves with the information that is available.

The VE workshop starts with a presentation by the design team. This should include all pertinent project data, history and development to-date for the VE Team's use and consideration. For this study, there was not a field visit but time was allotted for aerial mapping review of the site. Once the team is familiar with the project and the available documentation, they need to agree upon and document the objective of the study and any constraints or controlling decisions that will affect the recommendations they develop. The Investigation Phase provides the VE team with a thorough understanding of the project and what the VE study is expected to accomplish.

## Function Analysis Phase

The Function Analysis phase is the most critical element of the VE study and is what separates value engineering from conventional plan review and cost-cutting measures. Based on the study objective, the team will determine the primary and secondary functions of the major project elements in verb/noun format. Function analysis is also performed for the project as a whole and a F.A.S.T. diagram is developed to determine the critical path necessary to accomplish each primary function of the project.

## Speculation (Creative) Phase

During the Speculation Phase, the VE team brainstorms ideas that satisfy the project functions. Off-the-wall, out-of-the-box ideas are encouraged, as they often lead to other ideas that can be developed into innovative and workable solutions. "Piggybacking" of ideas is enabled by the diversity and backgrounds of the team members. The team lists all of the brainstorm ideas, even the most improbable. A team member can explain an idea to the rest of the team, but no evaluation is allowed at this point. There are no bad ideas or negative comments tolerated, only "what do I like about the idea", and "what can I do to make it better."

## Evaluation Phase

The Evaluation Phase begins by going back through the ideas brainstormed during speculation and rating the ideas. The VE team discusses advantages and disadvantages of each VE opportunity. Then, based on their analysis the team decides whether to categorize the idea as a "+" and carry it forward as a formal recommendation or as a "-" and not develop the idea any further.

## Development Phase

The team members, working in sub-groups or individually develop the ideas that survive the evaluation phase. The recommendations are fully developed on approved Recommendation Forms and worksheets that include a summary sheet describing the existing conditions, recommended designs and the benefits of the recommendation and the cost data. The recommendation development and worksheets should also include sketches, calculations, assumptions and all pertinent information for the design team to make an informed decision regarding the recommendation's benefits and implementation.

## Presentation Phase

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

The final VE report represents the complete documentation of the team's activities during the duration of the workshop. At the conclusion of the study, the team facilitator will have collected all the documents produced by the team during the course of the workshop for inclusion in the final report.

## Resolution Phase

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