VALUE ENGINEERING IN THE FEDERAL-AID HIGHWAY PROGRAM

Federal Highway Administration

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Memorandum

U.S. Department of Transportation
Office of the Secretary
of Transportation
Office of Inspector General

Subject: ACTION: Report on Value Engineering in the Federal-Aid Highway Program Report No. MH-2007-040

Date: March 28, 2007

From: Kurt Hyde
Assistant Inspector General
for Surface and Maritime Programs

Reply to Attn. of: JA-40

To: Federal Highway Administrator

This report presents the results of our audit of the Federal Highway Administration's (FHWA) oversight of value engineering (VE) in the Federal-aid highway program and the effectiveness of the states' respective VE processes. VE is the systematic process of review and analysis of a project, during the concept and design phases, by a multi-disciplined team of persons not involved in the project. The analysis is documented in a report that contains recommendations for: (a) delivering the project safely, reliably, and at the lowest overall cost; (b) improving the value and quality of the project; and (c) reducing the time to complete the project. The National Highway System Designation Act of 1995 (the 1995 Act), requires states to perform value engineering analysis for all Federal-aid highway projects on the National Highway System (NHS) with an estimated cost of $25 million or more. In implementing the 1995 Act, FHWA enacted a provision that provides for states to be reimbursed for the cost of conducting value engineering studies for projects under the Federal-aid program.

Over the years, value engineering has evolved into a management tool that can be used alone or with other management techniques to improve operations and project quality and reduce project costs, by streamlining operations and implementing cost saving recommendations. It can also increase the use of environmentally sound and energy efficient practices and materials. Nationally, state departments of transportation have realized substantial savings by using value engineering.

Our objectives were to determine whether FHWA's oversight is adequate to ensure that: (1) value engineering studies are performed on all Federal-aid NHS projects that have an estimated cost of $25 million or more, (2) value engineering studies are performed on all Federal-aid projects that have a high potential for cost savings, and (3) all value engineering recommendations that can be implemented are approved, permitting the greatest degree of potential savings to be achieved. We conducted this performance audit in accordance with Generally Accepted Government Auditing Standards prescribed by the Comptroller General of the United States, except for standard 7.57, *Data Gathered by Management*.

The conditions identified in this report are based on our review of FHWA documents and state documents (for example, Connecticut's VE studies and interviews with the FHWA VE coordinator) and state highway officials (such as Washington State's Secretary of Transportation). Our estimates of savings lost are based on FHWA's official data for fiscal year (FY) 2001 through FY 2004. The FHWA data are the only nationwide data available on the subject, and are widely used and accepted by outside experts and policymakers. FHWA uses this information to compile its *Annual Federal-Aid Value Engineering Summary Report*, which is submitted to the Secretary and the Office of Management and Budget (OMB). The Transportation Research Board (TRB) used the same data in its assessment of state value engineering programs. We validated the data for the 10 states we visited and deemed it sufficiently reliable for use in this report. We also performed such tests as we considered necessary to detect fraud, waste, and abuse. Additional details of our objectives, scope, and methodology are in Exhibit A.

Congress first sought to apply value engineering to highway projects in the late 1960s, at a time when the highway network was being significantly expanded. The Federal-aid Highway Act of 1970 reflected this growing interest with a provision requiring that value engineering or other cost reduction analyses be performed on any Federal-aid highway project and that states certify and report to the Secretary that design alternatives were considered in a public forum. Provisions in the Code of Federal Regulations (CFR) part 23, section 627.1, required states to establish a program to improve project quality, reduce project costs, foster innovation, eliminate unnecessary and costly design elements, and ensure efficient investments by requiring the application of value engineering. OMB Circular A-131 (May 1993 update) requires all Federal agencies to use value engineering, where appropriate, to reduce program and acquisition costs and to report to OMB each fiscal year on the results of value engineering. Section 303(b)(f)(1) of Public Law 104-59, the *National Highway System Designation Act of 1995*, provides, "The Secretary shall establish a program to require States to carry out a value engineering analysis for all projects on the NHS with an

estimated total cost of $25,000,000 or more."[1] The 23 CFR Part 627.1(a) codified this provision requiring "the application of value engineering to all Federal-aid highway projects on the NHS with an estimated cost of $25 million or more."

Each year, FHWA awards more than $30 billion to states through Federal-aid grants. In each of our annual Top Management Challenges reports from 2003 through 2006,[2] we have pointed to the need for FHWA to make improvements in the area of grants management. Ensuring that states have effective value engineering programs in place is a component of grants management. In addition, savings generated by implementing value engineering recommendations reduce states' project costs. Savings realized by implementing value engineering recommendations on Federal-aid projects are not returned to FHWA, thereby allowing states to reapply the Federal share of these savings (which is generally 80 percent) to other needed projects, such as repairing structurally deficient bridges, improving existing roadways, or constructing new bridges or roadways. In an age when Highway Trust Fund revenues are not keeping pace with state infrastructure needs, more effective value engineering programs will enable states to do more with available Federal funds.

RESULTS IN BRIEF

Value engineering provides a substantial opportunity for states to obtain the most value from Federal-aid funds by achieving savings on planned construction projects. Furthermore, it has the potential to serve as a key tool in FHWA's stewardship of Federal funds. Historically, states have saved an average of 5 percent[3] of estimated project costs by performing value engineering studies and accepting resulting recommendations. From FY 2001 through FY 2004, states collectively reported $4.2 billion in recommended savings (about $1 billion annually). During the same 4-year period, we estimate that conducting required NHS value engineering studies and high-potential non-NHS value engineering studies, and accepting more recommendations, could have saved an estimated $725 million in Federal funds.[4] (See Table 1 on the next page.) Had these savings been achieved, additional planned projects could have been started.

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[1] In 2005, the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users, PL 109-59, lowered the threshold for requiring value engineering studies on bridge projects to $20 million. Because we reviewed states for the period of FY 2001 through FY 2004, this did not affect our conclusions.

[2] The Office of Inspector General annual reports on the United States DOT Top Management Challenges can be found on our website: www.oig.dot.gov.

[3] To calculate our estimate that 5 percent of estimated project costs could be saved from performing required VE studies, we analyzed FHWA's Annual Federal-Aid Value Engineering Summary Report(s) from FY 2001 through FY 2004. Our calculation was corroborated by the Transportation Research Board's December 2005 National Cooperative Highway Research Program's Synthesis 352.

[4] The Federal participation rate of most Federal-aid projects is generally 80 percent, while projects such as Federal Lands and Emergency Relief can go as high as 100 percent, with states or other allowable sources being responsible for the balance. To conservatively calculate the Federal share of the potential savings lost, we used 80 percent of the $906 million in estimated savings, which is approximately $725 million.

To assess FHWA's oversight of the value engineering program, we judgmentally selected and visited 10 states.[5] We selected these states because they possessed attributes such as not reporting any value engineering studies, approving low or high percentages of recommendations, or receiving large amounts of Federal-aid dollars. Based on our work in these states, we concluded that for state value engineering programs, FHWA provided limited oversight, such as facilitating states' use of value engineering and identifying and disseminating states' best practices.

We also engaged the assistance of the U.S. Army Corps of Engineers (the Corps), under the direction of the Office of Inspector General (OIG) Engineer Advisor, to review and assess the appropriateness and adequacy of North Carolina and Michigan's value engineering programs, processes, and studies and their compliance with FHWA policy. These states were selected because they had approved a low percentage of recommendations.

Table 1. Summary of Estimated Savings Lost
(FY 2001-FY 2004)

Area of Improvement	Estimated Savings Lost ($ in millions) *
Performing Value Engineering Studies ➢ 39 NHS Projects (in 7 states)--$98.4 million ➢ 9 Non-NHS Projects** that OIG identified as having a high potential of cost savings (in 3 states)--$19 million***	$117
Approval of Value Engineering Recommendations to achieve the 44.4 percent national average in all states (in 28 states)	$789
Total	**$906**
Federal Share	**$725**

Source: These savings were computed using FHWA's data and a calculation methodology developed in conjunction with the OIG Statistician.

* See Scope and Methodology section of Exhibit A for information on how the estimates were calculated.

** With respect to Federal-aid projects not on the NHS or NHS projects with estimated costs less than $25 million, 23 U.S.C. 106(e) states, "For such projects as the Secretary determines advisable, plans, specifications, and estimates for proposed projects on any Federal-aid highway shall be accompanied by a value engineering analysis or other cost reduction analysis."

*** VE studies were not required per Federal Regulations, but we chose to include these projects because of the potential savings.

[5] There are 52 Division Offices: the 50 states, the District of Columbia, and Puerto Rico. For purposes of this report, we refer to the District of Columbia as a "state."

Seven of Ten States Reviewed Missed Opportunities to Achieve Significant Savings by Not Performing Required Value Engineering Studies

Section 303(b)(f)(1) of Public Law 104-59, the *National Highway System Designation Act of 1995*, provides, "The Secretary shall establish a program to require States to carry out a value engineering analysis for all projects on the NHS with an estimated total cost of $25,000,000 or more."[6] Regulations in 23 CFR Part 627.1(a) codified this provision requiring "the application of value engineering to all Federal-aid highway projects on the NHS with an estimated cost of $25 million or more." Neither Federal law nor regulations allow exceptions to these requirements, and FHWA is not allowed to grant waivers.

FHWA's *Policy Guide* states, "The FHWA will assure that a VE study is performed on all Federal-aid funded NHS projects with an estimated cost (includes design, right-of-way, and construction costs) of $25 million or more, and on other Federal-aid projects where its employment has high potential for cost savings." For purposes of our analysis, we considered all non-NHS Federal-aid projects with an estimated cost exceeding $25 million to have a high potential for cost savings.[7] We assessed the use of value engineering on 314 NHS projects in 10 states for the period FY 2001 through FY 2004 and found that the application of value engineering varied across those states. Of the 10 states, 3 (Massachusetts, Washington, and Wisconsin) performed value engineering studies on all 25 projects that met the $25 million threshold.

In contrast, the remaining seven states (California, Connecticut, Michigan, New Jersey, North Carolina, Texas, and the District of Columbia) did not perform required value engineering studies on 39 of the 289 projects (13 percent) that met the threshold. If the seven states had performed the required studies for the 39 projects, collectively valued at $2.0 billion, and achieved the 5-percent national average savings,[8] we estimate they could have saved an additional $98.4 million ($24.6 million annually) and reprogrammed the savings to other projects. For example:

- North Carolina DOT (NCDOT) officials did not perform required value engineering studies on five design-build projects valued at $435 million even though they acknowledged that design-build projects are not exempt from the Federal requirement to conduct value engineering studies. If these studies

[6] In 2005, the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users, PL 109-59, lowered the threshold for requiring value engineering studies on bridge projects to $20 million. Because we reviewed states for the period of FY 2001 through FY 2004, this did not affect our conclusions.

[7] We considered non-NHS Federal-aid projects with an estimated cost exceeding $25 million to have a high potential for cost savings. According to FHWA, some projects with estimated costs below $25 million could also have a high potential for cost savings, while other projects exceeding $25 million, such as repaving existing roadways, may not.

[8] The 5-percent savings average is computed by dividing the value of approved recommendations by the estimated cost of projects for which value engineering studies were performed for FY 2001 through FY 2004.

had been performed and had produced the national 5-percent average savings, North Carolina could have saved and reprogrammed an estimated $21.7 million.

- The Texas and California state DOT central offices delegated the responsibility for ensuring performance of value engineering studies to the district levels. However, the central offices did not follow up to ensure that the districts performed the studies. Consequently, between these two states, 27 additional studies should have been performed. If these studies had been performed and had produced the national 5-percent average savings, these states collectively could have saved an estimated $62.7 million.

Further, our audit showed that value engineering studies were not conducted on nine additional Federal-aid projects in the District of Columbia, North Carolina, and Texas that are not on the NHS, all with estimated costs exceeding $25 million. By not performing these value engineering studies, the three states collectively lost the opportunity to save an additional estimated $19 million, had the studies produced the national 5-percent average savings. We estimate that if these NHS and non-NHS Federal-aid highway projects had undergone the required value engineering studies, the remaining seven states in our sample could have saved an additional $117 million.

Value Engineering Recommendations That Were Not Implemented Resulted in Additional Missed Opportunities for Significant Savings

For those projects on which value engineering studies were performed, states did not approve many of the resulting recommendations. From FY 2001 through FY 2004, 5 of the 10 states we visited (Connecticut, North Carolina, California, Michigan, and Wisconsin) collectively approved 23 percent of the proposed recommendations, which contrasts with the nationwide approval average of 44.4 percent.[9] We calculated that had those five states achieved the 44.4 percent national average, and saved the national average of $1.18 million on each accepted recommendation,[10] an additional estimated $381 million (a combined Federal share of approximately $305 million) could have been saved and reprogrammed to other qualifying projects.

During the same FY 2001 through FY 2004 time period, 23 states that were not in our judgmental sample of states visited, did not meet the 44.4 percent national average. We calculated that, if those states had achieved this national average, an

[9] Our 44.4 percent average estimate of value engineering recommendations is based on our analysis of FHWA's *Annual Federal-Aid Value Engineering Summary Report(s)* from FY 2001 through FY 2004. Our calculation was corroborated by the Transportation Research Board's December 2005 National Cooperative Highway Research Program's *Synthesis 352*.

[10] The national average of $1.18 million in savings includes all accepted recommendations. Value engineering recommendations can increase or decrease project costs.

estimated additional $408 million (of which the Federal share is approximately 80 percent or $326 million) could have been saved and reprogrammed to other qualifying Federal-aid projects. Nationally, had the 28 states (5 visited plus 23 not visited) achieved the national average for the percentage of recommendations implemented, we estimate they could have saved an additional $789 million (about $197 million annually).

According to state DOT and FHWA officials, low acceptance rates of value engineering recommendations occurred because: (1) state officials did not promote to staff the fiscal benefits of using value engineering, (2) the states perceived that value engineering studies caused unneeded project delays, and (3) value engineering studies were performed too late in the design process to approve and implement recommendations. States have the final decision whether to accept or reject recommendations. However, these decisions should be documented and available for FHWA's review. In assessing why states did not accept recommendations, we found that only 2 of the 10 Division Offices we visited participated in the implementation process or required documentation justifying the decisions for rejecting the recommendations. Without independent FHWA review we cannot be assured that states were correct in rejecting their respective recommendations.

FHWA's Oversight of State Value Engineering Programs Needs To Be Significantly Strengthened

To ensure that states use value engineering analyses throughout highway project development, design, and construction, FHWA Division Offices should increase their oversight and strengthen existing policies. Enhanced FHWA oversight is needed in the areas of:

- **Limited time to develop expertise.** FHWA VE coordinators stated that their tenures were too short (2 to 3 years) and during their tenures, they were responsible for other assignments. Additionally, they opined that their limited tenures did not allow them the time to acquire sufficient knowledge and training to perform as coordinators.

- **Discontinued performance measures.** FHWA's performance goal of increasing the use of VE and measures to achieve greater cost savings was discontinued in FY 2001, limiting the agency's ability to assess the VE program's effectiveness and to reveal problem areas within the program.

- **No review of internal controls over the VE program.** FHWA is implementing two processes to assess controls and improve oversight of grants management—the Financial Integrity Review and Evaluation (FIRE) Program and its program of corporate risk assessments. However, FHWA

does not specifically assess its internal controls over the VE program as part of either process.

FHWA Needs to Disseminate States' Best Practices to Improve Value Engineering

FHWA initiated a task force to improve the value engineering process and establish new value engineering performance measures. The task force, which first met in 2005 and comprises many stakeholders–including experts from both FHWA and the states, could identify and disseminate best practices. FHWA has not collected and disseminated best practices that could enhance the benefits of value engineering studies. However, we identified a range of best practices already being used. For example:

- In Washington State, senior management and outside stakeholders participate in the value engineering process and the state has adopted the Society of American Value Engineers (SAVE) International's methodology, which facilitates implementing the best alternatives recommended.

- New Jersey value engineering team members are trained annually by the National Highway Institute. This training includes conducting a value engineering study on an active project. In fostering a multi-disciplinary approach, New Jersey offers this training to both engineers and non-engineers.

- Massachusetts requires written justification for value engineering recommendations that are not approved and challenges questionable justifications for rejection.

We analyzed the effectiveness of value engineering programs in the states visited and generally found that states with best practices ranked higher overall in key indicators of value engineering effectiveness than states that had not adopted best practices. Further, adopting best practices can make state value engineering studies more cost-effective. For example, over the 4-year period, FY 2001 through FY 2004, Washington State produced a return on investment of $523 for each $1 spent performing value engineering studies and approved 83 percent of its recommendations, while the national average for return on investment was $128 for each $1 spent, with a 44.4 percent recommendation approval rate. New Jersey and Massachusetts yielded the highest percentages of project savings. Implementing the following recommendations will help FHWA and the states generate more savings from the value engineering process.

RECOMMENDATIONS

Our recommendations are summarized below. The complete list of recommendations begins on page 11.

We recommend that FHWA revise its value engineering policy to:

- Require responsible state management (for example, the chief engineer) to sign off on the rejection of value engineering recommendations that contain substantial cost savings.
- Establish requirements for the support of cost estimates, including the evaluation of life-cycle cost alternatives.
- Require the FHWA Division Offices' value engineering coordinators to either monitor or participate in all state value engineering studies for Federal-aid projects.

To strengthen the FHWA oversight of the value engineering program and to better monitor value engineering performance, we also recommend that FHWA:

- Develop performance goals for measuring the effectiveness of state value engineering programs and for evaluating the responsible Division Office personnel.
- Incorporate value engineering into either the FIRE reviews or the corporate risk assessment process to determine whether all required studies were performed and to assess how the states determine to either accept or reject recommendations.
- Collect and disseminate best practices to the states' departments of transportation.

SUMMARY OF MANAGEMENT COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On January 31, 2007, we provided FHWA a draft copy of this report. On March 2, 2007, FHWA provided us its formal response, which is included in its entirety in the Appendix.

In its response, FHWA fully concurred with all of our recommendations and provided planned corrective actions that will begin as early as March 2007. Specifically, FHWA plans to (1) revise Federal regulations by updating FHWA policy, developing technical guidance, and producing outreach material; (2) convene a working group to evaluate and establish performance goals and measures to assess FHWA's value engineering program; (3) incorporate an assessment of state value engineering programs into the corporate risk assessment

program; and (4) develop value engineering technical guidance, best practices, and outreach materials. Additionally, in discussing the results of our review, FHWA officials accepted our calculations of the estimated savings lost from states not performing required value engineering studies and from not achieving the 44.4 percent national average of recommendations approved.

ACTIONS REQUIRED

FHWA's planned actions were responsive to our recommendations and we commend FHWA for promptly initiating actions to address each of our recommendations. However, the recommendations will be considered unresolved until FHWA provides target dates for completed corrective actions. In accordance with DOT Order 8000.1C, we would appreciate receiving, within 30 days, estimated completion dates for all planned corrective actions.

We appreciate the cooperation and assistance provided by FHWA and Army Corps of Engineers representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-5630, or Rebecca Anne Batts, Deputy Assistant Inspector General for Surface and Maritime Programs, at (202) 493-0331.

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FINDINGS

States Need To Perform Value Engineering Studies In Order To Achieve Substantial Savings

Section 303(b)(f)(1) of Public Law 104-59, the *National Highway System Designation Act of 1995*, provides, "The Secretary shall establish a program to require States to carry out a value engineering analysis for all projects on the National Highway System with an estimated total cost of $25,000,000 or more." The 23 CFR 627.1(a) codified this provision requiring "the application of value engineering to all Federal-aid highway projects on the National Highway System with an estimated cost of $25 million or more." Neither Federal law nor regulations allow exceptions to these requirements. However, we found that value engineering analyses are not being conducted in accordance with Federal regulation and FHWA policy, Federal-aid funds are being expended on projects with unrealized cost savings, and states are missing opportunities for substantial savings.

While Some States Performed Required Value Engineering Analyses for Projects Over $25 Million, Others Did Not

Our fieldwork concentrated on highway projects covering the period from FY 2001 through FY 2004. Based on our analysis, using the 5-percent national average, we estimated that the 10 states visited could have saved an additional $117 million ($29 million annually) and reprogrammed these savings to other qualifying Federal-aid projects by performing additional value engineering studies.

As shown in Table 2 on the following page, the extent to which the 10 states in our audit performed their required value engineering studies varied. To their credit, from FY 2001 through FY 2004, 3 of the 10 states (Massachusetts, Washington, and Wisconsin) performed all required value engineering studies.

However, we found that the remaining seven states we visited (California, Connecticut, Michigan, New Jersey, North Carolina, Texas, and the District of Columbia) did not perform many required value engineering studies. Of the 289 NHS projects in these seven states, 39 projects (or 13 percent) with a total cost of $2.0 billion did not undergo the required value engineering studies, resulting in lost opportunities to reprogram an estimated $98.4 million. Because it did not effectively track the status of state value engineering efforts, FHWA was unaware that most of the required studies were not performed.

We also identified nine Federal-aid projects (five in Texas, three in North Carolina, and one in the District of Columbia), each with estimated costs

exceeding $25 million, that were not on the NHS and did not have value engineering studies performed. With a total estimated cost of $379 million for these nine Federal-aid projects, each of them could have been identified as having a high potential for cost savings. Although value engineering studies were not required for these non-NHS projects, we estimated that the three states lost the opportunity to save an additional $19 million of the $379 million combined cost by not performing value engineering studies on the nine projects.

Table 2. Value Engineering Studies Not Performed (FY 2001—FY 2004)

States Visited	NHS Projects Above the $25 Million Threshold			Non-NHS Projects With a High Potential for Cost Savings	
	Number of NHS Projects	Number of NHS Projects Without Required Study	Estimated Savings Lost by Not Performing the Study ($ millions) *	Number of Non-NHS Projects Without Study	Estimated Savings Lost by Not Performing the Study ($ in millions)
California	102	11	$26.5	*N/A*	
Connecticut	10	2	$3.3	*N/A*	
District of Columbia	1	1	$1.4	1	$1.7
Massachusetts	6	*All required studies performed.*			
Michigan	18	1	$1.6	*N/A*	
New Jersey	11	1	$1.8	*N/A*	
North Carolina	34	7	$27.6	3	$6.0
Texas	113	16	$36.2	5	$11.3
Washington	10	*All required studies performed.*			
Wisconsin	9	*All required studies performed.*			
Total	**314**	**39**	**$98.4**	**9**	**$19.0**

Source: FHWA generated list of Financial Management Information System projects estimated to cost $25 million or more.

***** See Scope and Methodology section of Exhibit A for information on how the estimates were calculated.

The use of value engineering programs varied widely across the states we reviewed, as indicated in the examples below.

- **Texas DOT.** Texas performed no value engineering studies on 16 applicable NHS projects collectively valued at $724 million. Using the 5-percent national average, we estimated potential lost savings of $36.2 million (a Federal share of approximately $29 million). The Texas Central DOT Office delegated responsibility for performing the value engineering studies to the

25 districts throughout the state, but did not follow up to ensure the districts performed the required studies.

- **California DOT.** California performed no value engineering studies for 11 applicable NHS projects, collectively valued at $529 million. Using the 5-percent national average, we estimated potential lost savings of $26.5 million (a Federal share of approximately $21.2 million). California's central DOT office delegated responsibility for performing value engineering studies to its 12 districts located throughout the state, but did not follow-up to ensure that districts performed the required studies.

- **North Carolina DOT.** North Carolina did not perform required value engineering studies on seven projects, collectively valued at $551 million. Using the 5-percent national average, we estimated that North Carolina lost potential savings of $27.6 million (a Federal share of approximately $22 million). NCDOT explained that, for five of these seven projects, valued at $435 million, value engineering was not required because the projects were awarded through the design-build process. However, FHWA's value engineering coordinator acknowledged that design-build projects are not exempt from undergoing value engineering studies.

  NCDOT established a Value Engineering Advisory Panel in March 1995 that planned to meet quarterly to review rejected recommendations. The Advisory Panel had the authority to concur with the rejection, approve the recommendation, or require modifications to the recommendation before approval. However, despite some interest among NCDOT personnel, the Advisory Panel has never met, and therefore has not provided the oversight it was established to perform.

States Are Not Implementing Many Value Engineering Recommendations, Missing Further Opportunities to Achieve Significant Savings

The 1995 Act and 23 CFR Section 627.1 emphasize the benefits of value engineering "for reducing the total cost of the project and providing a project of equal or better quality." Public Law 104-59 and SAVE provide specific requirements for conducting value engineering studies and for ensuring that approved recommendations are incorporated into design plans.

Few States Achieved Established Industry Benchmarks

The TRB's synthesis, *Value Engineering Applications in Transportation*,[11] developed two metrics that can be compared to state DOT performance of value

[11] "*Value Engineering Applications in Transportation*," NCHRP Synthesis 352, prepared by David C. Wilson, PE, CVS, Vice President NCE Limited, 2005.

engineering studies—percentage of savings of total project costs and percentage of the number of approved recommendations (see Table 3 below.) The synthesis allowed us to compare the states' performance against the two established industry benchmarks.

Of the 10 states we visited, 1 state (New Jersey) achieved project cost savings exceeding the 10-percent industry benchmark and 3 states (New Jersey, Texas, and Washington State) achieved the industry benchmark of approving 60 percent or more of their recommendations. Nationally, for the period FY 2001 through FY 2004, only 12 states achieved the industry benchmark by approving at least 60 percent of the value engineering recommendations. More states might have been able to achieve the industry benchmark, but states face unique challenges that private sector entities do not, such as the need to consider context sensitive solutions,[12] which may preclude approval of some cost savings recommendations.

Table 3. Comparison of Industry Benchmarks to Federal-Aid Value Engineering Performance (FY 2001-FY 2004)

Value Engineering Program Metric	Industry Benchmark (Percent)	Federal-Aid VE Performance (Percent)
Project Savings (value of approved recommendations/estimated capital cost of projects studied)	10	5
Acceptance of Value Engineering Proposals (number of approved recommendations)	60 to 80	44.4

Source: TRB's "*Value Engineering Applications in Transportation*," NCHRP Synthesis 352, December 2005, except the 44.4 percent, which was calculated by the OIG statistician.

Using FHWA data, we found that from FY 2001 through FY 2004, 28 states did not approve the national Federal-aid performance average of 44.4 percent of proposed value engineering recommendations. Had each of those states approved additional recommendations to achieve the 44.4 percent rate, and if each of the additional recommendations yielded the national average of $1.18 million in savings per approved recommendation, an additional $789 million could have been saved and reprogrammed to other qualifying Federal-aid projects.

Of the 10 states we visited, 5 (Connecticut, North Carolina, California, Michigan, and Wisconsin), collectively approved 23 percent of the proposed recommendations, as contrasted with the national approval average of 44.4 percent for Federal-aid highway projects. We estimated that had those five states achieved

[12] Context sensitive solutions is a collaborative, interdisciplinary approach that requires all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. For example, some value engineering recommendations may not be approved if they negatively impact historic or environmental resources at the project site.

the national average of 44.4 percent, an additional $381 million (a combined Federal share of approximately $305 million) could have been reprogrammed to other qualifying Federal-aid projects.

From FY 2001 through FY 2004, 23 other states that we did not visit did not achieve the 44.4 percent national average. We estimated that if those 23 states had achieved the national average, an additional $408 million (a combined Federal share of approximately $326 million) could have been reprogrammed to other qualifying Federal-aid projects.

Management at state departments of transportation and FHWA attributed the low acceptance rate to:

- the failure of state senior transportation managers to send a strong enough message to department staff on the benefits of value engineering,
- states' perception that value engineering causes unneeded project delays, and
- studies being performed too late in the design process to approve and subsequently implement recommendations.

To determine how effectively states were assessing value engineering recommendations, we evaluated the reasons for the rejection of value engineering recommendations in Connecticut, Michigan, and North Carolina. These three states had the lowest recommendation approval rates of the 10 states visited. For example, during the 4-year period of FY 2001 through FY 2004, Connecticut and North Carolina collectively approved only $3.1 million of a combined total of $508 million of the proposed recommendations. Of the 10 states visited, with the exception of the Massachusetts and Connecticut FHWA Division Offices, we found no documentation showing that the FHWA Division Offices took exception to or challenged the states' explanations and decisions for rejecting the recommendations, as appropriate. That is, independent FHWA review would provide added assurance that states were prudent in rejecting recommendations.

As demonstrated in the following examples, additional independent review is warranted:

- North Carolina rejected all but $3 million of $203 million in recommended value engineering savings. Additionally, at our request, the Army Corps of Engineers (the Corps) reviewed and analyzed North Carolina's value engineering program, including four value engineering studies. The Corps determined that documentation of engineering effort varied from report to

report and the project designer's review and determinations sometimes lacked content and quality.

Though the VE recommendations were forwarded to the design teams for acceptance or rejection, there was no coordination after that point. The Corps found that NCDOT did not include support for cost estimates, including evaluating life-cycle cost alternatives. However, following our November 2004 visit, North Carolina improved its value engineering process and reported accepting 73 percent of value engineering recommendations in FY 2005.

- Connecticut rejected all but $80,000 of $305 million in recommended value engineering savings. For FY 2005, Connecticut reported no value engineering activity at all.

  The Connecticut DOT value engineering studies did not always have complete or consistent documentation supporting recommendations for changes or reasons for rejecting suggested changes. The value engineering study of the Moses Wheeler Bridge illustrates two different ways in which the lack of complete documentation limited acceptance of value engineering recommendations. For example, the study included a recommendation to use reinforced earth embankments in lieu of structural piers, for a savings of $10.6 million. However, because the recommendation was not supported by a detailed cost estimate with a life-cycle cost analysis, Connecticut DOT rejected the recommendation, citing unrealistic cost savings. As part of the same study, Connecticut DOT rejected three recommendations relating to modification of the bridge, with estimated savings of $9.9 million. Although Connecticut DOT cited the reduction in vertical bridge clearances and the need for design exceptions as reasons to not implement the recommendations, we questioned the explanation, in part because it was incomplete. Further, we noted that the state had previously granted a design exception for vertical clearance in a similar situation.

FHWA Can Strengthen Its Oversight of State VE Programs

Analysis of FHWA Oversight Indicates Need for Increased Participation

In interviews with personnel from the states and FHWA Division Offices, we found that the level of compliance with the *Policy Guide* varied from state to state. Most Division Offices reported that they participated in value engineering studies, but our audit showed that some offices demonstrated very little impact from their efforts. Further, FHWA Division Office personnel indicated that their participation in state value engineering programs was limited because: (1) state

value engineering was viewed as a mature program not requiring oversight; (2) limited FHWA resources required engineers to be assigned to other priorities, such as reviewing project proposals and monitoring construction projects; (3) state and FHWA management placed low emphasis on the value engineering program; (4) FHWA value engineering coordinators served as resources for information, but not as participants in state studies; and (5) one Division Office was not provided sufficient lead time to attend value engineering meetings or to participate in studies.

In addition to the Division Offices' reported limitations, we identified four additional factors that we believe hindered FHWA Division Office oversight of value engineering in the states within their regions.

- Division Offices did not ensure that states performed all required value engineering studies**.** For example, the Connecticut and Texas Division Offices granted waivers from the statutory requirement to perform value engineering studies, stating that the projects were already underway and that a similar project, such as resurfacing, had previously undergone a value engineering study. FHWA incorrectly considered the new projects extensions of the ongoing projects, even though the new projects were initiated under new project agreements. Notably, FHWA policy does not waive the requirement for states to perform value engineering studies. If FHWA wants to consider approving waivers for routine tasks, such as repaving projects, a change will be required to Federal Regulations and FHWA's policy.

- FHWA value engineering coordinators reported their tenures to be too short and too multi-functional. During the 2 to 3 years that value engineering coordinators typically spend in their role, they may also be assigned other significant responsibilities. They interface with the state DOT and FHWA Headquarters by actively participating in value engineering studies and reconciling the studies performed with studies the states were reporting in their annual summary reports to FHWA Headquarters. Because the coordinators' tenures are temporary, they do not have time to acquire sufficient knowledge and training to perform their oversight functions. Coordinators were required to interface with the state DOT and FHWA Headquarters by actively participating in value engineering studies, and reconciling the studies performed with studies the states were reporting in their annual summary reports to FHWA Headquarters. Our work and the Corps' review corroborated the coordinators' claim, as neither found evidence that the coordinators were sufficiently involved to provide adequate guidance and oversight.

Findings

- FHWA discontinued its performance measures for value engineering, which hindered its ability to determine the program's effectiveness, reveal problem areas, and implement improvements. After FY 2001, FHWA dropped from its performance plan the only value engineering performance goal of increasing the use of value engineering to achieve greater cost savings. As a result, only 2 of the 10 Division Offices we visited had value engineering performance goals in effect at the time of our visit. To their credit, in response to FHWA's discontinuing their sole performance measure, the North Carolina and Texas Division Offices developed their own performance goals and measures. Of note, FHWA initiated a task force to improve the value engineering process and establish new value engineering performance measures.

Army Corps of Engineers' Review was Consistent With Our Analysis

The Corps assessed FHWA's oversight over the state value engineering process in two states, North Carolina and Michigan, and identified weaknesses in the FHWA policy. Specifically, the Corps concluded that FHWA policy:

- does not require complete documentation of work performed in all phases of the value engineering study in the final value engineering study report. Industry standard is to create a thoroughly documented report to demonstrate that all value engineering study elements are covered and proper methodology is followed.

- implies that early timing of a value engineering study in a project is optional. In contrast, the policy should require that value engineering studies be conducted between the 10 percent and 35 percent design completion stages, unless dictated otherwise by extenuating circumstances.

- does not state that management needs to assure that value engineering proposals are given serious consideration by the design team and incorporated into designs as needed.

- does not specify any necessary credentials for the value engineering study team leader, and implies that the value engineering training for that position is optional.

FHWA Has Not Assessed the Effectiveness of State Value Engineering Program

Until the May 19, 2006 FIRE Program directive, FHWA did not have a system in place to recognize the grants management oversight weaknesses we identified in this report. In each of our annual Management Challenges Reports from 2003 through 2006, we pointed to the need for FHWA to make improvements in the

area of grants management. Additionally, the Highway Trust Fund financial statement reports for 2004 and 2005 identified a material weakness in FHWA's grants management. As required in OMB Circular No. A-123, "Management's Responsibility for Internal Control," agency managers should use audit results, such as those detailed in this report, in annual assessments of agency internal controls. The focus of internal control in the value engineering program is on the effectiveness and efficiency of operations and compliance with the regulation to complete required value engineering studies.

FHWA is in the process of implementing two processes to improve oversight of grants management. In the FIRE Program, FHWA conducts annual assessments of state management of Federal-aid funds. FHWA is also initiating a corporate risk assessment process that will assess risk in all major aspects of the Federal-aid program. As stated, value engineering is a key component of state management of Federal funds because it provides states the opportunity to improve operations and project quality and to reduce project costs by streamlining operations and implementing cost saving recommendations. However, under the current policy, FHWA is not required to assess value engineering in FIRE reviews or in the risk assessments of states' Federal-aid programs. FHWA should consider including in the annual report to the Secretary, required by OMB Circular No. A-123, the issues identified in this report.

FHWA Needs To Disseminate States' Best Practices for Value Engineering

We found that FHWA does not have any mechanism in place to identify best practices related to value engineering or a means to recommend any best practices to states. We used four key indicators[13] and the corresponding metric to measure the effectiveness of value engineering programs in the 10 states we visited. Our assessment of 10 value engineering programs identified the following best practices:

- Washington State included top-level management and outside stakeholders in the value engineering process to consider all views.
- New Jersey hosted annual training by the National Highway Institute for value engineering teams. In fostering the multi-disciplinary approach promoted by SAVE, New Jersey offered this training to engineers and non-engineers, which included conducting a value engineering study on an actual highway project.

[13] The four key indicators were: (1) completion of required studies—fulfilling a statutory requirement, (2) percentage of approved recommendations—exceeding the national average, (3) return on investment of the cost spent to perform value engineering studies—exceeding the national average, and (4) percentage of project savings—exceeding the national average.

- Massachusetts required written justification for value engineering recommendations that were not approved and for challenges to rejections of value engineering recommendations.

By using best practices associated with performing VE studies, New Jersey achieved nearly 13.5 percent project cost savings, whereby the industry benchmark is 10 percent for savings as a percentage of total project costs. Massachusetts came close to achieving the benchmark, realizing more than 9 percent in savings as a percentage of total project costs. Similarly, using best practices associated with implementing recommendations, Washington State approved 83 percent of recommendations and produced an annual return on investment averaging $523 in cost savings for every $1 spent on value engineering studies from FY 2001 through FY 2004. In contrast, nationally, states approved 44.4 percent of recommendations and realized an annual return on investment averaging $128 for every $1 spent. The best practices that these states implemented enhanced their respective value engineering programs and merit wider dissemination to other states for adoption, where practicable.

As shown in Table 4, states using best practices ranked higher overall in these indicators than states that had not adopted best practices. In the 10 states visited, Washington State ranked best in three of the four indicators. Other states using best practices and exceeding the national average in three of the four indicators were Massachusetts and New Jersey.

Table 4. Comparison of States' Performance in Key Indicators of Value Engineering Effectiveness

	Key Performance Indicators States listed from highest to lowest			
	Percentage of Required Studies Performed [b]	Percentage of Approved Recommendations[b]	Return on Investment[b]	Percentage of Project Savings[b]
More Effective	**Massachusetts**[a]	**Washington**	**Washington**	**New Jersey**
	Washington[a]	**New Jersey**	**Massachusetts**	**Massachusetts**
	Wisconsin[a]	**Texas**	**Texas**	**California**
	Michigan	**Massachusetts**	**New Jersey**	Texas
	New Jersey	Wisconsin	California	Washington
	California	California	Wisconsin	Wisconsin
	Texas	Michigan	North Carolina	Michigan
	Connecticut	Connecticut	Michigan	North Carolina
	North Carolina	North Carolina	Connecticut	Connecticut
Less Effective	District of Columbia	District of Columbia	District of Columbia	District of Columbia

Source: FHWA Annual Value Engineering Summary Reports, FY 2001 through FY 2004 and OIG site visits.
[a] These 3 states completed all required studies and are listed alphabetically.
[b] **Bolded states** indicate that they met statutory requirements or exceeded national averages.

Findings

States with the OIG-identified best practices tended to be more effective in the metrics cited. Unlike Washington State, Massachusetts, and New Jersey, the District of Columbia DOT does not have an active value engineering program and as of November 2004, it had not performed any value engineering studies, although one of its Federal highway projects required a value engineering study.

We recognize that additional best practices are being used in the states we did not visit, and recommend that FHWA identify best practices among all the Division Offices and issue the results to all Division Offices and state departments of transportation.

RECOMMENDATIONS

We recommend that FHWA:

1. Revise its value engineering policy to:

    a. Require complete documentation of all value engineering study phases in the final value engineering report.

    b. Require that value engineering studies be conducted between the concept phase and 35 percent completion stage of the project design.

    c. Include management review guidelines to ensure that all value engineering recommendations are considered by the design team and incorporated into designs, as appropriate, and require responsible state management, (for example, the chief engineer) to sign off on the rejection of value engineering recommendations that contain substantial cost savings.

    d. Require full support of cost estimates including evaluation of different scenarios that offer the lowest life-cycle cost alternative.

    e. Require Division Office engineers to either monitor or participate in all state value engineering studies including Federal-aid projects, and ensure that all required studies are performed.

2. Develop performance goals for measuring the effectiveness of state value engineering programs and for evaluating Division Office personnel in fulfilling the FHWA and OMB requirements for value engineering programs.

3. Incorporate value engineering into either the FIRE reviews or the corporate risk assessment process to determine whether all required studies are performed and to assess the states' consideration of recommendations with identified cost savings. Ensure that FHWA's annual assurance statements that each Federal-aid Division Office is required to perform in support of FHWA's

annual certification of internal and financial controls to support the financial statements, as required by the Federal Managers' Financial Integrity Act, are based on the results of the FIRE reviews and the corporate risk assessments.

4. Disseminate to the states known best practices for value engineering, including:

   - Performance metrics,

   - Annual value engineering training by the National Highway Institute or other vendors with similar expertise, and

   - Inclusion of states' senior management and outside stakeholders in the value engineering process.

MANAGEMENT COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On January 31, 2007, we provided FHWA a draft copy of this report. On March 2, 2007, FHWA provided us its formal response, which is included in its entirety in the Appendix. In its response, FHWA fully concurred with all of our recommendations and provided planned corrective actions that will begin as early as March 2007, which, collectively, meet the intent of all of our recommendations. We commend FHWA for initiating prompt actions. However, the recommendations will be considered unresolved until FHWA provides target dates for completed corrective actions.

Recommendation 1. FHWA concurred with the recommendation to revise its value engineering policy. Recognizing that additional proactive guidance and oversight measures are needed in support of advancing current value engineering practices of state and local agencies, in addition to revising Federal regulations, FHWA plans to initiate the development of technical guidance and production of outreach material in April 2007.

These revisions will be incorporated, as appropriate, into all future activities of FHWA's value engineering program. Also in April 2007, FHWA plans to initiate the process to (1) modify the value engineering provisions contained in 23 CFR, part 627 and (2) initiate the development of technical guidance and outreach material.

OIG Response. FHWA's planned actions meet the intent of our recommendation.

Recommendation 2. FHWA concurred with the recommendation to develop performance goals for measuring the effectiveness of state value engineering programs and goals for Division Office personnel in fulfilling the FHWA and OMB requirements for value engineering programs. In May 2007, FHWA plans to convene a working group to evaluate and establish performance goals and measures to assess FHWA's value engineering program.

This group would also be tasked to work with industry representatives to identify changes in the report that annually assesses and reports on the progress of value engineering programs of state departments of transportation and their completed studies. This effort will focus on identifying changes that will be used in the data collection and reporting conducted in FY 2007 on the progress that state departments of transportation value engineering programs have achieved.

OIG Response. FHWA's planned actions meet the intent of our recommendation.

Recommendation 3. FHWA concurred with the recommendation to incorporate an assessment of state value engineering programs into its corporate risk assessment to support the risk management assessments that are completed for FY 2008, as well as to ensure that FHWA's annual assurance statements that each Federal-aid Division Office is required to perform, are based on the results of the FIRE reviews and the corporate risk assessments. FHWA plans to incorporate value engineering into FHWA's corporate risk assessment process to support the risk management assessments to be completed for 2008.

OIG Response: FHWA's planned actions meet the intent of our recommendation.

Recommendation 4. FHWA concurred with the recommendation to disseminate to the states known best practices for value engineering. Starting in March 2007, FHWA plans to develop value engineering technical guidance, best practices, and outreach materials.

OIG Response. FHWA's planned actions meet the intent of our recommendation.

EXHIBIT A. OBJECTIVES, SCOPE, AND METHODOLOGY

Our objectives were to determine whether FHWA's oversight is adequate to ensure that: (1) value engineering studies are performed on all Federal-aid NHS projects that have an estimated cost of $25 million or more, (2) value engineering studies are performed on all Federal-aid projects that have a high potential for cost savings, and (3) all value engineering recommendations that can be implemented are approved, permitting the greatest degree of potential savings to be achieved.

To accomplish our objectives, we met with the FHWA value engineering coordinator in Washington, D.C., to assess the role of FHWA Headquarters in the FHWA Value Engineering Program, and we administered to all 52 Division Offices (50 states, the District of Columbia, and Puerto Rico) a questionnaire on the role of the FHWA Division Offices in the value engineering programs and analyzed the results. Additionally, to better understand why states were not approving significant value engineering recommendations, we evaluated the reasons for their rejection in 3 of the 10 states we visited (North Carolina, Michigan, and Connecticut).

We discussed questionnaire responses with FHWA Division personnel and the roles and responsibilities in the value engineering process with FHWA Division and state personnel (for example, Washington State DOT), including initiatives for approving all recommendations that can be implemented. We also analyzed data that FHWA collects from states or Division Offices to compile its *Annual Federal-aid Value Engineering Summary Reports.*

To corroborate the questionnaire responses and assess value engineering performance, we selected for review 10 states and their respective Division Offices because they: (1) did not report any value engineering studies during FY 2002 (District of Columbia and Massachusetts), (2) approved a low percentage of their value engineering recommendations from FY 2001 through FY 2004 (North Carolina, Connecticut, Michigan, and Wisconsin), (3) approved a high percentage of their value engineering recommendations from FY 2001 through FY 2004 (New Jersey and Washington State), or (4) received large amounts of Federal-aid dollars (California and Texas).

At the OIG's request, FHWA provided OIG with Fiscal Management Information System (FMIS) computer runs that listed all Federal-aid projects underway between FY 2001 through FY 2004 that had estimated costs of $25 million or more. These lists included NHS and non-NHS projects. When we visited the 10 states, we had state DOT personnel identify which Federal-aid projects were NHS and which were non-NHS. From the FMIS lists, state DOT personnel identified 323 Federal-aid projects in the 10 states from FY 2001 through

FY 2004, estimated to cost $25 million or more. Of these 323 projects, 314 were identified as NHS projects. We worked with state DOT personnel to determine whether required value engineering studies were performed on each of the 314 projects. In addition, nine Federal-aid projects with estimated costs greater than $25 million were identified that were not on the NHS and that had not undergone a value engineering study. We then asked why the projects had not undergone a value engineering study. Because of the high-dollar amount of the nine projects, we believe they would have had a high potential for cost savings. Consequently, we judgmentally determined to expand our audit universe by including in our review the nine non-NHS Federal-aid projects.

Finally, to better understand why states were not approving significant value engineering recommendations, we evaluated the reasons for their rejection in three of the states visited with the lowest recommendation approval rates (North Carolina, Michigan, and Connecticut). Specifically, we assessed the merit and supporting documentation of the proposed recommendations and judged the technical sufficiency of the states' rationale for not approving the recommendations.

We analyzed responses to the questionnaire from the Division Offices and interviewed Division Office and state department of transportation personnel to assess their respective roles and responsibilities. We also determined whether states performed all required value engineering studies by reconciling FHWA's FY 2001 through FY 2004 FMIS and cost data to state records, and determined whether states reported the correct number of value engineering studies and recommendations. We conducted separate interviews with state department of transportation and FHWA Division Office personnel to evaluate their respective processes and responsibilities for their value engineering programs. At the end of each site visit, we discussed our preliminary results with the responsible state and FHWA Division Office personnel.

We also reviewed FHWA and state value engineering policy and procedures to determine whether FHWA Divisions participated in and oversaw the states' value engineering programs. We reviewed the content of the states' value engineering studies and recommendations, and obtained any written justification for the states not approving value engineering recommendations covering the period from FY 2001 through FY 2004. We assessed the adequacy of FHWA's policy and procedures and included such tests as were considered necessary to provide a reasonable assurance of detecting abuse or illegal acts.

To estimate the potential lost savings that resulted from state departments of transportation not performing required value engineering studies or from studies that did not achieve the national average of recommendations accepted, we used the OIG calculated percentages that are comparable to national averages published

in the TRB Synthesis 352, *Value Engineering Applications in Transportation*. We independently calculated the percentage savings using data from the state departments of transportation for FY 2001 through FY 2004—our calculations were consistent with the TRB's percentages. The TRB study included figures on historical Federal-aid value engineering performance and industry benchmarks. We used the cited metrics in our report of project savings[14] (5 percent) and the acceptance rate of value engineering recommendations (44.4 percent)[15] as a baseline for evaluating the projects we reviewed for this audit. For projects on which no value engineering study was performed, but should have been, we used the 5-percent project savings metric to estimate how much the state could have saved, had the study been conducted. Similarly, for projects on which a value engineering study was performed, we used the OIG-calculated 44.4-percent rate of value engineering recommendation approval metric to compare and estimate the additional potential savings. The OIG Statistician also computed the national average savings of $1.18 million per approved recommendation.

To present a conservative estimate of savings lost by not implementing recommendations, we used the OIG-calculated 44.4 percent average, instead of the higher industry benchmarks of from 60 percent to 80 percent cited in the TRB study. For states that approved less than 44.4 percent, we computed the number of recommendations that should have been approved to achieve the 44.4 percent. We credited the states for the number they did approve by subtracting them from the number they should have approved (based on 44.4 percent). The remainder, which was the number lost, was multiplied by $1.18 million (the national average savings per approved recommendation) to arrive at the estimated lost savings for each state.

The scope of our audit included reviewing the FHWA value engineering policy, regulations and legislation and FHWA's value engineering activity during the period FY 2001 through FY 2004, for all 52 Division Offices. With respect to the 10 states visited, the scope further included reviewing FMIS reports and Federal-aid NHS projects active during the period FY 2001 through FY 2004, with estimated costs exceeding $25 million; the states' value engineering standard procedures and policies; and FHWA's oversight of the states' value engineering programs.

Under the direction of the OIG Engineer Advisor, we engaged the assistance of the Corps to review and assess the appropriateness and adequacy of North Carolina and Michigan's value engineering programs, processes, and studies and their

[14] The project savings metric is based on the value of the approved value engineering recommendations divided by the estimated capital cost of the project.

[15] The acceptance rate of value engineering recommendations metric is based on the number of recommendations approved for implementation divided by the total number of recommendations put forward by the value engineering study.

compliance with FHWA policy. These states were selected because they had approved a low percentage of recommendations. Under this scope, the Corps:

- reviewed the FHWA value engineering policy;
- reviewed the state value engineering standard procedures and policy;
- reviewed four North Carolina and seven Michigan value engineering studies to evaluate the:
  - application of FHWA policy,
  - application of standard value engineering principles and procedures,
  - justifications for acceptance or rejection of value engineering recommendations, and
  - timeliness of the studies; and
- reviewed FHWA oversight of the state value engineering programs.

Our audit work included contacts with FHWA Headquarters, FHWA Division Offices and state departments of transportation, the American Association of State Highway and Transportation Officials, and the Corps.

We conducted this performance audit from October 2004 through March 2007, in accordance with Generally Accepted Government Auditing Standards prescribed by the Comptroller General of the United States, with one exception, standard 7.57, *Data Gathered by Management.* We did not independently verify the reliability of the data reported in FHWA's *Annual Federal-aid Value Engineering Summary Reports,* which formed the basis for our estimates of potential savings. However, the data are used by FHWA to report to the Secretary and OMB and used in research performed by the TRB. The data are the only nationwide data available that contains the value and number of reported and accepted value engineering recommendations.

Our audit findings are based on evidence we gathered during our fieldwork in the states and FHWA Division Offices, as well as work conducted by the Corps. We used the data in FHWA's *Annual Federal-aid Value Engineering Summary Reports* to quantify the estimated monetary impact of our findings.

Preliminary analysis of the data that states submitted to FHWA (and reported in FHWA's *Annual Federal-aid Value Engineering Summary Reports*) disclosed reporting inconsistencies among the states that affected the precision of our estimates of potential savings. It was not practicable for us to quantify the effect of these issues on our estimate; however, we performed alternative procedures to determine the usefulness of our estimates in illustrating the potential monetary benefits of the increased use of value engineering studies and the increased implementation of value engineering recommendations. For example, we

compared our 4-year results to the results reported by TRB and found them to be comparable.

EXHIBIT B. ACTIVITIES CONTACTED OR VISITED

American Association of State Highway Transportation Officials Office

Washington, DC

American Association of State Highway Transportation Officials Value Engineering Conference

San Antonio, Texas

Federal Highway Administration

Washington, DC

Federal Highway Administration Division and State Transportation Department Offices

California
Connecticut
District of Columbia
Massachusetts
Michigan
New Jersey
North Carolina
Texas
Washington State
Wisconsin

U.S. Army Corps of Engineers

EXHIBIT C. MAJOR CONTRIBUTORS TO THIS REPORT

The following individuals contributed to this report.

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Aron Wedekind	Engineer
Petra Swartzlander	Statistician
Harriet Lambert	Writer-Editor

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION:** Federal Highway Administration (FHWA) Response to Office of Inspector General (OIG) Draft Audit Report, "Value Engineering in the Federal-Aid Highway Program"

Date March 2, 2007

From: J. Richard Capka
Administrator

Rick Capka
Thanks for the recommendations!

Reply to
Attn. of: HIPA-1

To: Calvin L. Scovel III
Inspector General (JA-40)

Thank you for the opportunity to review and comment on the OIG Draft Report, "Value Engineering in the Federal-Aid Highway Program." We concur with the recommendations and plan to implement them as described herein. FHWA is committed to continue promoting the importance of and need to improve value engineering practices nationally. We will continue to collaborate and partner with industry to advance our collective practices to ensure value engineering is being applied to improve the quality, cost-effectiveness, and productivity associated with developing improvement projects on the surface transportation.

Following are our comments and planned actions on the specific audit report recommendations.

Recommendation 1: "Revise its value engineering policy to:

a. Require complete documentation of all value engineering study phases in the final value engineering report.

b. Require that value engineering studies be conducted between the concept phase and 35 percent completion stage of the project design, recommending that conducting studies early in the process is preferable.

c. Include management review guidelines to ensure that all value engineering recommendations are considered by the design team and incorporated into designs, as appropriate; and require responsible state management, (e.g., the chief engineer) to sign off on the rejection of value engineering recommendations that contain substantial cost savings.

d. Require fully supported cost estimates and the evaluation life cycle cost alternatives.

e. Require Division Office engineers to either monitor or participate in all state value engineering studies involving Federal-aid projects, and ensure that all required studies are performed."

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Response: We concur with these recommendations. These comments will be incorporated as appropriate into all future activities of the FHWA's Value Engineering program. The FHWA recognizes that additional proactive guidance and oversight measures are needed in support of advancing current value engineering practices of State and local agencies. These value engineering activities will include revising Federal regulations, updating FHWA policy, developing technical guidance, updating training materials, and producing outreach material.

Accordingly, we will initiate the process in April of 2007 to modify the value engineering provisions contained in the Code of Federal Regulations (23 C.F.R. Part 627) to reflect the changes in Federal law reflecting the congressional intent and policy direction provided in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), P.L. 109-59. Upon issuance of this final rule, we will also complete an update of FHWA's value engineering policy contained in FHWA's Federal-Aid Policy Guide to reflect these changes in Federal law and regulations. Outreach will be conducted through our Division Offices to their State partners. The outreach includes raising their awareness and assisting with implementing these changes into current practices of State and local agencies.

The FHWA recognizes the need to develop value engineering technical guidance and outreach material. Accordingly, we will initiate the development of technical guidance and outreach materials in April 2007. We will work with industry in developing and promoting these resources to advance value engineering practices nationwide. These products will focus on integrating and supporting value engineering within each agency, along with advancing the application of value engineering on individual surface transportation improvement projects.

Specifically, these activities will include previously identified revisions to 23 C.F.R. Part 627, updating FHWA's policy, and developing technical guidance and outreach material to:

1(a). Clarify the information to be contained in the final report documenting the results of value engineering studies. While FHWA's Federal-Aid Policy Guide requires complete documentation of all value engineering study phases in the final value engineering report, we will explore clarifying what additional information should be included in this report.

1(b). Clarify opportunities of when value engineering studies should be performed in the process of planning and developing surface transportation improvement projects.

1(c). Provide a framework State and local agencies could use to improve how they consider and approve value engineering recommendations. The FHWA's Federal-Aid Policy Guide identifies only the need for management guidelines and reviews to be performed to ensure value engineering recommendations are incorporated into the development of projects.

1(d). Encourage the use of life-cycle costs to improve the cost estimating that is performed on value engineering studies.

1(e). Enhance FHWA's stewardship and oversight of State DOTs value engineering programs and ensure VE studies are performed on required improvement projects.

Recommendation 2: "Develop performance goals for measuring the effectiveness of state value engineering programs and goals for Division Office personnel in fulfilling the FHWA and OMB requirements for value engineering programs."

Response: We concur with this recommendation. FHWA will convene a working group in May 2007 consisting of representatives from the FHWA Division Offices, Resource Center, and the Office of Program Administration, to evaluate and establish performance goals and measures to assess FHWA's Value Engineering Program. This group will also be tasked to work with industry representatives to identify changes in the report that annually assesses and reports on the progress of State DOT's value engineering programs and their completed studies. This effort will focus on identifying changes that will be used in the data collection and reporting that will be conducted in FY 2007 on the progress achieved by State DOTs value engineering programs.

Recommendation 3: "Incorporate value engineering into either the FIRE reviews or the corporate risk assessment process to determine whether all required studies are performed and to assess the states' consideration of recommendations with identified cost savings. Ensure that FHWA's annual assurance statements, required by FMFIA and the Office of Management and Budget Circular A-123 are based on the results of the FIRE reviews and the corporate risk assessments."

Response: We concur with this recommendation. Value engineering will be incorporated into FHWA's corporate risk assessment process to support the risk management assessments that are completed for 2008. The FHWA does not consider the Financial Integrity Review and Evaluation (FIRE) Program process to be suitable for monitoring, reporting, or assessing value engineering practices. This is based on the limited ability for a State DOT or FHWA's financial accounting system to track or identify changes in a projects construction cost estimate that may result from implementing value engineering study recommendations.

Recommendation 4: "Disseminate to the states known best practices for value engineering, including:

a. Performance Metrics,

b. Annual value engineering training by the National Highway Institute, or other vendors with similar expertise, and

c. Inclusion of states' senior management and outside stakeholders in the value engineering process."

Response: We concur with these recommendations. FHWA recognizes the need to develop and distribute value engineering technical guidance, best practices, and outreach material. As previously identified, we will initiate the development of these resources in March 2007. These resources will include a focus on the need for and importance of performance metrics, available training resources, inclusion of agency management and stakeholders in sustaining a successful value engineering program, and in conducting specific value engineering studies.

In closing, we would like to emphasize that FHWA's role is to provide general program stewardship and oversight of State DOT's value engineering programs and specific studies. Our role is not to carry out, participate in, require the use of, or approve recommendations identified in every value engineering study. Rather, it is our stewardship and oversight of State DOT's value engineering policies, program, procedures, and approach where we continuously encourage improvements, which is consistent with the direction of FHWA Federal-aid highway program oversight responsibilities set by Congress in current legislation, balanced against our available resources.

The efforts of the OIG auditors to further improve the value engineering programs and practices of public agencies nationally are greatly appreciated. If you have any questions or comments regarding this response, please contact Mr. Jon Obenberger at (202) 366-2221.