



*Office of the Chief Internal Auditor*

---

***Audit Report***

---

*South Carolina Department of  
Transportation  
Bid Analysis Management System/Decision Support System  
(BAMS/DSS)*

*July 16, 2014*

# *Table of Contents*

**Office of the Chief Internal Auditor  
South Carolina Department of Transportation  
Bid Analysis Management System/Decision Support System (BAMS/DSS)  
Audit**

July 16, 2014

**TABLE OF CONTENTS**

---

	<u>Page</u>
Transmittal Letter	1
Executive Summary and Conclusions	3
Detailed Audit Findings	6
Department Response	18

# ***Transmittal Letter***



Commission  
**OFFICE OF THE CHIEF INTERNAL AUDITOR**

July 16, 2014

Commission of the South Carolina Department of Transportation

The Honorable Lawrence K. Grooms, Chairman  
South Carolina Senate Transportation Committee

The Honorable Hugh K. Leatherman, Sr., Chairman  
South Carolina Senate Finance Committee

The Honorable Phillip D. Owens, Chairman  
South Carolina House Education and Public Works Committee

The Honorable W. Brian White, Chairman  
South Carolina House Ways and Means Committee

Dear Gentlemen:

The Office of the Chief Internal Auditor has completed an operational audit of the SCDOT Bid Analysis Management System/Decision Support System (BAMS/DSS) as of March 27, 2014. In accordance with Section 57-1-360, we are transmitting to you this report of our audit findings.

We conducted this operational audit in accordance with Generally Accepted Governmental Auditing Standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for these findings and conclusions.

Please contact us if you have any questions or comments.

Respectfully submitted,

A handwritten signature in black ink that reads "Paul B. Townes". The signature is written in a cursive style with a long, sweeping underline.

Paul B. Townes, CPA  
Chief Internal Auditor  
Office of the Chief Internal Auditor

---

## *Executive Summary and Conclusions*

---

## Executive Summary and Conclusions

Bid Analysis Management System/Decision Support System (BAMS/DSS), an AASHTO (American Association of State Highway and Transportation Officials) Transport® product provides operational and management information support for construction contract activities. Supported activities include management-level decision support, project cost estimate and proposal preparation, and bid letting and award management.

BAMS/DSS allows management and other employees to analyze bids, estimate costs using historical data, and assist with detecting collusion among contractors.

The Office of the Chief Internal Auditor (OCIA) reviewed BAMS/DSS to determine the effectiveness and efficiency of the system in providing decision support in the areas of bid monitoring and evaluation, vendor and market analysis, item price estimation, and to determine the adequacy of internal controls to award bids and detect collusion. We conducted this audit in accordance with Generally Accepted Government Auditing Standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. Our objectives were as follows:

- Analyze the need, accuracy, and adequacy of BAMS outputs and reports
- Determine if SCDOT is utilizing all applications and reports within BAMS to make decisions
- Determine the accuracy of the data entered into and analyzed by BAMS, to include the engineer's estimate
- Determine if SCDOT's use of the BAMS system is effective in detecting collusion
- Analyze the business application controls within the system

We interviewed employees, selected samples, and documented the process and its controls. We have developed sixteen recommendations related to efficiencies and controls in managing construction projects and the adequacy of internal controls to protect access and integrity of information. These recommendations are summarized below:

- Consultation with InfoTech to assist with improving the operating performance and efficiency of BAMS/DSS.
- Implementation of the *Bid Review Summary* as written in the *Bid Review Policies and Procedures*.
- Identification of a second person to verify the unit prices entered into Proposal and Estimates System (PES) prior to creating the official estimate.
- Implementation of the use of current prices for items that do not have prior history.
- Development of greater consistency with the method of developing unit prices in preparation of the engineer's estimate.
- Ensure justification Memo written to adhere to Recommendation 1.4.3.2.2 of the SCDOT Bid Review Policy and Procedures Manual.

- When determining the justification to move a project forward, an analysis should be prepared and included with the justification to show all the costs associated with a project to ensure the decision to justify the project moving forward is a good choice.
- SCDOT should review alternative methods in areas of the state where competition is limited to increase competitive bidding.
- Production of the addition reports as part of the Bid Review process and collusion detection.
- Creation of a document that explains errors in the Import Summary and what was done to resolve them.
- Development of staff consultation with InfoTech concerning data conversion, setting system parameters, and agency customization to prevent errors during the import of external data.
- Notification to BAMS/DSS application owner of *SCDOT Termination Report* by SCDOT, IT Services.
- Implementation of unique user IDs.
- Removal of any software from the computer not in direct relation to the BAMS/DSS application.
- Inclusion of BAMS/DSS machine in the SCDOT Information Technology Services (IT SERVICES) Equipment Life Cycle process.
- Implementation of precautions to protect system data by ensuring two office staff be responsible for the system back-up.

The findings and recommendations will be discussed in greater detail in the Audit Findings and Recommendations section of the report.



---

## *Detailed Audit Findings*

---

## Detailed Audit Findings

BAMS/DSS has a historical database of construction contract information, analysis models, and ad hoc analysis and query features. The system enables SCDOT to monitor and analyze bidding activity, item price estimates, and vendor activity. BAMS/DSS has the capability to produce executive information requests, summary reports for management, bid management and monitoring analyses, market analyses and cost indexes, project planning, project cost estimation, and legislative presentations.

BAMS/DSS allows management and other employees to become knowledgeable of the agency's construction process, analyze bids, estimate costs using historical data, and assist in the detection of collusion among contractors.

SCDOT Construction Data Support and Construction Offices use the BAMS/DSS to review the engineer's estimate, to compare between engineer's estimate and bidders, to compare bids among bidders, and to make an award. In the period from July 2008 to June 2010, there were 828 proposals that went through the letting and review process. The average is 34.5 per month with low of 18 and high of 64.

The BAMS/DSS System audit was subdivided in the following areas to determine effectiveness and efficiency: application system documentation; need, accuracy and adequacy of BAMS/DSS outputs; application utilization; accuracy of data entered into BAMS/DSS; logical access controls; physical access controls; problem tracking and management procedures; and contingency planning/back-up. The findings and recommendations for each area are referenced in detail below.

### **Vendor Contract**

BAMS/DSS is supported by an AASHTO Transport® Maintenance, Support, and Enhancement Work Plan (MSE). The goal of the MSE is to provide high-quality, progressive Transport; knowledgeable and prompt consulting services; timely response; system maintenance; system upgrades; system documentation and user information; user assistance; and an opportunity to share ideas.

### SCDOT's Responsibilities

SCDOT is required to attend national and regional meetings to receive information.

### Vendor Responsibilities

The vendor provides maintenance services on the following: program errors in the base product; new releases of any third-part software; copyright/trademark updates, intellectual property issues, usability or accessibility updates; new releases of operating systems under which Transport runs; changes in the licensed user's local computing environment; changes in supported platform configurations; minor improvements to the operating performance and efficiency of software operation; and updates to documentation.

### Ownership and Location of Application/Source Code

In response to the discovery of program errors or changes in the program's operating environment that cause the program to work incorrectly, maintenance service is conducted. Maintenance includes analysis to determine how to change the code, programming, and testing the changed code.

### Release/Upgrade Testing and Installation Responsibilities

Multi-phase testing of maintenance modifications is conducted to correct validated maintenance items.

### Maintenance Agreements and Terms

A one-year maintenance, support, and enhancement work plan is developed for the annual Transport support contract.

AASHTO's Transport contractor (Info Tech), as requested, can support the following activities: installing Transport modules; setting system parameters; converting data to the Transport product format; populating Transport database; analyzing differences between Transport modules and current agency practices; providing orientation and training; and developing agency customizations.

### **Finding 1**

In reviewing the vendor contract, we found that the vendor provides appropriate user assistance as part of the contract.

### **Recommendation 1**

We recommend that the Construction Data Support staff consult with InfoTech to assist with improving the operating performance and efficiency of BAMS/DSS.

## **Need, Accuracy, and Adequacy of BAMS/DSS Outputs**

### Process for Preparing Engineer's Estimates

SCDOT uses historical or bid-based estimating to develop the Engineer's Estimates prior to the bid letting (date bids are received). The data are used from recently awarded contracts as a basis for estimating the unit prices on the project (e.g., Bridge Replacement, Cement Stabilization, Chip Seal, Clearing and Grubbing). In some instances, data for all bids are captured and considered when developing unit prices. Adjustments are made based on the project location, size of the project, project risks, quantities, general market conditions, and other factors. The engineer's estimate is confidential and not made available to bidders.

Plans are received from the Maintenance, Regional Production Group (RPG), and Traffic Engineering. The quantities are entered into the Proposal and Estimates System (PES) by the designer then forwarded to Pre-Construction Support Office. Then the information is copied from PES to an Excel estimating spreadsheet (in-house application custom spreadsheet). The general project information and project specifics information is entered. During this process, the following occurs:

- Obtain prices to compare against historical database (maximum 18 months of the letting date)
- Focus on major items (items that comprise a certain percentage of the total amount), Pareto Principle or 80-20 Rule
- Filter 20% items (by district then by "type of work") - appropriate to the situation being estimated and classify as minor items of work
- Determine reasonable cost for the anticipated work
- Use average prices for minor items of work

Next the project specifics information is printed, and the unit price is entered into the PES from estimating spreadsheet. An official estimate is created. The estimate is loaded into the AASHTO LAS (Letting and Award System) computer system for electronic bidding - 6 weeks before letting. The letting (date bids are received) is performed on the second Tuesday of the month. The estimate remains confidential at all times (only key SCDOT personnel have access). The estimator revisits key items about one week prior to the letting to make minor adjustments. The estimate is used to compare to the actual bids received. Each item of each project is compared to the estimate. The engineer's estimate should be within (+)(-) 10% of the low bid for at least 50 % of the project.

#### Preparing for the Bid Review Committee

Construction Data Support inputs the type of work into LAS. Several reports are executed to compile the *Bid Review Summary* comparison spreadsheet. This summary is reviewed in the Bid Review Committee meeting.

Line Item Profile (LIP) reports are used to review current bid against historical data. The Line Item Profiled Estimate (LIPEST) details all items from vendors indicating unit bid price and percent over estimate. These reports produce graphic and tabular displays that can be used to identify the bid items most responsible for vendors' bidding deviations on a specified contract. The identified bid items can then be studied to determine the cause(s) of the deviations (for example, unbalanced bidding, front-end loading, complementary bidding, or an inaccurate estimate). Since these key items usually determine the outcome (that is, the winner) of the contract, Line Item Profiles highlight the key items on each contract. The Engineer's Estimate is represented as a flat line and the Vendor's unit prices vary under or over the Engineer's Estimate base line.

#### Bid Review Committee (BRC) Meeting

The Bid Review Committee (BRC) reviews each bid from the SCDOT Highway Letting to ensure recommendation of the "lowest responsible bid." The BRC determines if there is any irregularity in the bids and whether the most competitive bid was received. Recommendations for award, pending, or rejection are then presented to the Director of Construction (DOC).

In accordance with the Federal Guidelines for reviewing proposals and recommending awards, any bid that is within 20% of the low bid is considered a competitive bid. With a greater number of competitive bids, the low bid can be higher than the engineers estimate and still be considered reasonable.

Competitive Bids	Level for Reasonable/Awardable Bid
1 (low bid only)	<= Engineer's Estimate
2	<= Engineer's Estimate + 5%
3	<= Engineer's Estimate + 10%
4	<= Engineer's Estimate + 15%
5 or more	<= Engineer's Estimate + 20%

The Bid Review Summary is focused on the individual letting and proposals in that letting. Using the *Bid Review Summary*, the committee reviews project by project to evaluate each bid in accordance with FHWA guidelines. If an item quantity will likely increase during the project, the BRC will send an email to the district to watch line item(s) for quantity. More comparison is made with the other bidders vs. the engineer's estimate.

When an engineer's estimate is outside the award criteria, a justification is written in support of awarding the contract. The Justification Memorandum identifies the contract proposal, the Engineer's Estimate, the bids received, and the bids with the majority of the difference between the estimate and the responsive low bidder. The memorandum is issued by the Director of Construction as a recommendation to award a contract. The overall bid is reviewed instead of one line item.

An "apparent low bid" may be declared irregular and be rejected if any of the following occur: unbalanced bidding (placement of high unit prices on items that may overrun); front loading (shifting monies to early occurring items in the contract); Disadvantage Business Enterprise (DBE) submission errors or shortfall (committals are uploaded improperly through BidX); bid bond omitted (bid bond verification number not submitted electronically through BidX); electronic bid system file altered (bidder made changes to the file); non-DBE bid received on set-aside project; and insufficient minimum required Contract Performance Score (CPS).

If none of the bids meet FHWA guidelines, the BRC recommends to "REJECT" all bids and the project is re-let in upcoming lettings.

#### Director of Construction (DOC) Letting Review Committee

The DOC Letting Review Committee reviews the recommendations by the BRC. The committee discusses projects deemed PENDING, REJECT, or with other issues noted. After discussions, the recommendations are forwarded the Commission for contract approval.

#### **Finding 2**

In reviewing the *Bid Review Summary*, some of the items noted in the *Bid Review Policies and Procedures* document as part of the *Bid Review Summary* were not displayed for review and discussion during the BRC meeting. The following documents should be a part of the Bid Review process:

- Plan Holders List – shows all potential bidders in order to evaluate the interest on the project when fewer than anticipated.

- Maps – evaluate the impact of location and proximity of multiple sites on the line item pricing.
- Line Item Profile (LIP) – provide a comparison of the bidder’s individual line item pricing to the Engineer’s Estimate to illustrate the “bid item differences” via the percentage over estimate.

**Recommendation 2**

We recommend that the *Bid Review Summary* contains all items listed in the *Bid Review Policies and Procedures*. This would allow the BRC to gauge overall competition, evaluate project interest, and determine if a project should be re-advertised or re-let to encourage more competitive results.

**Finding 3**

We observed an error when unit prices are entered into Proposal and Estimates System (PES) from the estimating spreadsheet. Since this is a manual process, errors are more likely.

**Recommendation 3**

We recommend that a second person verify the unit prices entered into PES prior to creating the official estimate. Also, we recommend that SCDOT Contract Support Office consult with Info Tech to convert data (from the estimating spreadsheet) to the Transport product format.

**Finding 4**

The engineer has difficulty preparing an estimate for a bid item that has no prior bid history. We found that SCDOT almost total reliance on historical pricing to be unique amongst the other states we polled. North Carolina and Mississippi use current cost for the majority of projects. Tennessee uses historical costs but with regression analysis.

**Recommendation 4**

We recommend the department perform cost-based estimating for items that do not have prior history. The department could also periodically check the current prices of items to determine the reasonableness of the historical data.

**Finding 5**

In some instances the unit prices of the lowest successful bidders are used to develop the engineer’s estimate and in other instances all bids are used.

**Recommendation 5**

We recommend there be greater consistency with the method of developing unit bid prices in preparation of the engineer’s estimate. In accordance with *A Practical Guide to Estimating* (prepared by AASHTO), dropping outlying data from the set and then using weighted averages, regression analysis, etc. is the most accurate method in estimating costs. Using only the lowest unit bid prices may result in an estimate that under predicts project costs.

**Finding 6**

When the decision is made to award a project with Justification (AWJ) that should be rejected according to the FHWA standards, Recommendation 1.4.3.2.2 in the SCDOT Bid Review Policy and Procedures Manual states that the Director of Construction and FHWA are to sign the memorandum indicating the concurrence to proceed with the project. In the review of files that Internal Audit performed, it was noted that a FHWA representative did not sign the justification memorandum. According to a member of the Bidding Review Committee (BRC), the Director

of Engineering and Operations for FHWA sits on the Bid Review Committee and has input on the Letting decision. The BRC member also added that justifications only get FHWA concurrence when the project is classified as a Federal Aid Primary project, which is quite rare (typically interstate work over \$50M).

**Recommendation 6**

While it is understandable that not all projects require FHWA concurrence, the recommendation in the SCDOT Bid Review Policy and Procedures Manual should be updated to reflect exactly which projects would require FHWA approval on the justification memo.

**Finding 7**

In reviewing some of the projects where justifications have been prepared to award the projects outside of the FHWA guidelines, it was noted there were no cost justifications or analysis detailing the costs of justifying moving the project forward vs. rebidding it. In the cases of safety projects, information that should be included is accident data and any property damage that occurs as support for the justification given.

**Recommendation 7**

An analysis should include projected costs of proceeding forward with the project including the difference between the actual bid and engineer's estimate as the largest expenditure. Other costs to include would be the guess as to what bids may be if the decision is to rebid the project. In the case of safety projects, other items to include would be accident data and the number/cost of potential accidents that may occur during the delay.

**Finding 8**

Internal Audit noticed from some of the justification letters written there is lack of competition in some areas of the state. This lack of competition occurs due to the geographic location of asphalt plants and the lack of being able to get asphalt to the job site at the proper temperature. This lack of competition leads to higher prices for the projects in these areas of the state.

**Recommendation 8**

SCDOT should review alternative methods in areas of the state where competition is limited to increase competitive bidding.

**Application Utilization**

The Construction Data Support staff indicated that the application does not prove or refute collusion. The application is used to view indicators (reports), study market shares, and view geographic market allocations over a period of time. If a strong indication of collusion is seen, the Construction Data Support staff indicated that the information is forwarded to upper management.

We reviewed the Line Item Profile Estimate (LIPEST) reports for several projects during a letting. The LIPEST and "Tabulations of Bids" reports displayed high mobilization. The Bid Tabulations report displayed the bid items most responsible for vendors' bidding deviations on a specified contract. The identified bid items are studied to determine the cause(s) of the deviations. These key items usually determine the outcome (winner) of the contract, LIPEST highlight the key items on each contract. The staff indicated that, at times, the vendors' bid is more realistic than engineer's estimate.

The Market Analysis reports display statistics over several years and provide measures of the competition within the markets that are also defined by analysis of the competition. We noted that only five vendors are listed separately and all other vendors are grouped into a category known as “other.” The staff noted that this is how the report is produced.

The Market Analysis report displayed forecasting. The staff indicated forecasting is based on the project completion date. In reference to Market #1, one vendor’s beginning data was skewed. The vendor’s forecasting displayed the vendor as being out of the market, or no longer a major market holder. This was not a true representation of the data. Because there wasn’t data entered for that vendor for the first few months, the vendor appeared to be out of the market.

The staff never detected collusion nor could they show a graph that indicated collusion. Selectively, vendors with bids 40% over the low bid were contacted. One of the considerations in monitoring bidder activity is the reasoning of bidders who submit bid proposals that are not serious attempts to win the bid. One of the theories is that bids of this type may be a complimentary bid or a bid intended to signal intent to play-along with the bidding cartel (if it exists). The intent is to send letters to obtain their explanation and inform the bidders that they are being watched for this type of bid. Also, this may deter contractors from engaging in collusive bidding practices, if they are aware that bids are being monitored for such practices.

The Construction Data Support staff produced three reports quarterly in an effort to assist with detecting collusion: Market Area Map, Market Shares, and Vendor Competition.

Market Area Map report groups counties (six areas defined) into logical areas which serve as the basis for other model and/or ad hoc analysis.

Market Shares (MSD2) report determines the percentage of the economic market controlled by each vendor either over the entire highway construction market or for selected items.

Vendor Competition (VENCOM) report allows users to examine the bidding activity among a selected group of vendors to determine whether or not they are competitive. This report determines whether each vendor's wins versus losses ratio appears reasonable in head to head competition with specific opponents.

The Quarterly Collusion Reports are stored electronically. The reports are emailed to the Director of Construction. There was no documentation of this process. These reports are analyzed by three staff members in the office. The analysis is documented.

### **Finding 9**

There are several reports available in BAMS/DSS for use but are not utilized. The following reports are not utilized:

- Cost Data Book (CDBOOK) Using the Comparison of Indices Output Option – compares engineer’s estimates, average bids, and low bids by month, quarter, and year.



- Cost Variance Profiles (CVARYE) – compares actual costs and engineer’s estimates for items to the amount bid by the winning vendor to determine how closely cost followed the original plans.
- Bid Evaluation Analysis (BIDEVL) – identifies contracts and items that require further review due to excessive deviation of item bid prices from the engineer’s estimates. The items with deviations that are large are identified and displayed.
- Work Location Maps (LOCMAP) – displays the work locations and facilities of contract winners for the selected time periods, geographic regions, or vendors. This report compares the locations of award contracts to the locations of a particular vendor’s facilities.

**Recommendation 9**

We recommend that the BIDEVL report be produced as part of the Bid Review process to allow the review of excessive item bid prices in comparison to the engineer’s estimate.

Also, we recommend that the CDBOOK, CVARYE, and LOCMAP be produced as part of collusion detection to assist with the review for abnormal bid patterns such as: the number of contract awards to a specific firm; rotation of firms as lowest bidder; consistent percentage differential between the various firms' bids; specific percentage of the available work in a geographic area to one firm or several over a period of time; location of the low bidder's plant versus location of the second and third low bidders' plants; and variations in unit bid prices submitted by a bidder on different projects in the same letting.

**Accuracy of Data Entered into BAMS/DSS**

Files were imported from Proposal and Estimates Systems (PES), Letting and Award System (LAS), and SiteManager. Overall, there is approximately 7.6 years of data (from March 2003 through September 2010) stored in the application.

BAMS/DSS will utilize most if not all data in LAS. Upon completion of the import, an import summary is generated. The summary indicates the records that were transported and errors that occurred. Errors are checked after each import to determine if the data needs to be corrected. Most errors are a blank field or a data code that the program does not recognize. Evidence of the correction is not maintained.

Within PES, projects are grouped into a proposal and then the proposal is assigned to a letting. A project represents the work to be included in a proposal (includes location, funding information, and subordinate elements including categories and items). One or more projects may constitute a proposal. A proposal represents the work advertised for a letting (includes subordinate data elements such as projects, categories, and items that define the work). A proposal must include at least one project. Contractors can download an electronic version of the proposal for bidding purposes. Once the contractors bid, information is entered. This information is still termed a proposal until awarded and executed – then it becomes a contract. Contract represents the work let, awarded, and executed between the agency and a private contractor (includes all the elements of a proposal, adds the contractor’s identifying information, bid prices, insurance, and bonds).

During the audit, OCIA spoke with other states that received great benefits from requesting Infotech to review how they were using BAMS. In fact, one state discovered they had major errors in the data that had been entered into the system.

**Finding 10**

Errors may occur on the import summary but there isn't evidence of the correction.

**Recommendation 10**

We recommend that when errors exist on the Import Summary, a record be maintained noting what was done to resolve the error and/or an explanation of the error.

**Application Controls**

BAMS/DSS interface with SiteManager and LAS. In BAMS/DSS, parameters are set to load directly from SiteManager and LAS since the last import.

**Finding 11**

During the interface or import, errors occurred with record inserts.

**Recommendation 11**

We recommend that staff consult with Info Tech concerning data conversion, setting system parameters, and agency customization to prevent errors during the import of external data.

**Logical Access Controls**

General access to BAMS/DSS requires a user ID and password. We determined that the user ID (login name) is unique. Also, there is not a procedure in place to ensure that inactive user IDs are reviewed and deactivated on a regular basis. Unfortunately, there is not a specific criteria required to establish a password. The passwords are not required to be changed at any particular time. However, the passwords were not accessible or viewable to others, including administrators.

We obtained and reviewed the list of all BAMS/DSS users to include access levels. We determined that the following user types are granted to individuals:

- Normal
- Installation

A normal user is a default user. An installation user is the system administrator. The generic administrator and default user profiles were also listed.

**Finding 12**

No procedure exists to ensure that inactive user IDs are reviewed and deactivated on a regular basis.

**Recommendation 12**

We recommend that BAMS/DSS application owner be added to SCDOT, IT SERVICES Terminated E-mail List. The e-mail provides a *Terminated Employee Report* to application owners.

### **Finding 13**

User authentication is performed at a very low level.

### **Recommendation 13**

We recommend ensuring all user IDs are unique. Also, we recommend that all generic and default user profiles are deleted from the system.

We recommend enhancing password requirements that force users to change passwords every 30-90 days. We recommend that passwords be unique and meet four of the six below minimum requirements:

- *Eight or more characters*
- *Use Pass-Phrases (e.g., "I love MCDLDS," "My1964.5mustang," "Auditorsarebest")*
- *Upper case alpha*
- *Lower case alpha*
- *Numeric*
- *Special*

Understanding that this is an AASHTO product and some changes are not possible by the application owner, we recommend that the application owner suggest the before mentioned recommendation in the Transport Users Group conference.

This will ensure user authentication and to ensure that outsiders cannot gain unauthorized access to the system or data. Also, this will ensure that authorized users have only the access needed to perform their duties.

### **Physical Access Controls**

The Construction Data Support office and the Construction office use the workstation for many meetings and presentations. A number of these presentations could be accomplished with laptop computers; however, there are certain meetings that use software and data that are specific to this machine and installation. The BAMS/DSS installation and data sets are on this machine as well as the software that allows for interactive views of the Line Item Profile model. SCDOT utilizes a "Stand-a-lone" set-up for BAMS/DSS, whereby a workstation houses the BAMS/DSS data and allows for access via that workstation and up to two other workstations that can point to that workstation for the data and system administration setup. The unit was received April 29, 2011. The Construction Data Support office has selected this arrangement to minimize the cost of SAS licensing that is required for use with BAMS/DSS.

Also, there are software applications such as Primavera and Visio that are installed on the machine and shared by users in the Construction Data Support office and the Construction division. The BAMS/DSS support person is obtaining information on licensing SAS in a Client/Server architecture with four (4) client machines.

The use of the BAMS/DSS system ultimately involves the following processes: preparing the Engineer's Estimates, preparing for the Bid Review Committee, conducting the Bid Review Committee meeting, and Letting Review Committee.

**Finding 14**

There were other software applications installed on the machine for other office staff members that do not relate to BAMS/DSS.

**Recommendation 14**

We recommend that any software not in direct relation to the BAMS/DSS application be removed in order to decrease the risk of a potential virus attack and to decrease the use of the machine by staff members not directly involved in the Bid Review Process.

**Finding 15**

The computer that houses the BAMS/DSS application is approximately 7.2 years old.

**Recommendation 15**

We recommend that this machine becomes part of SCDOT Information Technology Services (IT Services) Equipment Life Cycle process. This would reduce failures and data loss because computer equipment is replaced before it fails, and it should reduce the total cost of equipment management over its lifetime.

**Contingency Planning and Back-Up**

BAMS/DSS is a standalone system. Currently, the staff's Contingency Plan is to reinstall BAMS/DSS on the primary BAMS workstation and copy the backup folders to the C:\ drive of the computer from SCDOT's server.

There was no written documentation for a disaster recovery plan to identify procedures for moving back from the recovery center once the disaster is over. Instead, IT Services staff utilize VMware to virtualize the server infrastructure. IT Services uses a secondary data center (Hot Site) that includes the storage and software license for MirrorView (provides highly available data storage across campus, across the state, or across the globe).

**Finding 16**

The Construction Data Support Office staff copy the specific folders (from BAMS data directories) to SCDOT's server after each import from PES/LAS or SiteManager. All data views and models are backed up by this process.

**Recommendation 16**

Even though BAMS/DSS is part of SCDOT's disaster recovery plan manually, we recommend that two office staff be responsible for this process to add greater assurance that the backup process is performed on a timely basis.

***Department Response***



South Carolina  
Department of Transportation

Secretary of Transportation  
Janet P. Oakley  
(803) 737-1312 Fax (803) 737-2038

**MEMORANDUM**

**TO:** Paul Townes, Chief Internal Auditor  
**FROM:** Janet P. Oakley, Secretary of Transportation  
**DATE:** July 7, 2014  
**RE:** BAMS/DSS Audit - Management Response

We are in receipt of the audit of the Bid Analysis Management System/Decision Support System (BAMS/DSS) performed by your office. Attached are our responses to the recommendations presented in the report.

As you are aware, many of the recommendations have been implemented and are being utilized at this time due to the close coordination between your staff and the engineering division during the course of the audit.

We will continue to monitor our processes and look for areas of improvement as we move forward. Please let me know if you have any questions.

JPO:de  
Attachments  
ec: Christy Hall, Deputy Secretary of Engineering  
File: Con/RTS





---

## *SCDOT Management Response*

---

*South Carolina Department of  
Transportation  
Bid Analysis Management System/Decision Support System  
(BAMS/DSS)*

*July 3, 2014*

## SCDOT Management Response to the Office of Chief Internal Auditor Audit Report titled *Bid Analysis Management System/Decision Support System (BAMS/DSS)*

**Recommendation 1** – We recommend that the Construction Data Support staff consult with Info Tech to assist with improving the operating performance and efficiency of BAMS/DSS.

**Response:** We agree that the AASHTO/Trns•port vendor provides appropriate user support under the AASHTOWare Maintenance Support and Enhancement (MSE) Contract. We would like to highlight areas we have worked with the vendor to provide services over and above those provided under the MSE Contract, to include:

- AASHTO Service Units were used to obtain focused assistance and to bring vendor personnel on-site during the initial installation of our standalone BAMS/DSS system. Vendor staff assisted with data migration, system installation and configuration, system customization and user training.
- AASHTO Service Units were used to host a Collusion Detection Workshop in Columbia SC in 2007. Invitations were extended to various DOT divisions, but attendance was primarily Construction office staff. The workshop covered the general workings of BAMS/DSS, but also included the theoretical applications of Collusion Detection and Market Analysis, and several case studies to illustrate how the theoretical analysis built into BAMS/DSS was used to uncover and prosecute bid rigging and collusion.
- AASHTO Service Units were applied in the last year to fund a system enhancement in BAMS/DSS that will benefit SCDOT as well as other highway agencies. SCDOT provided service units in conjunction with other states to fund an enhancement identified as TMR 13990, which will overcome an issue in the system, allowing Vendor Mapping to show Proposal Locations or Project Locations of Vendor bidding activity. Multiple project proposals previously rendered these models too busy to be of use to this and other agencies. This enhancement is due to be available with the summer 2014 releases of AASHTO/Trns•port software.
- AASHTOWare Service Units have been applied to cover ongoing technical support for ad hoc needs that are above the phone support provided under the MSE Contract.
- As SCDOT's use of BAMS/DSS continues to mature, we plan to utilize on-site technical support to review our system, data, and methods in order to improve our utilization and derive more value from the system.

**Completion by:** Some measures already in effect and additional coordination is ongoing.

**Recommendation 2** – we recommend that the *Bid Review Summary* contains all items listed in the *Bid Review Policies and Procedures*. This would allow the BRC to gauge overall competition, evaluate project interest, and determine if a project should be re-advertised or re-let to encourage more competitive results.

**Response:** In conducting the Bid Review and Letting Review meetings, the documents prepared include the following at this time:



- **Bid Review Summary (printed):** displays identifying information for each proposal in the letting, including location, work description, number and length of roads, number and length of bridges, Contract Time, DBE Goals, Program Manager and Development Group, Contract Work Type, Estimate, Low Bid, % difference, Number of competitive and total bids, Addenda issued, Re-let History, special conditions relative to the letting and award, Award Recommendations, and comments relating to those recommendations.
- **Bid Tabulation (Adobe):** An electronic version of the bid tabulation is prepared for review by the Bid Review Committees and by the appropriate Program Managers in the Regional Production Groups.
- **Bid Tabulation (Excel):** An electronic version of the Bid Tabulation is prepared for use during the Bid Reviews and for reference by construction staff. This bid tabulation includes features to assist in the analysis of the bids to each other and to the engineering estimate. This document is projected for all review members during the review meetings.
- **Maps:** maps are prepared showing the locations of each roadway or bridge in a proposal, and the representative location for each project. These maps are available for viewing via projection during the review meetings.
- **Interactive Line Item Profiles:** BAMS/DSS has been enhanced to include an Interactive Line Item Profile that is viewed via projection during bid review meetings. This tool allows for Line Item Profiles to be viewed and filtered as needed to aid in the review process, including the ability to drill down into bid history for a particular item. This tool is available for viewing on the BAMS/DSS computer via direct or remote access.

**Additional Document in Response to this Recommendation:**

- An **Interested Bidder's List** will be prepared, utilizing 18 months of bid history to identify potential bidders by location and Contract Work Type. The Interested Bidders List will formally document this information which previously relied upon the experience of the bid review committee members.
- The **Interested Bidders List** may also serve to address a need highlighted in an audit related to the Disadvantage Business Enterprise (DBE) program. We plan to work with stakeholders in this area determine feasibility and methods for publicizing this information.

**Completion by:** November 30, 2014.

**Recommendation 3** - We recommend that a second person verify the unit prices entered into PES prior to creating the official estimate. Also, we recommend that SCDOT Contract Support Office consult with Info Tech to convert data (from the estimating spreadsheet) to the Trns•port product format.

**Response:** The Specifications and Estimates Unit has a process in place to review the estimates once they are entered into Trns•port and again before the Letting Date. The first review is for completeness and reasonability, which includes comparing the final quantity in the original spreadsheet to the final quantity in Trns•port. This will help prevent errors potentially caused by "typos". The final review is to update any prices that may have changed due to cost of fuel or

other factors in the time between the original estimate and the letting. The estimates are also sent to authorized RPG staff for review after they are entered into Trns•port.

**Completion by:** Measures already in effect and subject to Preconstruction Support's intent to constantly evaluate their processes for improvements.

**Recommendation 4** - We recommend the department perform cost-based estimating for items that do not have prior history. The department could also periodically check the current prices of items to determine the reasonableness of the historical data.

**Response:** The Estimators conduct research to determine a reasonable estimate for volatile items and items with limited bid history. The research includes discussions with the Designer specifying the product, internet search on the product, comparing the item to similar items with bid history, and internet searches of other DOT's bid histories. Historical bid prices are also adjusted when market volatility, material shortages or surpluses, or other cost trends are identified.

**Completion by:** Measures already in effect.

**Recommendation 5** - We recommend there be greater consistency with the method of developing unit bid prices in preparation of the engineer's estimate. In accordance with A Practical Guide to Estimating (prepared by AASHTO), dropping outlying data from the set and then using weighted averages, regression analysis, etc. is the most accurate method in estimating costs. Using only the lowest unit bid prices may result in an estimate that under predicts project costs.

**Response:** The Specification and Estimates Unit captures the bid history for the three lowest bidders on all projects. The Estimator begins analysis if the bid history with the low bidders only, and removes all outlying data. This data is analyzed using weighted averages, linear regressions, and quantity vs. cost trend line analysis. The second and third bid history is only used if additional data is needed to make a reasonable estimate. All methods used are outlined in AASHTO Practical Guide to Cost Estimating. The Unit has adopted the manual as the official source for developing estimate, and in the future all Estimators will be trained to follow the procedure set forth in the manual.

**Completion by:** Measures already in effect.

**Recommendation 6** - While it is understandable that not all projects require FHWA concurrence, the recommendation in the SCDOT Bid Review Policy and Procedures Manual should be updated to reflect exactly which projects would require FHWA approval on the justification memo.

**Response:** Agree with recommendation. Changes in the FHWA/SCDOT Stewardship Agreement have redefined which projects will require FHWA Concurrence on Award Justification Memoranda. Bid Review Policies and Procedures will be updated to reflect that only *Projects of Division Interest (PODI)* will require FHWA Concurrence.

**Completion by:** November 30, 2014.

**Recommendation 7** - An analysis should include projected costs of proceeding forward with the project including the difference between the actual bid and engineer's estimate as the largest expenditure. Other costs to include would be the guess as to what bids may be if the decision is to rebid the project. In the case of safety projects, other items to include would be accident data and the number/cost of potential accidents that may occur during the delay.

**Response:** With respect to this recommendation, the Director of Construction office would like to show that our practices have evolved over the course of this audit and are already in compliance with the intent of this recommendation. Award Justification Memoranda include appropriate statements and analysis to support moving forward vs. re-bidding of proposals. Examples include:

- **Analysis of Individual Bid Items:** for bid items where there is a significant difference between the estimate and the responsive low bid, analysis considers bid history, conditions of the work, quantities per location, and competition among other factors to determine if the estimate price is appropriate or should be adjusted. The aggregate of the bid item analyses are applied to the estimate, which is then used to re-evaluate the low bid. This *adjusted estimate* is essentially our cost analysis of where SCDOT would be if the bid was re-let.
- **Safety Issues:** when safety related projects require award justification, input is sought from the appropriate Program Manager regarding the situations which warrant the safety project. The warranting language is included in the justification memoranda.
- **Schedule Limitations:** some projects are tightly scheduled to avoid conflicts with times when the facility needs to be complete and available. Examples include school areas, seasonal tourist areas, high-profile events, and subsequent projects where completing the prerequisite project is critical. When relevant, these situations are included in the justification memoranda.
- **Necessity of Work:** Each project included in the letting has already risen through a prioritization process (i.e. Act 114), which supports the necessity of the work. Depending on the timing of the letting and the proposed work schedule, a two or three month deferral of awarding a contract could result in the work being deferred much longer. A proposed plan of pavement preservation or rehabilitation could be rendered obsolete or inappropriate if the pavement needs are not addressed in a timely manner. When relevant, this situation is cited and explained in the award justification memoranda. Inherent in this explanation is the understanding that delaying needed work will increase pavement distress and result in higher or much higher costs to restore the pavement.

**Completion by:** Measures already in effect.

**Recommendation 8** - SCDOT should review alternative methods in areas of the state where competition is limited to increase competitive bidding.

**Response:** This is a supply and demand business decision for the contractors based on the amount of work available in certain areas of the state. SCDOT projects are the primary users of asphalt in this state. The areas in question (portions of Districts 2 and 7) do not have a high concentration of asphalt plants due to the low demand from SCDOT in these rural areas. Over the years, several plants have shut down for economic reasons due to the lack of demand and production. If SCDOT demand could be managed to be more consistent, the economics could foster improved competition. Also, contractors have often stated that new plants are difficult to open due to environmental obstacles. Since 2012, SCDOT has placed an emphasis on the packaging of projects in order to make the work more attractive to a larger bidding group. SCDOT also continually evaluates alternative methods such as Microsurfacing, Warm Mix Asphalt and Ultra-Thin Lift pavements to support improved competition.

**Completion by:** Ongoing.

**Recommendation 9** - We recommend that the BIDEVL report be produced as part of the Bid Review process to allow the review of excessive item bid prices in comparison to the engineer's estimate.

Also, we recommend that the CDBOOK, CVARYE, and LOCMAP be produced as part of collusion detection to assist with the review for abnormal bid patterns such as: the number of contract awards to a specific firm; rotation of firms as lowest bidder; consistent percentage differential between the various firms' bids; specific percentage of the available work in a geographic area to one firm or several over a period of time; location of the low bidder's plant versus location of the second and third low bidders' plants; and variations in unit bid prices submitted by a bidder on different projects in the same letting.

**Response:** The Director of Construction office concurs with the recommendations to utilize additional BAMS/DSS resources in support of letting review and collusion detection. However, additional resource analysis is needed regarding collusion detection functions.

**Completion by:** June 30, 2015.

**Recommendation 10** - We recommend that when errors exist on the Import Summary, a record be maintained noting what was done to resolve the error and/or an explanation of the error.

**Response:** The Director of Construction office will modify our practice to retain a copy of the import error logs and will document the correction and/or explanation of the errors. Depending on the level of effort involved and the benefit derived from this practice, we reserve the right to re-evaluate this recommendation in the future.

**Completion by:** September 30, 2014.

**Recommendation 11** – We recommend that staff consult with Info Tech concerning data conversion, setting system parameters, and agency customization to prevent errors during the import of external data.

**Response:** The DOC office concurs with this recommendation to the extent that errors are resulting from configuration issues with our installations of AASHTOWare applications (Preconstruction, SiteManager, and BAMS/DSS). In the case of incomplete or incorrect data provided by users and/or systems interfacing with AASHTOWare, a combination of staff training, configuration and coordination of systems, and consultation with Info Tech have and will continue to be employed to address the issues.

**Completion by:** Ongoing.

**Recommendation 12** - We recommend that BAMS/DSS application owner be added to SCDOT, IT SERVICES Terminated E-mail List. The e-mail provides a *Terminated Employee Report* to application owners.

**Response:** The Director of Construction office will request addition to the IT Services Terminated E-mail list and will use the list as a notice to validate BAMS/DSS users. Reporting on this validation will be produced quarterly.

**Completion by:** September 30, 2014

**Recommendation 13** - We recommend ensuring all user IDs are unique. Also, we recommend that all generic and default user profiles are deleted from the system. We recommend enhancing password requirements that force users to change passwords every 30-90 days. We recommend that passwords be unique and meet four of the six below minimum requirements:

- *Eight or more characters*
- *Use Pass-Phrases (e.g., "I love MCDLDS," "My1964.5mustang," "Auditorsarebest")*
- *Upper case alpha*
- *Lower case alpha*
- *Numeric*
- *Special*

Understanding that this is an AASHTO product and some changes are not possible by the application owner, we recommend that the application owner suggest the before mentioned recommendation in the Transport Users Group conference.

This will ensure user authentication and to ensure that outsiders cannot gain unauthorized access to the system or data. Also, this will ensure that authorized users have only the access needed to perform their duties.

**Response:** Currently, the Standalone BAMS/DSS system is developed on an older platform and has limitations in User IDs and Password configurations. AASHTOWare Project applications, including BAMS/DSS are scheduled for major upgrades in the coming years. These upgrades will provide for more flexibility and security in the BAMS/DSS login. In the meantime, we will contact the limited group of users on a quarterly basis to update their passwords and use the above suggestions to strengthen their passwords (to the extent possible). All revised IT user authentication changes will complement the IT security enhancements as part the statewide initiative on data security.

**Completion by:** September 30, 2014

**Recommendation 14** - We recommend that any software not in direct relation to the BAMS/DSS application be removed in order to decrease the risk of a potential virus attack and to decrease the use of the machine by staff members not directly involved in the Bid Review Process.

**Response:** The DOC office agrees with this recommendation. Options are being considered for physically securing the machine and limiting access to staff members involved in the bid review process. All IT security enhancements will complement the statewide initiative on data security. Completion of this recommendation may be related to the compliance with Recommendation 15.

**Completion by:** September 30, 2014.

**Recommendation 15** - We recommend that this machine becomes part of SCDOT Information Technology Services (IT Services) Equipment Life Cycle process. This would reduce failures and data loss because computer equipment is replaced before it fails, and it should reduce the total cost of equipment management over its lifetime.

**Response:** The DOC office agrees with this recommendation. Contact will be made with IT Services to request this machine is included in IT Services' Equipment Life Cycle Process.

**Completion by:** September 30, 2014.

**Recommendation 16** - Even though BAMS/DSS is part of SCDOT's disaster recovery plan manually, we recommend that two office staff be responsible for this process to add greater assurance that the backup process is performed on a timely basis.

**Response:** The DOC office agrees with this recommendation. A brief policy will be prepared setting the frequency for this function and establishing requirements for two persons to be responsible for completing and verifying that backups are performed. The policy should allow some flexibility in the timing due to the variable timing of contract executions and activations in our systems. A log will be prepared and maintained for this function.

**Completion by:** September 30, 2014.